

From Department of Public Health Sciences
Karolinska Institutet, Stockholm, Sweden

DELIVERING HEALTH SERVICES TO CHILDREN THROUGH INTEGRATED COMMUNITY CASE MANAGEMENT IN UGANDA- FROM INNOVATION TO INSTITUTIONALISATION

Agnes Mbabaali Nanyonjo



**Karolinska
Institutet**

Stockholm 2014

All previously published papers were reproduced with permission from the publisher.

Published by Karolinska Institutet.

Printed by Universitesservice US-AB

© Agnes Mbabaali Nanyonjo, 2014

ISBN 978-91-7549-645-0

*Where is the Life we have lost in living?
Where is the wisdom we have lost in knowledge?
Where is the knowledge we have lost in information?*

“Choruses from the Rock, T.S. Eliot”

ABSTRACT

Background: Infectious diseases cause the majority of childhood deaths in low income settings. Integrated community case management (iCCM) is a health innovation relying on community health workers (CHWs) to diagnose and treat children with malaria, pneumonia and diarrhoea while referring children with severe disease. However, iCCM is a complex innovation and its perception by its intended users as well as the acceptability of its attributes and how these fit into the functions of the health system, are not well understood. Yet these factors are likely to affect adoption and effective coverage of the innovation.

Objective: The studies sought to explore the uptake and impact of iCCM in Uganda, with a focus on community acceptability, perceived quality of care, appropriate treatment and access to referral care, in order to formulate recommendations for improved implementation at scale.

Methods: Four studies (I-IV) were conducted among caregivers of children under-five and community members. Study I draws on diffusion of innovations and uses an explanatory qualitative approach with focus group discussions and interviews with community members, CHWs, and health facility supervisors to explore the acceptability and adoption of iCCM. In study II, a cross-sectional sample of caretakers of children aged 2-59 months who suffered an episode of malaria, pneumonia or diarrhoea and have been treated either by CHWs or primary health facility workers (PHFWs) were compared for perceived quality of care (PCQ) across quality domains specified in the Donabedian Model. Study III compares uptake of appropriate treatments for pneumonia and diarrhoea under iCCM and equity in use of CHWs. Study IV estimates the cost of referral and willingness to pay (WTP) for referral using a case-series study on children referred by CHWs to higher level health facilities.

Findings: CHWs were seen as acceptable providers of child health services and the communities appreciated the treatment provided (study I). The mean PCQ rating was higher among caregivers of children treated by CHWs relative to those treated by PHFWs (0.58 vs. -0.58; $p < 0.0001$). This finding was consistent across several domains of quality of care, except for continuity (study II). A significant increase in the proportion of children who received antibiotics for pneumonia (34.7%, $p < 0.05$) and ORS for diarrhoea (41.0%, $p < 0.05$) was observed among children using CHWs compared to those who did not; though no such increase was observed for zinc (study III). Use of CHWs was not significantly different between the poorest and least poor households for pneumonia (Concentration Index = -0.099; SE = 0.073) or diarrhoea (Concentration Index = -0.073; SE = 0.085) (study III). Referral completion was problematic and was hampered by both demand related factors among community members and access barriers within the health system. WTP for referral was higher (US\$8.25) than the average referral costs incurred (US\$ 4.89) by child caregivers (study IV).

Conclusions: iCCM as a complex health innovation was well accepted by the intended users due to the positive perception of most of its attributes; leading to equitable increase in appropriate treatment for sick children. However, uptake of zinc for diarrhoea and completion of referral remained problematic. In order to achieve optimal functioning and impact of iCCM, targeted efforts to embed the programme into the community and health system functions may be required, such as effective behaviour change communication, supervision and motivation of CHWs and functional drug supply chains. Ultimately local, sub-national and national level ownership is essential to ensure institutionalisation of iCCM into the health system.

Key words: malaria, pneumonia, diarrhoea, CHWs, case management, innovation, integration

LIST OF SCIENTIFIC PAPERS

- I. Nanyonjo A, Nakirunda A, Makumbi F, Tomson G, Källander K and the inSCALE-study group. Adoption and Acceptability of Integrated Community Case Management in Uganda. *Am. J. Trop. Med. Hyg.*, 87 (Suppl 5), 2012, pp. 97–104)
- II. Nanyonjo A, Makumbi F, Etou P, Tomson G, Källander K and the inSCALE study group. Perceived quality of care for common childhood illnesses: Facility versus community based providers in Uganda. *PLoS One*, 8, e79943
- III. Nanyonjo A, Ssekitooleko J, Counihan C, Makumbi F, Tomson G and Källander K. Impact of integrated community case management on uptake of appropriate diarrhoea and pneumonia treatments in Uganda: A propensity score matching and equity analysis study. (submitted)
- IV. Nanyonjo A, Bagorogoza.B , Kasteng F, Ayebale G, Makumbi F, Tomson G, and Källander K. for the inSCALE study group. Estimating the cost of referral and willingness to pay for referral to higher level health facilities: a case series study from an integrated community case management programme. (submitted)

These papers will hence forth be referred to by their roman numerals I-IV

CONTENTS

1	INTRODUCTION.....	1
1.1	CHILD HEALTH TODAY	1
1.2	TACKLING THE MAJOR CAUSES OF CHILD MORTALITY	2
1.2.1	Pneumonia and diarrhoea.....	2
1.2.2	Malaria.....	3
1.2.3	Neonatal conditions.....	3
1.2.4	Case management strategies	4
1.3	HEALTH SEEKING BEHAVIOUR	5
1.3.1	Demand-side factors affecting health seeking behaviour	5
1.3.2	Supply-side barriers affecting health seeking behaviour	6
1.3.3	The quality of care and utilisation of health services.....	7
1.3.4	Health seeking behaviour in the context of major causes of childhood mortality	7
1.4	EQUITY IN ACCESS TO CHILD HEALTH INTERVENTIONS	7
1.5	CHILD HEALTH IN THE CONTEXT OF HEALTH SYSTEMS	8
1.5.1	The role and structure of the health system.....	8
1.5.2	Health service delivery platforms for child health interventions.....	9
1.5.3	Health system interventions in complex adaptive systems.....	10
1.5.4	Community case management for childhood illnesses	11
1.6	THE DIFFUSION OF INNOVATIONS IN THE CONTEXT OF INTEGRATED HEALTH INTERVENTIONS.....	13
1.6.1	Simple and complex health innovations.....	13
1.6.2	The institutionalisation of health innovations	14
1.7	UGANDA COUNTRY PROFILE	15
1.7.1	Geographical, economic, and socio-demographic indicators	15
1.7.2	Child health indicators and millennium development goals.....	15
1.7.3	Health policy and systems in Uganda.....	16
1.8	INTEGRATED COMMUNITY CASE MANAGEMENT (iCCM) FOR MALARIA, PNEUMONIA AND DIARRHOEA IN UGANDA.....	19
1.8.1	Home based management of fever and home based care	19
1.8.2	Delivering iCCM through village health teams	19
2	STUDY RATIONALE	22
3	AIM AND OBJECTIVES	24
3.1	GENERAL AIM.....	24
3.2	SPECIFIC OBJECTIVES	24
4	METHODS.....	25
4.1	STUDY AREA AND POPULATION	25
4.2	MAIN RESEARCH METHODS	27
4.2.1	Qualitative methods	28
4.2.2	Quantitative methods	29

4.3	DESIGN, SAMPLE SIZE, SAMPLING AND DATA COLLECTION METHODS.....	30
4.3.1	Study I - Acceptability and adoption of iCCM	30
4.3.2	Study II - Perceived quality of care in iCCM.....	32
4.3.3	Study III - Impact of iCCM on uptake of appropriate treatment for pneumonia and diarrhoea)	33
4.3.4	Study IV - Cost of referral and willingness to pay for referral in iCCM	34
4.4	DATA ANALYSIS	35
4.4.1	Directed content analysis	35
4.4.2	Descriptive statistics.....	35
4.4.3	Chi-square test.....	35
4.4.4	Principal components analysis (PCA).....	36
4.4.5	Factor analysis.....	36
4.4.6	Wilcoxon rank-sum test	37
4.4.7	Logistic regression	37
4.4.8	Linear regression.....	37
4.4.9	Multinomial logistic regression	37
4.4.10	Modified Poisson regression.....	37
4.4.11	Concentration index	38
4.4.12	Propensity score matching (PSM)	39
4.5	ETHICAL CONSIDERATIONS	41
5	RESULTS.....	42
5.1	PERCEPTION OF iCCM AS A HEALTH INNOVATION	42
5.1.1	Qualitative exploration of perception of iCCM - Study I.....	42
5.1.2	Quantitative exploration of perception of iCCM –study II.....	44
5.2	INSTITUTIONALISATION OF iCCM IN THE COMMUNITY AND HEALTH SYSTEM	47
5.2.1	Impact of iCCM on the proportion of children accessing appropriate care for pneumonia and diarrhoea - study III	47
5.2.2	Referral under iCCM – study IV	48
5.3	EQUITY IN USE OF iCCM.....	50
6	DISCUSSION	51
6.1	MAIN FINDINGS.....	51
6.2	PERCEPTION OF iCCM - STUDIES I & II.....	52
6.3	INSTITUTIONALISATION OF iCCM IN THE HEALTH SYSTEM	56
6.3.1	Impact of iCCM on uptake of appropriate treatment.....	56
6.3.2	Impact of iCCM on equity in uptake of appropriate treatment and use of CHWs	57
6.3.3	Referral completion in iCCM	58
6.3.4	Institutionalisation of iCCM in the Ugandan health system framework	60

6.4	METHODOLOGICAL CONSIDERATIONS	60
6.4.1	The overall study design	60
6.4.2	Theory directed approach to research.....	60
6.4.3	Focus group discussions and interviews.....	61
6.4.4	Case definition and treatment indicators	61
6.4.5	Recall bias	62
6.4.6	Self selection of participants	62
6.4.7	The effect of timing.....	62
6.4.8	Cluster sampling.....	63
6.4.9	Principal components analysis and socioeconomic status	63
6.4.10	Model specification.....	64
6.4.11	Cost uncertainty.....	64
6.4.12	Study tools	65
6.4.13	Generalisability and transferability of the results.....	65
6.5	CONCLUSIONS	66
6.6	IMPLICATIONS FOR POLICY, PRACTICE AND RESEARCH.....	66
7	ACKNOWLEDGEMENTS.....	69
8	REFERENCES.....	71

LIST OF ABBREVIATIONS

ACTs	Artemisinin based combination therapies
AL	Artemether-Lumefantrine
CCM	Community case management
CDD	Community drug distributor
CHW	Community health worker
CI	Confidence interval
CCI	Corrected concentration index
C-IMCI	Community integrated management of childhood illnesses
CMDs	Community medicine distributors
FGDs	Focus group discussions
HBC	Home based care
HBMF	Home based management of fever
HMM	Home management of malaria
HSSIP	Health sector strategic investment plan
iCCM	Integrated community case management
IMCI	Integrated management of childhood illnesses
KIs	Key informants
MDGs	Millennium development goals
MOH	Ministry of health
OR	Odds ratio
ORS	Oral rehydration salts
PCA	Principal components analysis
PHFW	Primary health facility worker
PSM	Propensity score matching
RDT	Rapid diagnostic test
RRR	Relative risk ratio
UNICEF	United nations children's fund
UHC	Universal health coverage
VHT	Village health team
WHO	World health organization

OPERATIONAL DEFINITIONS

Acceptability: the degree to which a service is sufficiently tolerable to its users in terms of personal and practice characteristics (Penchansky and Thomas, 1981).

Adoption: the processes through which an individual passes when deciding to make full use of an innovation as the best course of action available (Rogers, 1995).

Appropriate antibiotic: receiving an antibiotic that is recommended for treatment of pneumonia in the Uganda clinical guidelines

Complex adaptive systems: a collection of individual agents with freedom to act in ways that cannot be predicted with total precision , and whose actions are interconnected so that one agent's actions change the context for other agents (Plsek and Greenhalgh, 2001)

Diffusion of innovation: a process by which an innovation spreads via certain communication channels over time among the members of a particular social system; it is a highly adaptive process by which the social system adapts to the innovation and the innovation is adapted to the system (Rogers, 1995)

Innovation: ideas, objects or practices perceived as new by the intended user or unit of adoption (Rogers, 2002)

Institutionalisation: the routine and accepted embedment of an innovation into all levels and functions of the health system.

Integration: the management and delivery of health services so that clients receive a continuum of preventive and curative services, according to their needs over time and across different levels of the health system (World Health Organization, 2008).

Intervention: a set of actions or combinations of programme elements aimed at bringing about change through production of identifiable health outcomes (Rychetnik et al., 2002).

Malaria: fever and parasitological confirmation with malaria RDT or history of fever in the last 24 hours in a high-risk malaria area (WHO and UNICEF, 2008).

Pneumonia: severe acute infections of the lungs by viral, bacterial, and other pathogens. Non severe pneumonia is any child with cough or difficult breathing who has fast breathing and no general danger signs (WHO, 2005).

Uptake: proportion of people who qualify to receive or use a health service who receive it.

1 INTRODUCTION

1.1 CHILD HEALTH TODAY

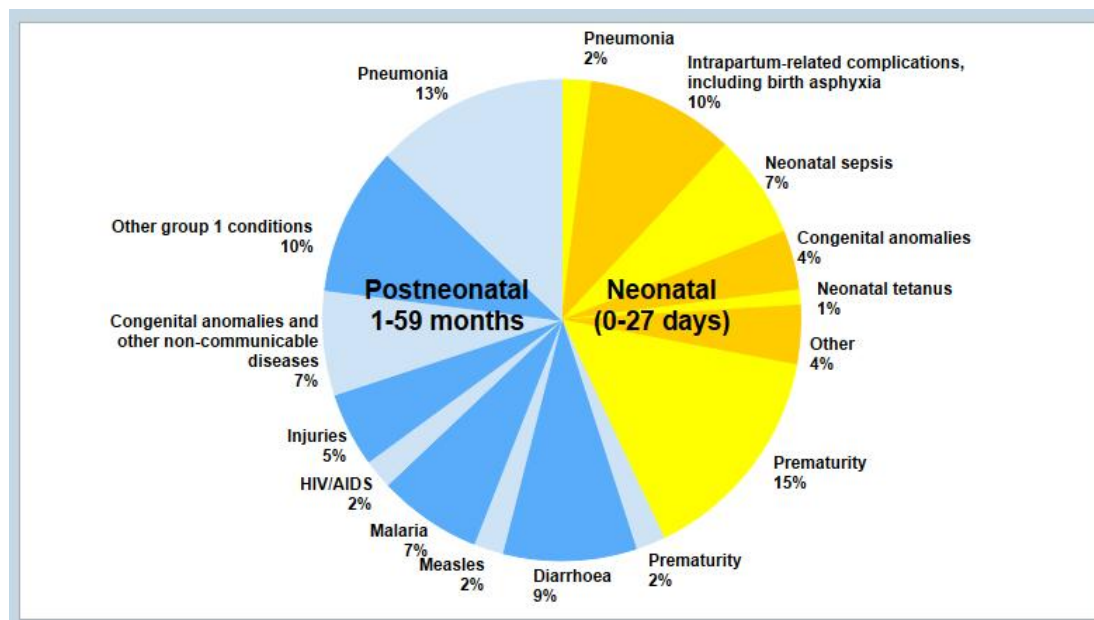
From a global point of view, there has been a general decline in child mortality with large absolute reductions occurring in regions with the highest mortality. Sub-Saharan Africa, the Middle East and North Africa have registered impressive and consistent acceleration in the pace of reduction of under-five mortality rates since 1990 (UNICEF, 2013). For example, child mortality in Senegal declined by half since 2000, Cambodia registered a 60% drop in child mortality and Rwanda reported a 10% average annual reduction since 2000 (UNICEF, 2013). Bangladesh, Brazil, Egypt and Peru reduced their under-five mortality by 66% or more. China, Lao People's Democratic Republic, Madagascar, Mexico and Nepal registered declines in child mortality between 60% and 65%. The reductions have been attributed to collaborative efforts in increased funding to the public and private sector health care, improved medical technologies, health systems strengthening, making essential medicines and vaccines more readily available, and increased government commitment and accountability (Wagstaff et al., 2006, UNICEF, 2013).

Recent analysis shows a decline in disparities in under-five mortality between the richest and the poorest households in most regions of the world except for sub-Saharan Africa (UNICEF, 2013, Requejo et al., 2014). Despite a seemingly impressive decline, large disparities continue to occur between low and high income countries and regions as well as between the poorest and richest households within in countries in all regions. Sub-Saharan Africa is the only region that has registered under-five mortality in several of its countries including Cameroon, Central African Republic, Chad, Congo, Kenya, and Zambia. All 36 countries with child mortality rates above 100 per 1000 live births are located in sub-Saharan Africa, except for Afghanistan and Myanmar (UNICEF, 2013). In summary, only 23 of the 74 Countdown countries with available data for 2013 were on track to achieve Millennium Development Goal (MDG) 4 by making significant progress in reducing under-five mortality by two thirds between 1990 and 2015 (Requejo et al., 2014). It is thus obvious that more needs to be done in order to attain MDG 4 (Bryce et al., 2006, Black et al., 2010, Liu et al., 2012, Requejo et al., 2014, UNICEF, 2013).

One major public health concern today is that only a small number of diseases and conditions continue to account for over 90% of avoidable mortality in the 75 Countdown countries (figure 1). These include pneumonia, measles, diarrhoea, AIDS and neonatal conditions (UNICEF, 2013, Darmstadt et al., 2005, Jones et al., 2003). From a wider perspective, an array of intermediate factors predisposes children in low income countries to disease states. These range from limited health care availability, maternal and child under nutrition, incorrect feeding practices, limited access to clean water and low maternal education (Save the Children, 2009). Moreover, other contextual factors such as poor governance, armed conflict and environmental changes undermine child survival prospects (Horton and Lo, 2014, Frenk and Moon, 2013). It is therefore evident that multiple and intersectoral

approaches are needed to address childhood mortality from both its immediate causes and the broader social, economic and political environment in which children fall ill.

Figure 1: Global causes of deaths in children below the age of five years



Source: http://www.who.int/gho/child_health/mortality/causes/en/

1.2 TACKLING THE MAJOR CAUSES OF CHILD MORTALITY

Although child mortality is attributable to a combination of both distal and proximal factors, a number of interventions are known to effectively address childhood mortality from its proximal determinants (Jones et al., 2003). These consist of promotional, preventive and treatment interventions that target pregnant mothers and under-fives which can be delivered through primary health care (Bhutta et al., 2008). However, child survival prospects have often been undermined by poor implementation of these interventions, particularly among the poor (Victora et al., 2005). Scaling up coverage of life-saving interventions through stronger health systems could avert more than 60% avoidable mortality (Jones et al., 2003, Darmstadt et al., 2005, Bryce et al., 2003).

1.2.1 Pneumonia and diarrhoea

Pneumonia and diarrhoea have been classified among the deadliest childhood diseases, accounting for approximately 29% of deaths worldwide (Gupta, 2012, UNICEF, 2012, Walker et al., 2013). The two diseases have overlapping risk factors, such as malnutrition, poverty, poor living conditions and poor hygiene. They can also be prevented by similar intervention approaches, such as optimal breastfeeding practices, improved nutrition, improved hygiene, vaccination and supplementation with zinc and vitamin A (UNICEF, 2012, Bhutta et al., 2013, Chisti et al., 2011). However for a child who gets sick, prompt treatment with effective antibiotics is required for pneumonia while a combination of oral

rehydration salts (ORS) and zinc is required for diarrhoea. Forty percent of the global reduction in child mortality has been attributed to a reduction in deaths from pneumonia and diarrhoea (Bhutta et al., 2013). An intervention affecting pneumonia mortality alone, has been estimated to reduce under five mortality by over 20% (Sazawal and Black, 1992, Sazawal and Black, 2003). Following the introduction of vaccines for *Streptococcus pneumoniae* and *Haemophilus influenzae* into routine childhood immunisation programmes, pneumonia aetiology has gradually shifted to predominantly viral causes (Rudan et al., 2008). Nonetheless, *S.pneumoniae* and *H.influenzae* are still the major causes of bacterial pneumonia among children (Rudan et al., 2008) and empirical treatment of children suspected to have pneumonia is generally recommended in resource poor settings, especially in remote areas where access to diagnostic facilities is problematic (Bari et al., 2011, Adegbola and Obaro, 2000, Graham et al., 2008).

1.2.2 Malaria

Globally, an estimated 627,000 deaths were attributed to malaria in 2012. Of these deaths 80% were in the Sub-Saharan African region. Malaria is responsible for approximately 1,200 child deaths every day. Children living in Africa and Southeast Asia have the highest risk of infection from malaria parasites. Although there has been a decline in mortality attributable to malaria in children over time, in 2012 malaria caused 14% of the deaths among under-fives (UNICEF, 2013, WHO, 2013). Vector control using insecticide treated bed nets, indoor residual spraying and treatment of sick children with artemisinin-based combination therapy (ACT) underpin malaria control efforts (Crawley et al., 2010). While chronic diarrhoea can lead to malnutrition, malnutrition predisposes children to severe malaria and pneumonia (Bhutta and Das, 2014). In resource poor settings, disease management is compromised by symptom overlap for malaria and pneumonia and often possible co-infection (Kolstad et al., 1997, Perkins et al., 1997, Kallander et al., 2004). In the absence of sophisticated diagnostic equipment, differential diagnosis can prove to be hard even for well trained health workers. It is therefore generally recommended that health workers in malaria endemic areas evaluate children presenting with both fever and cough for malaria and pneumonia (WHO, 1991).

1.2.3 Neonatal conditions

Neonatal conditions constitute 44% of under-five mortality and their share is steadily increasing as overall child mortality goes down (Wardlaw et al., 2013). Sub-Saharan Africa bore 21% of the global burden of neonatal mortality by 2012 (Wardlaw et al., 2013). Several packages of interventions addressing neonatal mortality have previously been identified. These intervention packages can be delivered through outreaches, community care and facility based care (Darmstadt et al., 2005). Community based packages targeting some of the poorest families encompass health education for home-care practices such as breastfeeding and prevention of neonatal hypothermia. They also include promotion of demand for skilled care at birth and improved health seeking behaviour (Callaghan-Koru et al., 2013).

1.2.4 Case management strategies

Efforts to improve child survival are often tailored towards efficient scaling up of interventions known to have an effect on child mortality and morbidity (Darmstadt et al., 2005, Bhutta et al., 2008). Historic attempts in the fight against malaria, pneumonia and diarrhoea were underpinned by the overarching principles of primary health care strengthening to prevent and treat disease (Van der Geest et al., 1990, WHO, 2008). However, most of these efforts were disease specific and were embedded within vertical approaches such as control of diarrhoeal diseases, acute respiratory infections, the Expanded Programme on Immunisation, newborn care and the Roll Back Malaria Programme (Nicoll, 2000). Children seeking medical treatment in low income countries are often suffering from more than one condition, making a single diagnosis impossible, and therefore health workers need to evaluate children for multiple conditions at the same time (WHO, 1997).

As evidence on the efficiency of use of simple and standardised guidelines for identification and treatment of disease at community, health facility and referral hospitals mounted, the integrated management of childhood illnesses (IMCI) strategy was recommended by WHO for low and middle income countries (Bar-Zeev et al., 2012, WHO, 1995). The IMCI strategy consists of three key components: (1) improving case management skills of health workers; (2) improving health system support; and (3) improving household and community practices related to child health, nutrition and development (Community IMCI, or C-IMCI) (Gove, 1997). All three components of IMCI account for a variety of factors putting children at risk of disease, thus ensuring combined treatment for the major childhood illnesses whilst emphasising prevention of disease through immunisation and improved nutrition. Specifically, IMCI involves classification of disease based on signs and symptom present, followed by provision of appropriate treatment and referral of children with severe disease (WHO, 1995, Bryce et al., 2005a, Bryce et al., 2004, Gove, 1997, Kalter et al., 2003). It targets serious bacterial infections, low weight for age, pneumonia, diarrhoea, malaria and other severe febrile illnesses, ear problems, malnutrition and anaemia (WHO, 1995, WHO, 2006). The strategy has proved effective in improving health worker skills, quality of care for sick children, and reducing mortality (Arifeen et al., 2004, WHO, 2006, Bryce et al., 2005a, Armstrong Schellenberg et al., 2004) and is widely implemented at low level health facilities in low and middle income countries (Bryce et al., 2005b).

Community case management of childhood illnesses (CCM) is a complementary strategy used to deliver effective treatment outside health facilities in areas where access to treatment is poor. CCM for pneumonia relies on community health workers (CHWs) utilising algorithms developed as early as the 1980s to evaluate children for cough, fast breathing and danger signs in order to dispense antibiotics for those classified as uncomplicated pneumonia (Marsh et al., 2008). CCM with appropriate antibiotics is estimated to lower pneumonia specific mortality in under-fives by 36% to 70% (Sazawal and Black, 1992, Theodoratou et al., 2010). Additionally, the number of children with diarrhoea treated with ORS and zinc has substantially increased due to CCM for diarrhoea, however there is limited evidence on the impact of CCM on diarrhoea specific under-five mortality (Das et al., 2013). Among under-

fives, CCM for malaria with recommended anti-malarial therapy has the potential to reduce overall mortality by 40% (Kidane and Morrow, 2000), malaria specific mortality by 60% and severe morbidity by 53% (Sirima et al., 2003).

1.3 HEALTH SEEKING BEHAVIOUR

Even though efforts have been made to design community and facility based interventions aimed at addressing child mortality, the impact of the intervention is reliant on caregivers' ability to recognise signs of child illness and to seek appropriate care through these interventions (Geldsetzer et al., 2014). The primary diagnosis and decision to seek treatment, is made by the caregiver in the home. In the literature, health seeking behaviour is broadly classified as treatment at home and treatment outside the home. Treatment practices outside the home range from treatment obtained from traditional healers, informal health providers such as drug shops and clinics, to formal providers in private and public health facilities (Scott et al., 2014, Smith et al., 2010, Bojalil et al., 2007, de Savigny et al., 2004, Geldsetzer et al., 2014, Hildenwall et al., 2009, Herbert et al., 2012, Bloom et al., 2011). However, health seeking behaviour is a complex phenomenon influenced by both demand- and supply-side factors which all determine the decision making process (Ribera and Hausmann-Muela, 2011, Muela et al., 2012). Demand-side determinants operate at the individual level and include socio-economic and cultural factors such as illness recognition, perception and labelling (O'Donnell, 2007, Muela et al., 2012). Supply-side determinants are aspects inherent to the health system that hinder service uptake by individuals or the community such as availability of treatment, staff time, treatment and technologies (Ensor and Cooper, 2004, O'Donnell, 2007). Differentiating demand-side from supply-side barriers is imperative as it is directly linked to the formulation of appropriate interventions to access barriers (O'Donnell, 2007). Nonetheless, it is necessary to address both barriers concurrently.

1.3.1 Demand-side factors affecting health seeking behaviour

Despite the diverse scope of health providers, prompt and effective treatment for common deadly childhood illnesses is necessary for better health outcomes (WHO/UNICEF, 2012). However, seeking treatment promptly requires that primary caregivers of children are able to recognise key illness symptoms and seek care from appropriate health facilities and providers (Herbert et al., 2012, Geldsetzer et al., 2014, Diaz et al., 2013). Nonetheless, the local perception of the causes of illness is not always in accordance with the biomedical model of disease causation (Sabuni, 2007) and misinterpretation of disease symptoms and severity is common and affects the health seeking behaviour of child caregivers (Nsungwa-Sabiiti et al., 2004b, Winch et al., 1996, Muhe, 1996).

In addition to poor symptom recognition, health seeking behaviour is often compromised by a number of social-cultural factors. Cultural norms such as codes of care for newborns (Herbert et al., 2012) and for children with convulsions (Mwenesi et al., 1995, Warsame et al., 2007) can compromise early health seeking behaviour. A study from Tanzania that investigated the effects of new biomedicine information in a community concluded that interaction between

new information and community raised syncretic models which deviated from the traditional biomedical model and had the potential to cause delay in health seeking behaviour (Muela et al., 2002).

Households may be located far from the health facilities and might have financial limitations to accessing health care, meaning that caregivers will be subjected to opportunity costs while travelling long distance in order to obtain care for the sick child. Furthermore, poor financial access diverts caregivers away from the formal health sector (Herbert et al., 2012, Geldsetzer et al., 2014). Caregivers may shun the professional care in the formal sector and opt for informal health providers who often have several flexible modalities of payment for services offered (Muela et al., 2000).

User perception of quality of health care creates what is known as the demand response to quality of care (O'Donnell, 2007). The perceived quality of health care provided by a health service and people's attitude towards the service is therefore known to drive utilisation of health interventions through influencing health seeking behaviour (Rutebemberwa et al., 2009a, Haddad et al., 1998, Patel et al., 2010, Acharya and Cleland, 2000, Diaz et al., 2013).

Since it is not possible to bridge health inequities by merely improving access to health care, efforts need to be made to make health services more people centred so that they are viewed as attractive to their potential users (Acharya and Cleland, 2000, Campbell and Roland, 1996).

1.3.2 Supply-side barriers affecting health seeking behaviour

Several factors within the health systems (supply-side barriers) hamper patients from receiving the appropriate treatment they deserve. At a national level the appropriate interventions may not be provided at all within the public sector or availability may be on and off; for example rural areas lack hospitals altogether and the lower level health facilities located in the rural areas suffer from frequent lack of drugs, (Hanson et al., 2003, Wagstaff, 2004, O'Donnell, 2007).

The services provided at health facilities are of poor quality in many low income countries. Health services in several low and middle income countries are characterised by long waiting times, lack of staff, and lack of medicines and equipment (Wagstaff, 2004, World Bank, 2004). Misdiagnosis is frequent, and inappropriate prescription behaviour and treatment practices are common (Wagstaff, 2004, O'Donnell, 2007). Health facilities also open and close irregularly, doctors and nurses are often absent and staff are occasionally rude to patients (Chaudhury et al., 2004, World Bank Group, 2010, World Bank, 2004). Prices of medicines and other consumables may be high coupled with relatively high user fees, including under the table user fees that are documented in several countries.

1.3.3 The quality of care and utilisation of health services

Even though poor quality services do not necessarily result in the death of those who utilise them, and equally good quality services may not necessarily lead to recovery among the treated; poor quality services are characterised by a degree of effectiveness that is short of any anticipated outcomes thus affecting demand for health care among populations (Filmer et al., 2000, Wagstaff, 2004, Campbell et al., 2000b, Donabedian, 1988). Total quality assessment requires structure, process and outcome measure evaluation (Donabedian, 1988, Opondo et al., 2009, Rademakers et al., 2011, Campbell et al., 2000b). Structure refers to the availability and well organisation of resources (infrastructure, material and human) acting as channels through which care is delivered (Donabedian, 1988). Process reflects the actual process undergone during a clinical interaction encounter between patients and health providers. During this interaction, structural inputs are transformed into health outcomes (Peabody, 2006). Outcomes are the changes in the receiver's health status or any desired outcomes occurring as a consequence of health provider-receiver interaction (Donabedian, 1988, Campbell et al., 2000b). The classical structure, process and outcome approach to quality assessment is well established although lately quality assessment frameworks have been expanded to include quality improvement objectives including: patient safety, effectiveness, patient centeredness, timeliness, efficiency, and equity (Peabody, 2006, Campbell et al., 2000b). The Donabedian model assesses accessibility, continuity, comprehensiveness, integration, clinical interaction, interpersonal treatment and trust in quality of care; all of which relate to the critical functions of the health system (Donabedian, 1988, Murray and Frenk, 2000). The quality of health care can be looked at from two perspectives: patient perception, and technical or professional assessment. Understanding the intended users' acceptability and opinions about a health intervention is important as it drives access and utilisation of health services which are in turn directly linked to effective coverage of the interventions (Tanahashi, 1978, Peabody, 2006). This thesis focused on the patients' perspective of the quality of health care.

1.3.4 Health seeking behaviour in the context of major causes of childhood mortality

Although malaria, pneumonia, diarrhoea and neonatal conditions disproportionately affect children in low income settings, gaps in health seeking behaviour for these conditions are still widespread. Recent literature reviews on care seeking practices for the conditions raise concern over the low ability of caregivers to recognise signs of malaria and pneumonia; suboptimal care seeking practices outside the home; poor use of some of the interventions commonly promoted by global action plans such as the use of ORS for diarrhoea and the use of CHWs (Geldsetzer et al., 2014, Herbert et al., 2012).

1.4 EQUITY IN ACCESS TO CHILD HEALTH INTERVENTIONS

Inequities in health can be defined unfair and systematic inequalities in health or its social determinants between more advantaged and less advantaged groups (Braveman and Gruskin, 2003). The term health equity focuses attention on the distribution of resources and other

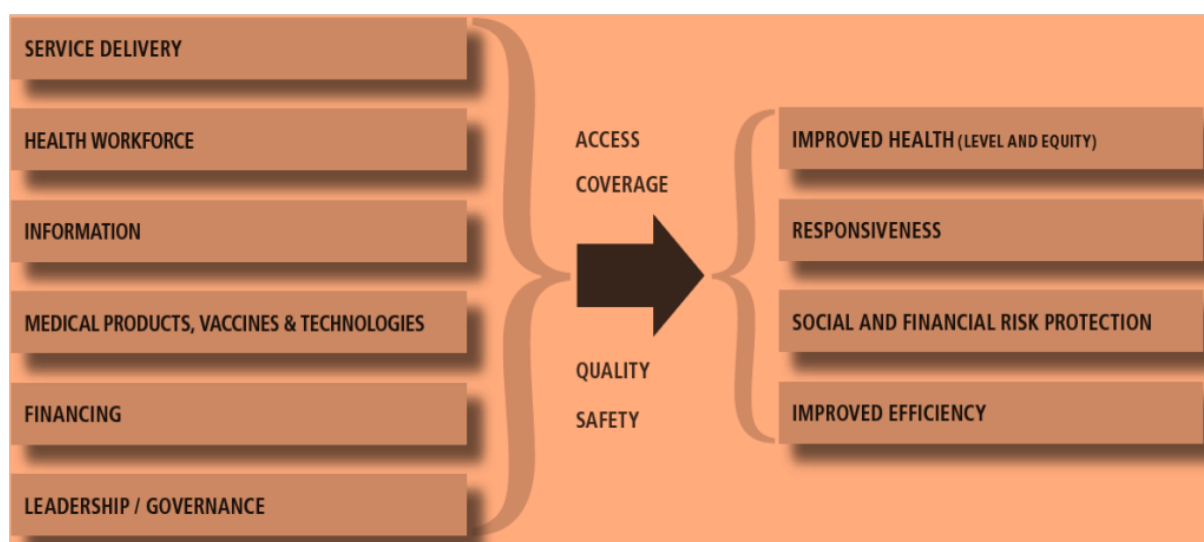
processes that drive a particular form of health inequality (Braveman and Gruskin, 2003, Marmot, 2005). Although one of the goals of health policies is to improve health even for the world's poorest people, the brunt of child mortality is borne by the poorest households within most countries (Marmot, 2005, Requejo et al., 2014). Moreover, these same households are least likely to access medical care (Victora et al., 2003) and yet the decision of who gets access to medical care is socially determined. Health care refers not only to the utilisation and receipt of health services but also to the allocation of health care resources, financing of health care, and the quality of health care and is thus a social determinant of health that is influenced by social policies (Braveman and Gruskin, 2003). While efforts are being made to reduce child mortality through improved interventions (UNICEF, 2013), it is necessary to ensure that these interventions reach the poorest households as previous studies have shown that well intended interventions ended up not reaching poor households (Gwatkin, 2006, Victora et al., 2000, Jones et al., 2003, Victora et al., 2006)

1.5 CHILD HEALTH IN THE CONTEXT OF HEALTH SYSTEMS

1.5.1 The role and structure of the health system

Health systems are tasked to ensure that those who utilise them are on the causal pathway to better health outcomes in an equitable, efficient and effective manner (Evans et al., 2008, Frenk, 1994, WHO, 2000b). Health systems are composed of all organisations, people and actions primarily aimed at health promotion, maintenance and restoration of health (WHO, 2007). The World Health Organization (WHO) names six interconnected blocks upon which health systems are built. They include service delivery, health workforce, health information, medical technologies, health financing, leadership and governance (figure 2) (WHO, 2007).

Figure 2: The WHO health system framework



Source: http://www.who.int/healthsystems/strategy/everybodys_business.pdf

The six building blocks of a health system: aims and desirable attributes

- Good health services are the part of the system that refers to delivery of effective, safe, good quality personal and non-personal health interventions to those who need them, when and where needed, with minimum waste of resources.
- The health work force block is the unit of the health system that relates to sufficient numbers of competent staff with a fair distribution delivering health care in responsive, fair and efficient ways to achieve the best possible health outcomes using the available resources.
- The health information systems block refers to systems which ensure reliable and timely production, analysis, dissemination and use of information on the determinants of health, performance of health systems and the prevailing health status.
- Ensuring scientifically sound and cost-effective use as well equitable access to safe, quality assured essential medical products, vaccines and a technology is the key block of the health responsibility.
- A well financed health system raises adequate funds for health, in order to ensure that people are able to use services when needed without suffering from catastrophic financial expenditure
- Leadership and governance involves ensuring that strategic policy frameworks exist and are combined with effective oversight, coalition-building, the provision of appropriate regulations and incentives, attention to system-design, and accountability.

1.5.2 Health service delivery platforms for child health interventions

Health services are often clustered into interventions that are delivered by the health system through various platforms. Delivery platforms in turn are organised structures and process through which health providers deliver services (Van Olmen et al., 2012). While the best arrangement for health service delivery is still debatable (Atun et al., 2010b), health service delivery platforms have broadly been classified into vertical programmes; which use resources separate from other services, and horizontal programmes; which work through existing health system structures (Travis et al., 2004, Lewin et al., 2008). At the same time the term diagonal approaches has been coined to refer to the mix of horizontal and vertical approaches encouraged by international health bodies to maximise resource allocation and health benefits (Ooms et al., 2008, Balabanova et al., 2010).

The term ‘integrated’ as applied to health interventions has been used to refer to organisational arrangements of delivering interventions ranging from integration of all elements of an intervention into the critical components of the health system, to partial integration of only a few components of the intervention (World Health Organization, 2008, Atun et al., 2010a). Even though the term ‘integration’ has been applied to the scenarios above, evidence to date shows that there are very few instances when clear-cut integration or non-integration occurs, as fuzzy levels of integration occur with most interventions (Atun et al., 2010b, Atun et al., 2010a).

With respect to child health, progressive efforts have been made at promotion of universal coverage of effective maternal, newborn and child health interventions. Delivery platforms recommended for the Countdown priority countries vary widely ranging from skilled care at health facilities to household care (Bhutta et al., 2008). There is emphasis on integrated approaches for maternal and newborn care (Bhutta et al., 2010, Bhutta et al., 2012) including improved child feeding (Bhutta and Das, 2014, Bryce et al., 2003, Jones et al., 2003), improved care of the newborn (Bryce et al., 2008, Black et al., 2003, Darmstadt et al., 2005), improved sanitation and hygiene, and increased immunisation coverage (Bryce et al., 2006), better facility based care through IMCI (WHO, 1995, Bryce et al., 2005a) and increased coverage of care for children with malaria, pneumonia and diarrhoea through integrated community case management (iCCM) (de Sousa et al., 2012, WHO/UNICEF, 2012).

1.5.3 Health system interventions in complex adaptive systems

Systems made of several interconnected units such as the health system are known as complex adaptive systems (Van Olmen et al., 2012). The term ‘complex adaptive systems’ specifically refers to systems that are made up of many individual, self-organising components that are capable of responding to their own and others’ environment (Van Olmen et al., 2012, Paina and Peters, 2012, Plsek and Greenhalgh, 2001). The system as a whole is a network of relationships and interactions that occur between the individual components of the system to form a functional unit. The interactions that occur within the system as a whole are therefore more important than discrete actions and functions of the individual components. Changes in any component of the system cause reactions in its related components and environment (Plsek and Wilson, 2001, Paina and Peters, 2012). Complex adaptive systems utilise resources from the environment and are expected to be responsive to that environment. They also have the capacity to reorganise themselves basing on prevailing circumstances. Since human actors are at the centre of health systems, the course of interaction between various components of the health systems does not always happen in a linear manner and can thus not be predicted with complete accuracy. Therefore, the effects of any health intervention on a health system cannot be predicted with complete certainty (Van Olmen et al., 2012, Van Olmen et al., 2010, Paina and Peters, 2012). Similar regulations, communication and coordination among various components of a health system can yield different outcomes in different settings depending on how the constituent components of the health system react. Due to this uncertainty in interaction pathways as well as unpredictable consequences of these interactions, health systems and interventions are often prone to unintended consequences such as marginalisation of the poor (Paina and Peters, 2012).

Although the role of the health system is to ensure that the health outcomes of the people served improve equitably through being responsive to people’s expectations, financial fairness and the efficient use of available resources; there are certain underlying values such as intersectoral action and community participation that must be possessed by a health system as a social institution in order to achieve this role. Even though these values are crucial to

achieving the goals of the health system through their ability to influence priority strategies, they are often omitted in most health system analysis frameworks (Van Olmen et al., 2010).

When the view point of complex adaptive system is applied to integrated interventions such as IMCI it is evident that several small changes to the implementation process could have improved the intervention's outcomes. However these changes are dependent on the country context and by making these small-scale changes to some parts of the intervention and selecting those changes that produce the desired effects, it is possible to make improvements in the system as a whole. This scenario is well illustrated by the Uganda case study. Uganda started implementing IMCI in 1995. IMCI is composed of three key distinct components that countries were asked to adopt based on local epidemiology. These included improving health workers' skills through training and reinforcement of correct performance; improving health system support for child health service delivery, including making drugs readily available, effective supervision, and the use of monitoring and health information system data; and a set of family practices deemed to be important for child health and development (Bryce et al., 2004). However, the pressure for rapid scale up for complete coverage of IMCI in all districts of Uganda did not allow for careful implementation planning. This led to the neglect of some components of the intervention such as need for supervision, quality assessment and monitoring and evaluation. The Ministry of Health (MOH) was taxed beyond its capacity to support districts and there was delayed implementation of some of the necessary components of IMCI such as the referral component as well and the community component of IMCI which was omitted altogether (Nsungwa-Sabiiti et al., 2004a). From the IMCI implementation experience in Uganda, it is clear that evaluation of interventions as they are being scaled up is of paramount importance as it provides implementers with the opportunity to make changes and rethink the components of the intervention which should be used.

1.5.4 Community case management for childhood illnesses

While IMCI was introduced as a health system strengthening strategy targeting case management skills for facility based health workers (Gove, 1997), the lack of human resources for health coupled with limited access to health services and the delayed implementation of the community component of IMCI (c-IMCI) limited its impact (Winch et al., 2002, Task Force on Health Systems Research, 2004, WHO, 2004a, Nsungwa-Sabiiti et al., 2004a). As it has been well established that interventions in health facilities will not reach their full potential unless households and communities are involved in the planning and implementation process, there was rekindled interest in the use of CHWs as a complementary strategy to reach sick children in the community (Gilson et al., 1989, Task Force on Health Systems Research, 2004).

It is generally agreed that well trained CHWs can be tapped as an important human resource for management of several childhood illnesses (Lewin et al., 2005, Kelly et al., 2001, Haines et al., 2007, Perez et al., 2009, Lewin et al., 2008, Christopher et al., 2011). This is supported by the mounting body of literature on use of CHWs in the management of several conditions

including: malaria, respiratory tract infections and diarrhoea (Brenner et al., 2011, Chanda et al., 2011, Christopher et al., 2011, Fagbule and Kalu, 1995, Hadi, 2003, Kallander et al., 2006a, Kelly et al., 2001, Khan et al., 1990, Mubi et al., 2008, Mukanga et al., 2011, Winch et al., 2005, Zeitz et al., 1993).

As a result WHO rolled-out recommendations for CCM of malaria in 2004 following its demonstrated effectiveness in large pilot studies (WHO, 2004b). In the same year a joint statement was released by UNICEF and WHO, recommending integrating CCM for pneumonia in areas where malaria was endemic (WHO/UNICEF, 2004b). The guidelines for clinical management of diarrhoea at home and by health facility workers were also made more explicit (WHO/UNICEF, 2004a). At the same time there was growing interest in integrated models for delivering child health interventions (Tulloch, 1999, Frenk, 2009, Winch et al., 2002). Subsequently iCCM for malaria, pneumonia and diarrhoea was recommended as a key child survival strategy in high child mortality burden countries (UNICEF/WHO, 2006a, WHO/UNICEF, 2012). iCCM is a simplified form of IMCI aimed at rectifying coverage gaps in curative and preventive interventions whilst promoting equity through targeting the most geographically remote areas (The Earth Institute, 2011).

Despite wide endorsement for CCM approaches, scaling up CCM has not been without challenges. Amongst these challenges is the slow progress in implementation of CCM for pneumonia which has been noted even in countries with the highest pneumonia burden (Marsh et al., 2008). There is a general concern that as the number of conditions simultaneously handled by CHWs increase, the quality of health service delivery might be compromised (Kelly et al., 2001, Kalyango et al., 2012b, Druetz et al., 2013). However, studies have shown that simple interventions such as provision of guidelines, refresher training and supervision can help improve quality of care (Rowe et al., 2005). Moreover, there is a growing body of literature showing that CHWs can deliver multiple interventions with high quality or quality comparable to that delivered at the health facilities (Hamer et al., 2012, Gilroy et al., 2013, Mukanga et al., 2011, Kalyango et al., 2013b, Yeboah-Antwi et al., 2010). However most of these studies have been conducted in controlled settings with small numbers of CHWs.

There is still some fear that iCCM might increase unnecessary administration of antibiotics which could eventually lead to resistance (Druetz et al., 2013). However, Okeke and colleagues argue that in low income countries guidelines such as IMCI can form the basis for educational interventions aimed at more rational prescription of antibiotics following diagnosis (Okeke et al., 2005). Noteworthy is the fact that CHWs use similar guidelines to those used by health facility workers and there is evidence of improvement in rational use of drugs when comparing CHWs to the private sector which is commonly used in low income settings (Kalyango et al., 2012a, Khanal et al., 2011). It is also feared that treatment of malaria based on clinical diagnosis alone may lead to excessive use of the drug, cause unnecessary expenses, and the inevitable risk of developing resistance (D'Alessandro et al., 2005). Nonetheless, studies conducted in Africa and elsewhere, have demonstrated that with

rigorous training and supervision, safe and accurate use of Rapid Diagnostic Tests for malaria (RDTs) by CHWs is possible (Mukanga et al., 2011, Elmardi et al., 2009, Harvey et al., 2008, Hawkes et al., 2009). The shift from presumptive treatment to diagnostically confirmed malaria treatment will potentially limit drug wastage and resistance that arises from drug misuse (D'Acremont et al., 2009).

While there is an atmosphere of both scepticism and optimism about approaches utilising CHWs for delivery of essential child health interventions, the adoption of iCCM at the community level will depend not only at how well it is perceived by the users but also on how well it will be integrated with existing structures and the overall support it receives from the broad health system. For example, CCM programmes relying on volunteer CHWs have been challenged with attrition which leads to discontinuity in community care and replacement costs (Bhattacharyya et al., 2001, Alam et al., 2012). However, health system investments such as adequate remuneration, training opportunities, supervision, and community approval have often been mentioned as some of the ways in which CHW motivation can be maintained and hence redress attrition (Alam et al., 2012, Glenton et al., 2010, Ruano et al., 2012, Abbey et al., 2014, Ludwick et al., 2014, Strachan et al., 2012, Rahman et al., 2010).

1.6 THE DIFFUSION OF INNOVATIONS IN THE CONTEXT OF INTEGRATED HEALTH INTERVENTIONS

1.6.1 Simple and complex health innovations

An innovation is a set of new ideas, routines, objects or institutional arrangements or organisation changes aimed at improving health outcomes that is perceived as new by individuals or units of adoption (Greenhalgh T, 2004, Atun et al., 2010a, Rogers, 2004). Health interventions range from combinations of technologies (e.g. vaccines, drugs, laboratory tests), service delivery inputs and organisational modifications made in an attempt to improve service delivery. Health services can thus be referred to as innovations that are introduced into an adapting health system (Greenhalgh T, 2004, Atun et al., 2010a). As earlier described, the health system is a complex adaptive system made of several components that interact in non-linear ways to produce unpredictable results (Plsek and Greenhalgh, 2001, Van Olmen et al., 2012, Paina and Peters, 2012). A paper from 2000 (Wolff, 2000) summarised the criteria for classifying interventions into simple or complex based on their nature. Simple interventions are characterised by a) simple standardised staffing, b) precisely specified protocols, c) subjects with easily defined conditions who have insight into their illness and value protocol goals, and d) solid external boundaries that are not influenced by the broader social setting. Complex interventions are characterised by a) complex and diverse staffing levels, b) fuzzy protocols, c) populations with diseases that cannot easily be clustered into one disease who have varying insights into their conditions and who may challenge the goals of the intervention and, d) permeable external boundaries in which intervention performance is dependent on the social setting (Wolff, 2001).

Health interventions vary in constitution from technological, to procedural to organisational innovations. Their level of complexity is determined by the multiple components and facets from which they are constituted. Integrated health interventions tend to be more complex in nature consisting of interrelated and interdependent interventions clustered together and delivered over time. Integrated interventions can also be delivered at different levels of the health system to a range of stakeholders by health professionals from various disciplines. Although there is no clear-cut definition for integration, it can generally be seen as the level, pattern and rate of adoption and assimilation of a health intervention into each of the functions of the health system (Atun et al., 2010a).

When looking at iCCM for malaria, pneumonia and diarrhoea, through the lens of complex interventions, it can be viewed as a relatively complex intervention. The intervention requires various diagnostic technologies and guidelines for malaria and pneumonia that are meant to differentiate between the two diseases for children who present to a CHW with fever. The intervention also consists of community health promotion that targets malaria, pneumonia and diarrhoea with the underlying assumption that similar factors predispose children to disease in the community. Furthermore, the CHW relies on the health facility for supervision, supplies and referrals. The intervention as a whole is therefore delivered by several health system functions and people from multiple disciplines who work together in an interconnected manner.

1.6.2 The institutionalisation of health innovations

When innovations are introduced into the health system the ultimate goal is that they are eventually institutionalised and scaled up in effective and sustainable ways (Feldstein and Glasgow, 2008, Yamey, 2011). The process through which an innovation is communicated through definitive channels among members of a social system is known as diffusion. Diffusion is also a social change that constitutes the process by which change occurs in the structure and function of a social system (Rogers, 1995, Rogers, 2002, Haider and Kreps, 2004). The terms ‘adopting’ or ‘social system’ refer to key actors and institutions in the health systems that have various levels of interest and power (Atun et al., 2010a). The process of transition from small scale to large scale implementation of interventions often calls for new arrangements in financing, organisational changes and work approaches that go with institutionalisation of the intervention into the health system. Some of these changes are indeed new to the adopting system and thus qualify as innovations (Yamey, 2011, Atun et al., 2010a).

Some innovations diffuse more quickly than others and diffusion theories attribute this to properties of the innovations which include: 1) relative advantage - the degree to which an innovation is perceived by the user as better than superseding ideas in terms that matter to the users such as cost convenience and satisfaction, 2) compatibility - the degree to which an innovation is perceived to be consistent with prevailing values, past experiences and needs of the adopting unit, 3) complexity - the degree to which an innovation is perceived as difficult to use and understand, 4) trialability - the degree to which an innovation can be experimented

with on a limited basis in order to address uncertainty, 5) observability – the degree to which the results of an innovation can be seen by the adopters and 6) reinvention - which is believed to occur when adopters adapt, modify and hence refine the innovation to suit their own needs (Rogers, 2002, Rogers, 2004, Greenhalgh T, 2004). Innovations perceived to have greater relative advantage, compatibility, trialability, observability and lesser complexity are more quickly adopted by adoption units. The perceived attributes of iCCM, and how they affect diffusion and adoption by its intended users, have not been studied previously.

However, effective and sustainable institutionalisation, or embedment of interventions into the adopting system, demands that gaps in efficacy, effectiveness and prevailing practices be addressed while moving from pilot studies to large scale implementation (Allotey et al., 2008). As an example, an evaluation of IMCI implementation revealed that it was first implemented in more easily accessible better-off areas with available human resources for health instead of worse-off, hard to reach areas with limited human resources for health, but with greater needs (Gwatkin, 2006). Several lessons learnt from the IMCI adoption experience offer an opportunity for reinvention of related public health programmes. Since efforts to scale up iCCM are underway in many countries, the focus should be redirected to the more pragmatic approaches that address changing contextual processes that influence how health systems and certain populations adopt interventions. Adoption of innovations therefore necessitates finding sound innovations, investment into the people who adopt the innovation early and creation of an environment that enables reinvention (Berwick, 2003).

1.7 UGANDA COUNTRY PROFILE

1.7.1 Geographical, economic, and socio-demographic indicators

Uganda is a land locked East African republic occupying a surface area of 241,550 square kilometres and has an estimated population of 35.4 million people. About 18% of Ugandans lives in urban areas. Uganda is a low income country where most of the population depends on agriculture for their livelihood. In 2011 Uganda's gross domestic product was estimated to be 19,271 million US dollars while the gross national income per capita was 549 US dollars. The average annual population growth rate for Uganda is 3.1%. About 48.3% Ugandans are below the age of 14 years and life expectancy at birth is 55.4 years for females and 53.8 for males (Uganda Bureau of Statistics, 2013).

1.7.2 Child health indicators and millennium development goals

Uganda is one of the 75 Countdown countries with high levels of maternal and child deaths. The last demographic and health survey in Uganda was conducted in 2011 and it showed that between 2006 and 2010, the infant mortality rate was 54 deaths per 1,000 live births, the child mortality was 38 deaths per 1,000 children surviving to 12 months of age, and the overall under-five mortality rate was 90 deaths per 1,000 live births (Uganda Bureau of Statistics, 2011).

All MDGs affect child survival in one way or another but MDG 4 directly targets child survival as it requires an average reduction in the rate of under-five deaths of 5% each year. Between 1995 and 2006, the under-five mortality rate fell from 156 to 137 per 1,000 live births; an average annual reduction of only 1.2%. Between 2006 and 2011 there was accelerated progress in child health with under-five mortality rates falling from 137 to 90 deaths per 1,000 live births, translating into an average annual reduction of 8.1%. Similar trends were observed in infant mortality and the gains were even higher among children born to mothers with low education. In the year 2011/12 common causes of under-five mortality included malaria (28%), pneumonia (15%), anaemia (10%), and other respiratory infections (9%) (Ministry of Finance Planning and Economic Development, 2013). Although significant gains have been made in controlling malaria and other common causes of under-five mortality, the same cannot be said about pneumonia and other respiratory diseases whose contribution to mortality rates has barely changed over time (Ministry of Finance Planning and Economic Development, 2013).

1.7.3 Health policy and systems in Uganda

Health markets in Uganda are broadly divided into formal and informal health markets. Although there is no clear definition for an informal health provider in the literature, informal health providers can be defined as those who have not received any form of formally recognised training, who collect payment from the patients served and not an institution, who are not registered with any governmental body and who typically have no professional affiliation that greatly regulates them (Sudhinaraset et al., 2013). Although these markets form the large proportion of care sought by poor people, they are often ignored by key actors in the health systems (Bloom et al., 2011, Goodman et al., 2007). Studies from Uganda show that over 50% of health providers are informal health providers (Sudhinaraset et al., 2013). The folk sector in Uganda has evolved over time with the privatisation process making medicines easily available outside legal pharmaceutical institutions (Whyte, 1992).

The formal sector consists of private and public health markets which combined constitute approximately 50% of health providers in Uganda (Ministry of Health et al., 2012). The private sector consists of private for profit and private not for profit health facilities also known as mission facilities. About 41% of the hospitals in Uganda are private not for profit while they make up 22% of the lower level health facilities. The private not for profit health facilities extend their services mainly to rural areas in contrast to private for profit health facilities which are predominantly urban oriented. Public private partnerships in the health sector are encouraged by the Government which occasionally subsidises certain services in the private sector (Ministry of Health et al., 2012). However patients attending the private sector are often prone to poor quality care as private practitioners are often under skilled and poorly regulated (Konde-Lule et al., 2010, Ministry of Health et al., 2012, Tawfik et al., 2006).

The MOH in Uganda provides the governance for the public health sector and is the overall health regulatory body. The public sector is tier based with the first level being a CHW also

known as the Village Health Team member (VHT) working from home and the highest level being the national referral hospital. Health service delivery is generally decentralised to districts and sub-district. Table 1 below summarises the various levels of service delivery within the public health sector as outlined in the strategic health sector plan (Ministry of Health (MOH) [Uganda], 2010).

Table 1: Structure of the National Health system

Level	Health structure	Human resources and designated roles
Central level	National referral hospital	Promotive, preventive and curative services in all specialties. The highest cadre of staff is a specialist.
Regional level	Regional referral hospital	Promotive, preventive and curative services in all specialties. The highest cadre of staff is a specialist.
District	District Hospital	Basic preventive, promotive curative, maternity services and inpatient care. Supervision of lower units. Highest cadre of staff is specialist
County	Health centre IV	Basic preventive, promotive, curative, maternity services and inpatient care. Supervision of lower units. Highest cadre of staff is a doctor.
Sub-county	Health Centre III	Basic preventive, promotive, curative, maternity services and inpatient care. Supervision of Health Centre-I. Highest cadre of staff is a clinical officer.
Parish	Health centre II	Health care, health promotion and outpatient services. Supervision of Health Centre-I. Highest cadre of staff is a comprehensive nurse.
Village	Health centre I	Basic health promotion, preventive and curative services for malaria, pneumonia and diarrhoea by CHWs.

Uganda has a shortage of health workers with a health worker population ratio of 1.8 per 1000 population which is below the 2.3 per 1000 ratio recommended by the WHO (Ministry of Health et al., 2012). According to the human resources for health audit report, the doctor patient ratio as per the last census was 1:24,725 and the nurse to patient ratio of 1:11,000. Most of these health workers are based in urban areas leading to the lower level health facilities in rural areas being more affected by the lack of health workers (Ministry of Health et al., 2012). The delivery of health services is poorly organised such that referral hospitals end up conducting the duties of regular hospitals. The public sector is characterised by poor quality, frequent drug stock outs and heavy staff workload all of which serve to demotivate the existing health workers. However, the Government has made efforts to improve quality of care within the public sector through provision of guidelines and reorganisation of human resources for health and bonuses have been promised to health workers willing to work in rural areas (Ministry of Health et al., 2012). The record system in Uganda is widely paper based and quite cumbersome for health workers who analyse records; however, efforts to digitalise some of its records are underway and initiatives such as human resources for health information systems have already been launched (Ministry of Health et al., 2012).

The MOH as the overall governing body is tasked to ensure that all health facilities including lower-level facilities are equipped and supplied with medicines and other equipment. The national medical stores is the official supplier and distributor of medicines and equipment for the public sector while the joint medical stores is the supplier of equipment for the private sector (Ministry of Health (MOH) [Uganda], 2010). In 2002, Uganda adopted the pull system whereby health units requested medicines and supplies that matched the disease burden. In 2010 the pull system was replaced with a dual pull-push system. The pull system was maintained for Health Centre (HC) IVs and hospitals, while the push system was adopted for rural and hard-to-reach HC IIIs and HC IIs to ensure that medicines and supplies reach rural areas. Medicines and supplies, such as diagnostics and equipment, are procured by the procurement unit of the MOH. However, the procurement process remains long, causing irregularities in the drug supply chain that translate as stock outs of essential medicines in the health facilities (Ministry of Health (MOH) [Uganda], 2010, Ministry of Health et al., 2012).

Regarding health financing, user fees were abolished in the public health sector in 2001, leading to increased utilisation of health services. Overall, health care spending amounts to around 44 USD/capita in 2012. However, many poor patients are still not able to access high quality care as dual systems still exist at hospital level. The MOH heavily relies on donors for health service provision who work through implementation partners often operating through vertical programmes. Furthermore, the MOH has been chronically underfinanced with less than 10% of the national budget being allocated to health in the past five years; a value that is way below the 15% declaration of Abuja target. The majority of the MOH budget is spent on hospitals in urban areas which serve less than half of the population (Xu et al., 2006, Ministry of Health et al., 2012, McPake et al., 2011, WHO, 2000a, Orem and Zikusooka, 2010).

1.8 INTEGRATED COMMUNITY CASE MANAGEMENT (iCCM) FOR MALARIA, PNEUMONIA AND DIARRHOEA IN UGANDA

1.8.1 Home based management of fever and home based care

The home-based management of malaria (HMM) strategy was recommended by WHO in 2004 following conclusive evidence on its effectiveness in control of malaria pilot studies (WHO, 2000a, Fapohunda. et al., 2004, WHO, 2004b). Uganda quickly responded to the Abuja declaration call by piloting home based management of fever (HBMF) in four sub-counties in 2002 (Nsungwa-Sabiiti et al., 2007). The intervention was gradually scaled to nationwide coverage by 2006. Under Uganda's HBMF initiative, community health volunteers known as community medicine distributors (CMDs) administered free co-packed chloroquine (CQ) and sulfadoxine/pyrimethamine (SP) combination (branded Homapak) which was given presumptively to all children under five years of age presenting with a history of fever (Fapohunda. et al., 2004). Homapak was replaced with pre-packaged artemisinin/lumefantrine (AL) combination (branded Cortem) following a malaria treatment policy change by the National Malaria Control Programme (NMCP) in 2006. With the subsequent WHO recommendation stating that AL treatment should only be given based on confirmed presence of malaria parasites, the policy change from CQ+SP to AL slowed, and finally halted the continued scale up of HBMF (MOH Uganda, 2009).

Between 2004 and 2006 iCCM was piloted in Acholi and Lango areas in Northern Uganda. The areas were in a post conflict setting with many internally displaced people confined to camps. The pilot studies were in the context of home based care (HBC) of childhood illness, a strategy that was recommended by UNICEF. In HBC of childhood illnesses CHWs were designated to the management of uncomplicated malaria, pneumonia and diarrhoea using cotrimoxazole for pneumonia and Coartem for malaria. They also treated diarrhoea with ORS, provided first aid and treated eye infections with tetracycline. Cotrimoxazole was later replaced with amoxycillin in 2010 as the first line of treatment for ear and lower respiratory infection following a policy change in order to conform to WHO guidelines. Studies from Uganda and elsewhere had also shown that there was more widespread resistance to cotrimoxazole compared to amoxycillin (UNICEF/WHO, 2006b, Joloba et al., 2001). Common to both the HBMF and HBC strategies was the pre-existing CHW structure, known as the village health team (VHT) platform, as a means for service delivery. The evidence and lessons from these pilot studies suggested that the interventions could have been more efficient if implemented together as a single programme than when implemented separately (MOH Uganda, 2009).

1.8.2 Delivering iCCM through village health teams

Based on lessons learnt from the pilot areas, plans for a country wide implementation scale up were initiated in 2008. In 2010 the iCCM policy was launched by His Excellence the Vice President of Uganda and VHT management of sick children was incorporated into the health sector strategic plan. iCCM has since been implemented in 34 districts with the help of various non-governmental organisations. The national health policy emphasises the

promotion and use of an IMCI approach at all health facilities, community and household levels. In the national health policy the components of iCCM were viewed as part and parcel of the Uganda national minimum healthcare package (UNMHCP); a package of low cost effective interventions for diseases with the highest burden on population health (Republic of Uganda MOH, 1999, Ministry of Health (MOH) [Uganda], 2010).

Under iCCM for malaria, pneumonia and diarrhoea health services are provided by members of the village health team (VHT) which is seen as a statutory health structure (Republic of Uganda MOH, 2005). The VHT member acts as the first link between the community and the formal health care sector and takes on the role of a health centre I. VHTs consist of 4-5 people who are selected by the community based on their personal characteristics, such as honesty, trustworthiness and respectability, and willingness to work as volunteers within their village of residence. They are trained and supported to mobilise communities and empower them in aspects of health promotion and disease prevention, and use of health specific programmes such as immunisation, sanitation, hand washing, complementary feeding, insecticide treated mosquito net use and intermittent malaria prophylaxis during pregnancy. VHTs also maintain a household register which documents overall health status of individual household members (Republic of Uganda MOH, 2005).

Within the iCCM context, VHTs are trained and equipped with skills and commodities to promote child health, disease prevention and treat uncomplicated cases of malaria, pneumonia and diarrhoea among under-fives. They carry out home visits for newborns and assess for danger signs. They are required to refer all children with danger signs, give pre-referral treatment and organise for facilitated referral to the nearest health facilities.

According to the national iCCM implementation guidelines, the proposed contents of the basic VHT kit include a) amoxycillin for pneumonia treatment, b) Coartem for malaria treatment, c) low-osmolarity ORS and zinc for treatment of diarrhoea, d) rectal artesunate that is given to children with danger signs due to malaria before referral, and e) diagnostic commodities e.g. respiratory timers, and RDTs for malaria. The VHT kit also has user items such as job aid cards with cut off respiratory breath rates for different age groups and drug dosages that help the VHT member to treat sick children using the algorithm below.

Upon meeting with a child a VHT is required to ask about fever, cough, diarrhoea danger signs and duration of the symptoms. For children presenting with fever, the VHT is expected to perform a RDT for malaria and children found to have a positive RDT without danger signs, are treated for uncomplicated malaria with pre-packed colour coded ACT (Coartem) strength; artemether (20mg)/lumefantrine (120mg) in the following recommended dosages: a) ages 4 months to 3 years: one tablet twice a day for 3 days (yellow pack), and b) ages 3 years to 5 years: two tablets twice a day for three days (blue pack).

For children presenting with signs of severe malaria and a positive RDT, administration of a start dose of rectal artesunate followed by immediate referral is advised. The rectal artesunate is administered in the following recommended dosages: a) ages 0-12 months: one 50 mg

artesunate capsule start, b) ages 13 to 42 months : 100 mg of artesunate in two separate 50 mg capsules administered at once, and c) ages 43 to 60 months: 200mg of artesunate administered as four 50 mg artesunate capsules at once.

For children whose caregivers report a history of cough, the VHT is expected to look for fast breathing and chest in-drawing. If a child is found to have high respiratory rate for its age (classified as simple/uncomplicated pneumonia), he or she is treated with pre packed colour coded dispersible amoxycillin tablets (125mg) in the following recommended dosages: a) for 2 to 11 months: two tablets twice a day for five days (red pack), and b) for ages 12 to 59 months: three tablets twice a day for five days (green pack). Children presenting with danger signs such as chest in-drawing in addition to cough and fast breathing are given the first dose of amoxycillin before referral to the nearest health facility.

All children presenting to a VHT member with diarrhoea are expected to receive low osmolality ORS and zinc tablets (20mg) in the following doses: a) ages 0-59 months: one sachet of ORS in a litre of boiled water per day for three days, b) ages 0 to 6 months: half a tablet of zinc once a day for ten days, and c) ages 6-59 months: one tablet of zinc everyday for 10 days. Children presenting with danger signs in addition to the diarrhoea receive ORS and are immediately referred to the nearest health facility.

VHTs are advised to provide the caregivers with a referral note stating any pre-referral treatments given to the children. Additionally, VHTs keep a register in which they document all case management activities provided, including, drugs dispensed, follow up and outcome. Data from the VHT register is entered into a periodic summary form by the VHT and are then submitted to one of the supervisors from the nearest health facility. The periodic summary form is then used by health facility to generate iCCM indicators.

The staff from the nearest health facilities train VHTs on iCCM and act as the primary supervisors. In addition to offering support supervision they are responsible for managing all severe cases referred by VHTS to the health facilities whilst providing counter referral. VHT drugs and other supplies are replenished from the nearest health facility.

2 STUDY RATIONALE

There is lack of human resources for health and efforts to bridge the gaps in equitable access to health are directed towards new policies constituting the use of CHWs to deliver integrated care (WHO/UNICEF, 2012). However there is limited research on the implementation of such models beyond small scale pilots or vertical programmes. Although iCCM is one of the evidence based programmes, the most recent evidence shows that it is still poorly implemented in many of the Countdown countries with the highest childhood mortality (de Sousa et al., 2012).

It has been argued that the greatest value for money is achieved when the most cost-effective and sustainable interventions are implemented. In the quest for sustainable, cost-effective interventions, there has been limited use of research evidence because of gaps in implementation research. To date, implementation research has focussed on efficacy and effectiveness trials at the expense of the broader context that defines the complex factors that underlie the reality of integrating and institutionalising interventions into the health system (Allotey et al., 2008, Glasgow et al., 2003). Pragmatic epidemiological methods have historically been the mainstay for establishing causal associations but the ability of these methods to isolate the several interactions that occur between individuals and agents in a complex adaptive system has been questioned (Galea et al., 2010). Moreover, the limitations of the use of randomised control trials in evaluation of complex adaptive systems like health systems is well acknowledged and a need to move towards other study designs when randomised control trials are not possible has been expressed (Wolff, 2000, Campbell et al., 2000a, Rychetnik et al., 2002). This research is conducted with in large scale implementation areas and uses alternative study designs to evaluate the adoption of iCCM.

Although the importance of community participation at all levels of health services is well known (Rosato et al., 2008), few studies have assessed the barriers to community involvement, which has previously been noted to be low in key child health interventions (Task Force on Health Systems Research, 2004). Furthermore, the complex interaction between the social factors, which affect people's access to health care and the context in which the interaction occurs to affect health outcomes, has rarely been studied (Savigny D and Adam T, 2009, Travis et al., 2004, Hanson et al., 2003, Ensor and Cooper, 2004). Since the ideas embodied in innovative social programmes are not self-executing, researchers are encouraged to have an implementation perspective in research. This implementation perspective on innovations considers post-adoption events to be important and the focus on the actions of those who convert to the practices a key to success (Fixsen et al., 2005). This thesis draws on research conducted shortly before, and during implementation of iCCM, to explore the adoption of iCCM by the communities.

In the Ugandan context, efforts have been made to bring health services closer to children in the communities through community based programmes such as HBMF. However, studies within this context showed low use of CHWs, necessitating more efforts for increased

utilisation (Rutebemberwa et al., 2009b, Nsungwa-Sabiiti et al., 2007). It is not known whether there will be improved use of CHWs under iCCM. According to the literature, uptake of a health intervention is more likely to be good if both the health providers and its users perceive it as being accommodative of the social and cultural beliefs and expectations of the community (Hill et al., 2003, Seidenberg et al., 2012, Greenhalgh T, 2004). The intervention needs to be affordable, accessible, available and of a degree of quality that is acceptable to those who need to use it (Rutebemberwa et al., 2009a, Seidenberg et al., 2012, Ewing et al., 2011, Kiguli et al., 2009, Bakeera et al., 2009). However, free key public health interventions led by governments, such as immunisations and mosquito net distributions have been undermined by conspiracy theories. Additionally, negative connotations have been associated with free or low cost medicines (Chuma et al., 2010, Jegede, 2007, Patel et al., 2010). The adoption of components of iCCM that are necessary for programme uptake have not yet been evaluated beyond small pilots. It is therefore not known how iCCM will be embedded in communities and institutionalised in the health system at the local, district and national levels.

There is major concern that key public health interventions aimed at improving equity in access to health care for children from the poorest families are first utilised by the least poor before the poorest can access them. There is therefore an outcry for investigation into health care inequalities and the context in which the inequalities occur (Victora et al., 2003, Edwards and Di Ruggiero, 2011, Victora et al., 2000). A study conducted within the context of HBMF in Uganda showed that children from households in the least poor wealth quintiles were more likely use HBMF compared to those in the poorest quintile (Nsungwa-Sabiiti et al., 2007). It is not known which socioeconomic status groups will be more likely to access and use iCCM.

Even when an intervention is well designed and acceptable to the community, gaps within components of the health system may hinder uptake of the intervention among the people who most need it (Atun et al., 2010a). Despite iCCM being a generally recommended child survival approach in Uganda today, it is more complex than its antecedent interventions which involved single disease strategies. Evaluation of the effects of iCCM as a policy in the community would require a multifaceted approach to test the fidelity of some aspects of the key interventions (case management and referral) delivered by the iCCM strategy. Such an evaluation is generally recommend (Carroll et al., 2007) and is relevant in establishing contextual factors that may hinder or facilitate the uptake and implementation of iCCM at scale. The studies on which this thesis is based explore adoption of iCCM as a complex intervention within the community, considering some of its constituent components such as acceptability, perceived quality of care, uptake of treatment and referral. In this study, the impact of iCCM on uptake of treatment has been limited to pneumonia and diarrhoea which were added onto the pre-existing HBMF programme. Failure to understand and address constraints to acceptability and uptake of iCCM might undermine the overall success of the intervention and thus child survival outcomes.

3 AIM AND OBJECTIVES

3.1 GENERAL AIM

The aim of the studies was to explore uptake and impact of iCCM, with special focus on community acceptability, perceived quality of care, appropriate treatment and access to referral care, in order to formulate recommendations for improved implementation at scale.

3.2 SPECIFIC OBJECTIVES

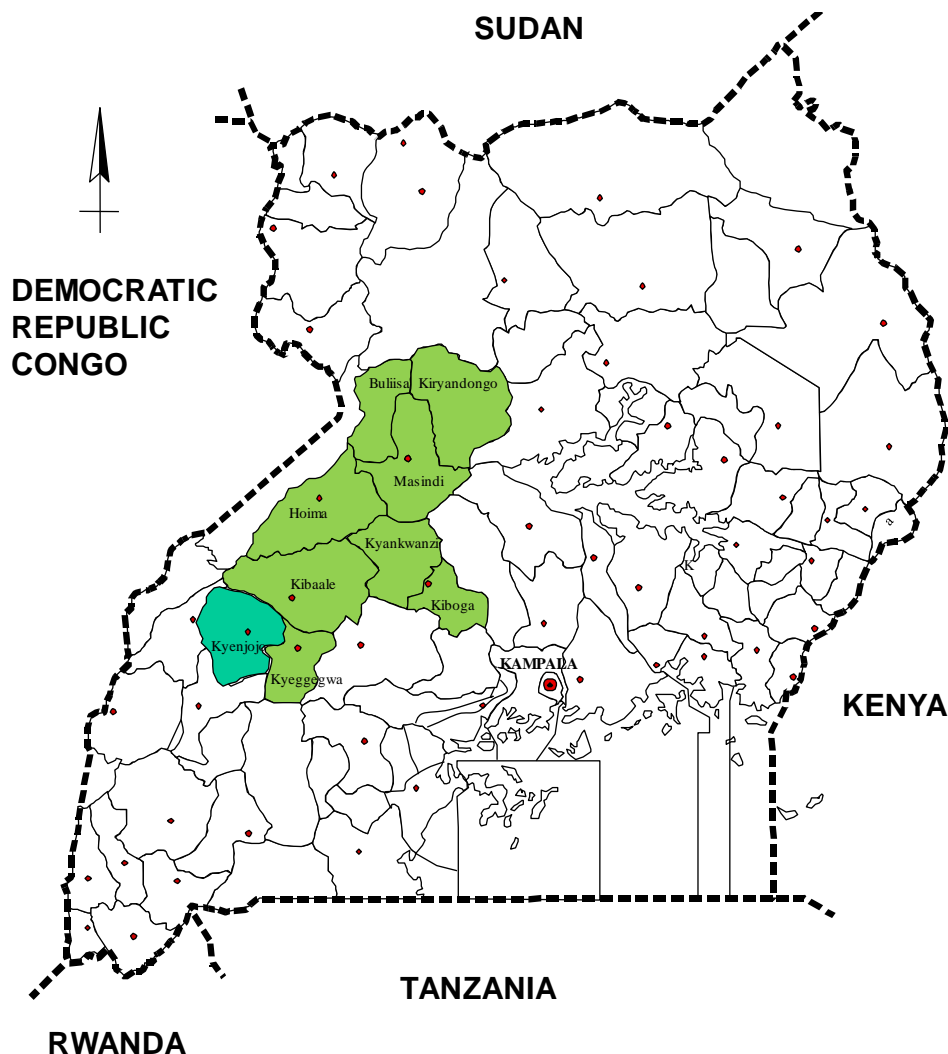
1. To explore the overall acceptability of iCCM by CHWs, health facility staff and child caregivers - study I
2. To establish the difference between perceived quality of care for child caregivers seeking treatment from CHWs and those seeking treatment from primary health facility workers with children suffering from uncomplicated malaria, pneumonia and diarrhoea - study II
3. To evaluate equity in use of iCCM and the impact of iCCM on uptake of appropriate treatment for diarrhoea and pneumonia - study III
4. To estimate the cost of referral completion and willingness to pay for referral among caregivers of children referred to higher level health facilities by CHWs - study IV

4 METHODS

4.1 STUDY AREA AND POPULATION

The study area was originally restricted to the geographical area of six districts in mid and central western Uganda (Kiboga, Kibale, Hoima, Masindi, Buliisa, Kyenjojo) that were marked for iCCM implementation by Malaria Consortium in 2009. In mid 2009 a new administrative district was carved out of Kyenjojo to form Kyegegwa and in mid 2010 new administrative districts were carved out of Kiboga and Masindi to form the districts of Kyankwanzi and Kiryandongo, respectively. In mid 2010 Malaria Consortium, in collaboration with the MOH spearheaded implementation of iCCM in these districts. For the studies I, II & III, Kyenjojo district was dropped from the study area due to late implementation of iCCM, and only eight of the districts were included (figure 3).

Figure 3: Map of Uganda with study districts coloured green and blue



The districts in the study have an estimated total of 2.2 million people of which 18% are children less than five years of age. The districts are predominantly rural and majority of the inhabitants are peasant farmers who depend on agriculture for their livelihood. There are also a few fishing communities along the shores of Lake Albert. The districts are administratively divided into counties, sub counties, parishes and then villages. Overall there are about 20,000 CHWs in the study area who are locally known as VHTs. All VHTs undergo compulsory 6 day training on basic health promotive and preventive behaviour using the National VHT Strategy and Operation guidelines. The VHTs operating in the area had their basic training conducted by the MOH with technical and financial support from various non-governmental organisations based on a curriculum that was developed by the MOH. Each village has a total of 4-5 VHTs who conduct health promotive and preventive activities. Each VHT oversees approximately 20 households within his or her area of reach to which he or she offers health education, antenatal visits, birth registration, newborn referral and other health promotive activities. Malaria Consortium together with the MOH gave an additional 6 day training on iCCM to at least two VHTs from each village. The VHT were trained to deliver iCCM to sick children according to the National iCCM guidelines.

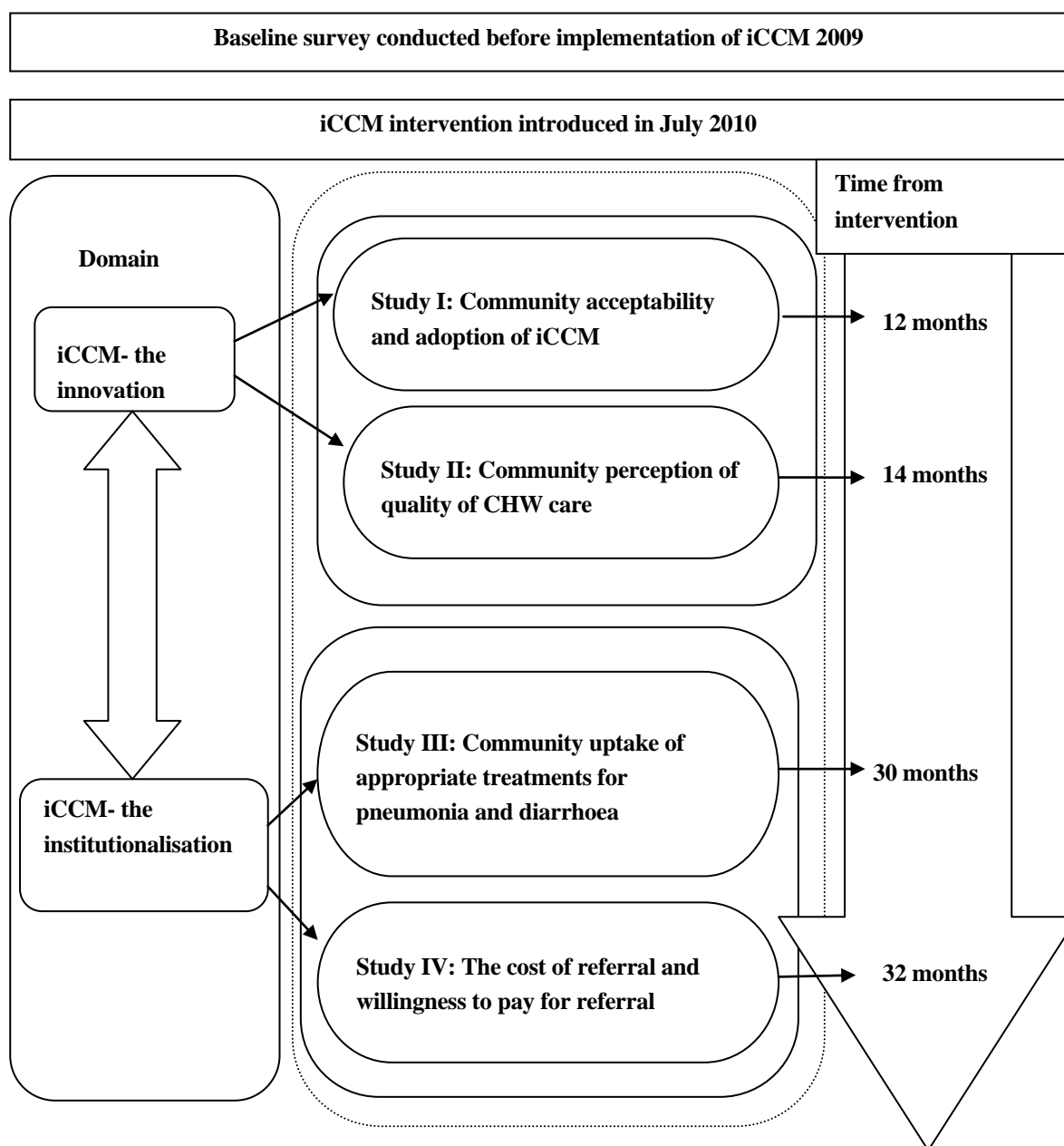
On the whole, drugs and medical supplies at health facilities are often pulled from the national medical stores to the district level. The district level then pushes the drugs and supplies to the lower level health facilities. However drugs and supplies for iCCM in the study districts were distributed to districts with logistical support from Malaria Consortium. The drugs were then distributed to VHTs by supervisors from the health facilities. Drug stocks were kept at the health facilities and at the district level from which VHTs would obtain replenishments. Nonetheless, drug delivery varies from district to district and some districts have started to setup their own drug supply chain by pulling their iCCM drugs from the national medical stores and distributing them internally among VHTs without the help of external agencies.

Several non-governmental organisations operate in the study area and use CHWs for several community based outreaches such as family planning, hygiene and sanitation water provision, mosquito net distribution, voluntary counselling and testing for HIV, directly observed therapy for tuberculosis and HIV, filariasis and oncocerciasis prophylaxis etc. No other non-government organisation utilised CHWs to offer curative treatment to children.

Malaria Consortium's inSCALE project (<http://www.malariaconsortium.org/inSCALE>) was conducting research on alternative approaches to motivating CHWs in the study area. By virtue of this research a three-arm cluster randomised control trial with one arm exploring a technology based approach to motivation, one arm a community based approach and one control arm was implemented in 39 sub-counties of the study area from September 2012 until June 2014. Although studies I, II and IV were conducted during the inSCALE trial, the research was restricted to the time period before the randomised control trial, the trial's control arm and those sub counties not included in the trial where standard iCCM procedures

were being followed. The third study (Study III) was nested within the overall iCCM programme evaluation that was conducted in the study area.

Figure 4: Overview of timing of the studies in months in relation to the intervention



4.2 MAIN RESEARCH METHODS

Health policy and system research addresses complex phenomena and it is generally recommended that theory plays an important role in study design (Gilson, 2012). Health policy and systems research relates to health system blocks drawing on both relativist social science perspectives and more positivist epidemiological approaches (Gilson, 2012). Positivist is based on the view that the phenomena under investigation exist independently of how they are understood and perceived by people. Positivist approaches are essential for identifying what interventions work best or have the most impact. Relativist research is

embedded in the understanding that phenomena under investigation are a result of interactions among social actors. As such, the relativist approach focuses on the intentions, values and beliefs of people and why certain meanings are attached to these beliefs. Relativist research is therefore essential in understanding the meanings given by actors to social phenomena.

This thesis draws on the theory of diffusion of innovations to explore attributes of iCCM and its diffusion into the community. The thesis also uses both realist and positivist approaches to explore why iCCM is adopted in the communities and estimate the impact of iCCM on uptake of appropriate treatment. The thesis is composed of four studies (I-IV) which apply multiple qualitative and quantitative methods to explore different components of iCCM. Studies I and II look at iCCM as an innovation and explore its acceptability in the community in terms of its components and perceived quality. Studies III and IV look at the how iCCM is used and acted on by the targeted users. Figure 4 above provides an overview of the studies in terms of time from the innovation roll-out. In sub-sections 4.2.1 and 4.2.2 below, each of the methods is broadly discussed in terms of its indications and main limitations. In section 4.3 a description of how the methods were applied to the various studies is provided. Section 4.4 describes the data analysis methods applied to each of the studies. The limitations of the research methods, study designs and data analysis methods as pertains to individual studies are further discussed in methodological considerations in section 6.2.

4.2.1 Qualitative methods

Study I used qualitative methods to explore adoption and acceptability of iCCM in the communities. It used focus group discussions (FGDs), key informant interviews (KIIs) and in-depth interviews with community members, VHTs and VHT supervisors.

4.2.1.1 Focus group discussions

FGDs are a form of data collection method that is often used to establish trends in people's opinion. Focus groups are widely used in social science, action and applied research. A FGD consists of seven to ten people who are selected because of common characteristics that are relevant to the research question (Green and Thorogood, 2013). An interviewer asks focused questions to encourage discussion and expression of different opinions in a supportive environment. The method relies on interaction between individuals to generate data that helps researchers understand people's experiences, knowledge, perceptions and attitudes towards a subject of interest and the reasons behind people's opinions in a natural setting (Patton, 2002). The method presumes that an individual's attitudes and beliefs do not form in a vacuum since people need to hear others' opinions and understandings to form their own. Focus group discussions are useful for gaining access, focusing selection, sampling and checking for tentative conclusions when combined with observations. The focus group discussion method is simple and produces quick results that are easy to believe. FGDs can increase the sample of qualitative research by permitting more people to be interviewed in one go. However FGDs are limited by power dynamics, lengthy arguments and the

interviewer has less control over the group compared to an individual interview. The data from FGDs may be difficult to analyse because context is important (Marshall and Rossman, 2006).

4.2.1.2 In-depth interviews

An interview has been defined as a conversation with a purpose. In a qualitative research interview the researcher explores general topics to understand participants' views. The method presumes that participants' view on the phenomena of interest should unfold as the participants see it (emic view) and not as the researcher sees it (etic view) (Marshall and Rossman, 2006). In-depth interviews require systemisation in questioning. Interviews are able to generate a lot of data rapidly. Interviews provide the researcher with the opportunity to understand the meanings attached to everyday activities by people. Since interaction in in-depth interviews is personal, they are limited by possible discomfort to participants, lack of cooperation and require a highly skilled interviewer in order to elicit reasonable narratives from the interviewees (Marshall and Rossman, 2006).

4.2.1.3 Key informant interviews

A key informant (KI) is selected to represent an overview of the whole community and not just sections of the community. KI interviews are interviews with people who are aware of what is going on in the community. KI interviews generate information from a wide range of people-including community leaders, professionals, or residents with more than average knowledge about the community. These interviews provide systematic information about the living environment and provide insights into the problem. KIs describe attitudes, perceptions and meanings attached to everyday life (Marshall and Rossman, 2006, Patton, 2002).

4.2.2 Quantitative methods

Studies (II-IV) used quantitative methods to explore perceived quality, uptake of appropriate treatments and equity in utilisation of iCCM. All three studies used facilitator administered questionnaires (structured interviews) to collect data from respondents. While studies II and IV used record review to identify potential study participants, study I relied on VHT utilisation records to identify study areas with varying uptake.

4.2.2.1 Structured interviews

Structured interviews are a means of data collection for large quantitative surveys which ensure that the questions are asked in the same way and order to all participants. This is done by interviewers reading questions to participants in the exact way they appear on the questionnaire. Structured interviews therefore provide opportunity for standardisation of answers. It is thus important that the interviewers stick to the agreed questions even though interesting lines of enquiry may arise during the interview (Glewwe et al., 2000).

4.2.2.2 Cross-sectional surveys

Cross-sectional surveys are descriptive study designs in which a sample of reference population is examined at a given point in time or over a short period of time. Cross-sectional studies thus provide a snap shot of the outcome together with its associated characteristics. Cross-sectional surveys are used to estimate the prevalence of an outcome of interest. Due to the fact that cross-sectional surveys can indicate existing associations, they are useful for generating hypotheses for which future research can be conducted. However one cannot make causal inferences as cross-sectional surveys could give different results if conducted at another time point. Cross-sectional surveys are prone to several forms of selection bias such as sampling and timing bias (Levin, 2006, Delgado-Rodriguez and Llorca, 2004).

4.2.2.3 Case series study

Case-series is a descriptive study design in which only cases with a particular disease or disease related outcome of interest are selected. The cases with the outcome of interest may be selected based on either the presence of the outcome of interest alone or on the basis of having both the outcome of interest and exposure. These cases are described to suggest at best a hypothesis since the absolute risks cannot be calculated from case series studies. Case series studies lack a comparison group and may be confounded by selection bias, which limits statements on the causality of correlations observed. Thus, in terms of generating evidence regarding various aspects of the disease process, a case-series is a very weak study design (Dekkers et al., 2012).

4.2.2.4 Medical record review

Record reviews use pre-recorded patient focused data to answer a research question. The records must be able to produce data that are both reproducible and valid. Record reviews are limited to measuring phenomena that are usually documented and data may not always be easily accessible. Furthermore ethical issues concerning confidentiality of the patients may arise and the records may be incomplete or imprecise since the data were not primarily collected for research purposes. Information may be erroneously recorded and records are prone to biased reporting (Worster and Haines, 2004, Brenner et al., 1997).

4.3 DESIGN, SAMPLE SIZE, SAMPLING AND DATA COLLECTION METHODS

4.3.1 Study I - Acceptability and adoption of iCCM

The study used a qualitative study design with an explanatory approach (Frankel and Devers, 2000, Marshall and Rossman, 2006) to explore factors that influence the acceptability and adoption of iCCM in the communities. The sample size of qualitative studies is not predetermined but data are collected from participants until no new information is being captured (Patton, 2002).

Data were collected by the doctoral student and three experienced research assistants who conducted homogenous FGDs with female caregivers (N=6) and male caregivers (N=1) of

children under five years residing in seven communities. Interviews were held with female (N=1) and male (N=6) resident primary caregivers of children. On average each focus group discussion consisted of 8–10 participants. KI interviews were held with VHTs (N=7), VHT supervisors (N=7), and village chairpersons (LC1s) (N=6). Interviews and FGDs were conducted in a convenient and private place within the village. KI interviews with VHTs and LC1s were held at the respondent's home. KI interviews with VHT supervisors were held in a private setting at the health facility premises. All interviews were audio recorded.

Sampling activities were guided by the theory of diffusion of innovation and the research question (Greenhalgh T, 2004, Marshall and Rossman, 2006). The selection of study participants was therefore purposeful, targeting only communities and participants believed to have rich data on barriers and facilitators for iCCM adoption. The sampling method sought to achieve maximum variation within the sample (Coyne, 1997) from areas with both high and low uptake of iCCM; areas with attributes theoretically known to influence use of health services, such as age, gender and geographical location (Molyneux et al., 1999). Table 2 below shows the sampling frame for the study.

With an operational definition of a community as a village served by one or more VHTs trained on iCCM, communities were classified into high and low uptake areas based on utilisation of iCCM services. The classification was based on an initial description provided by the VHT supervisor and the judgment to classify an area as high or low uptake was based on confirmation from VHT activity records in relation to attendance of sick children at health facilities. Areas where more than 10 sick children visited their VHT in the preceding two weeks (on average, 10–20 cases are treated in each village) were classified as high-uptake areas. Areas with less than five children seen within two weeks despite high attendance of children from the same villages at the supervising health facility were classified as low-uptake area. Resident primary caregivers of under-fives with the required attributes were then identified with the help of the LC1 chairpersons for the selected villages. Semi structured interview guides framed within the theory of diffusion of innovations were used to probe for attributes of iCCM that could affect acceptability and use of the intervention. The guides were pre-tested and modified. Interviews and FGDs were digitally recorded with the informed consent of each participant. All interviews were conducted in local languages except for the ones conducted with VHT supervisors.

Table 2: Sampling framework

District	Rural	Peri-urban	Hard to reach	Low-uptake	High- uptake
Buliisa	X		X	X	
Hoima	X		X		X
Kiboga		X			X
Kibaale	X			X	
Kyankwanzi	X		X	X	
Kyegegwa	X			X	
Masindi		X			X

4.3.2 Study II - Perceived quality of care in iCCM

The study used a comparative cross-sectional survey to explore the perceived quality of care in iCCM. Caregivers' perceived quality of care for children treated by CHWs under iCCM was compared to that of children treated by health facility based workers. The required sample was based on the main study outcome thus the sample size calculations were based on ability to detect a difference in mean perceived quality of care between the two groups of caregivers. Assuming a mean perceived quality of care score of 2.7 with a standard deviation 0.82 for primary health facility based workers (mean satisfaction with quality of health care for patients attending the outpatient clinic in Mulago hospital Uganda according to (Nabbuye-Sekandi et al., 2011)), a sample size of 158 participants was required in order to detect a 30% difference in mean perceived quality of care for services offered by CHWs and health facility based workers with 90% power at a 5% level of significance. When cluster design effects of 2 and a loss to follow up of 10% were adjusted for, a sample of 348 participants was required in each group. Of the 72 sub-counties with CHWs trained on iCCM in the study, 30% were sampled using computerised random sampling. Using cluster sampling with probability proportionate to cluster size, 98 villages were selected from the sub-counties. The study included all CHWs from the selected villages together with their supporting primary health facility units. A maximum of three children were sampled from all children treated by each CHW within two weeks of interview. The sample was randomly drawn from the CHWs' register through systematic random sampling by a trained research assistant. Primary health facility unit samples were drawn through systematically sampling a list of children with the diagnosis of malaria, pneumonia or diarrhoea compiled from the outpatient register. The list included only children aged 4-59 months with uncomplicated malaria and children aged 2-59 months with pneumonia or diarrhoea. Equal numbers of children were sampled from the CHWs and primary health facility units serving the same catchment area.

Upon being successfully traced, caregivers of children were given a structured questionnaire by one of the research assistants. The questionnaire was based on Donabedian's criteria for quality assessment. The questionnaire asked about the perceived quality of care for the different domains of quality for the last illness episode for which the caretaker sought treatment from a health provider for their child. The tool was adapted from the primary care assessment survey (Safran et al., 1998) and the Uganda service provision assessment survey (Ministry of Health (MOH) [Uganda] and Macro International Inc, 2008). In the questionnaires caregivers were asked to rate seven quality of care domains (accessibility, continuity, comprehensiveness, integration, clinical interaction, interpersonal treatment and trust) using a set of questions with rating scales that constituted the summary scales items.

4.3.3 Study III - Impact of iCCM on uptake of appropriate treatment for pneumonia and diarrhoea)

The study draws on data that were available from two cross-sectional surveys which were conducted before introduction of iCCM in 2009 and two years after introduction of iCCM in 2012. Having baseline (pre-programme) data is important in assessing the programme's impact in two ways. First, baseline data can be used for predicting programme outcomes in the population of interest (as in ex ante evaluations) whereby the research can check whether an evaluation plan will in fact work out by examining the conditions faced by the population in question. Second, baseline data can be used for making before and after comparisons also known as reflex comparison (Khandker et al., 2010).

The surveys were conducted by Malaria Consortium Uganda as part of an evaluation of their iCCM programme. The evaluation had two primary objectives: i) to assess the effect of iCCM on the proportion of children with access to appropriate care for fever, diarrhoea and pneumonia through assessment of caregivers' health-seeking behaviour around the illnesses. Pneumonia was operationally classified as presence of both cough and fast breathing in these surveys, and ii) to provide an indirect estimate of infant and under-five mortality before and after implementation of iCCM compared to control areas (data not presented in this study).

The sample size was therefore calculated based on a population-based, representative household interview survey for children under five, with a primary sample of 100 clusters for which household and birth history data were collected, and a smaller, nested sample of 40 clusters for the health-seeking behaviour component. Participant sampling was done with two-stage cluster sampling using the census database of the respective districts as a sampling frame, without restriction or exclusion. The primary sampling unit was an enumeration area (village or cluster of households) which was selected with probability proportionate to size. First, the total sample needed for mortality estimation was drawn jointly with the Uganda Bureau of Statistics followed by a sub-set of clusters selected with equal probability, which were used for the health-seeking behaviour assessment. In the second stage of sampling, all households in the selected villages were listed and the number of households needed was selected by systematic sampling. For villages with more than 200 households, an equal size section approach was used whereby the village was divided into 2-4 sections with an approximately equal number of households, and one of the sections was selected using simple random sampling.

Data were collected from primary caregivers of under-fives to whom an adapted questionnaire capturing socio-economic status and health-seeking behaviour for recent illness episodes was administered by a facilitator. The sample size for this study is limited to children aged 2-59 months whose primary caretakers were interviewed for health-seeking practices from the nested 40 clusters.

4.3.4 Study IV - Cost of referral and willingness to pay for referral in iCCM

The cost of referral and willingness to pay for referral was assessed using a case series study of caregivers of sick children referred to seek care from higher level healthcare facilities by CHWs. The desired sample size was calculated in relation to expected mean cost of referral. Assuming a sample mean of 8,950 UGX (approximately 3.5 USD) with a standard deviation of 16,860 UGX (actual costs of referral was 8,500 UGX in community referral in home management of malaria (Kallander et al., 2006b) and a hypothesised mean referral cost of 15,000 UGX in the sample, and adjusting for cluster design effects of 2 and a loss to follow up of 5%, a total of 174 referred children was required to detect the mean cost per completed referral equivalent to the hypothesised mean. With the village as the primary sampling unit and assuming uniform distribution, four out of nine districts were selected. Twelve sub-counties were selected from a list of all the sub-counties in the four selected districts. Under the assumption that a CHW would have referred at least one child within two weeks of interview, 50 villages were sampled from the list of sub-counties using probability proportional to population size of the sub-county.

Referred children were identified through an interview with CHWs from the selected villages. Facilitator-administered questionnaires were used to capture socio-demographic characteristics of the child and caregiver as well as referral related characteristics, circumstances and outcomes. With an operational definition of referral completion as - seeking care from a recognised public referral health centre that supervises the CHWs- the direct and economic costs of referral and referral completion were examined. Contingence valuation methods with the bidding method followed by an open ended question on maximum willingness to pay for referral (Drummond et al., 2005) to a preferred health centre were used to elicit caregivers' willingness to pay for referral. Most parts of the questionnaire were adapted from previous research on referral in integrated management of childhood illnesses and home based management of fever (Kallander et al., 2006b, Peterson et al., 2004, Simoes et al., 2003)

A societal view point was adopted for this study (Drummond et al., 2005) and all costs (financial and economic) related to management of children referred, regardless of to whom they accrued, were captured. CHW associated costs were therefore captured through a questionnaire. The opportunity costs to the volunteering CHWs and the child caretakers for time spent on the referred child were valued using the market price approaches (Drummond et al., 2005, Posnett and Jan, 1996, Agyei-Baffour et al., 2012). However, the time foregone as reported by the participants was eventually valued basing on the average income for rural dwellers as estimated in the Uganda National household survey (Uganda Bureau of Statistics, 2010). Direct and indirect health facility related costs were identified from the literature using a study conducted by Medical Sciences for Health on delivery of the minimum health care package at various levels of health facilities in Uganda (Collins et al., 2013).

4.4 DATA ANALYSIS

In this section, the data analysis methods applied to the studies are described in terms of their overall principles, strengths and weaknesses. The limitations of the methods as applied to studies are further discussed under methodological considerations in section 6.2.

4.4.1 Directed content analysis

In study I, the audio recordings from all interviews were transcribed into English by the research team. During the analysis, acceptability was operationally defined as the degree to which a service is sufficiently tolerable to its users as reflected not only in uptake but also in perceived quality (Tanahashi, 1978, Penchansky and Thomas, 1981). While the adoption of an innovation has been defined as an individual's decision to make full use of an innovation as the best course of action (Rogers, 1995), adoption was characterised as utilisation of health services provided by CHWs.

A directed content analysis approach was used to analyse the data. In directed content analysis, the researcher starts with a theory or key findings as guidance for initial codes. The analysis was therefore guided by the predefined categories in the theory of diffusion of innovation. Two independent raters, including the first author, read the text from each interview and identified meaning units which were labeled to make codes; the codes were grouped into sub-categories and pre-defined categories within in the theory of diffusion of innovation including perceived relative advantage, compatibility with societal needs, degree of complexity, trialability and observability of results. The analysis was cyclical, i.e. moving among literature review, data collection, transcription, preliminary analysis and scrutiny by other authors. The analysis sought for explanations for health seeking behavior for malaria, pneumonia and diarrhoea; initial choice of health care provider and factors affecting adoption of iCCM within the communities.

4.4.2 Descriptive statistics

For all statistical analysis in studies (II-IV) the departure point was the generation of descriptive statistics including frequencies and proportions for categorical variables such as socio-demographic variables. Continuous variables such as quality of care scores (study II) and money spent (study IV) were summarised using means and medians.

4.4.3 Chi-square test

Chi square tests are used to compare association in distribution of data that are categorical (Kirkwood, 2003). Chi square tests were used in study II to compare socio-demographic characteristics of participants and categorical summary scale items measuring perceived quality of care between caregivers' of children seen by CHWs and primary health facility based workers. They were also used to compare categorical treatment outcomes between children treated by CHWs and primary health facility based workers. In study III the chi-square tests were used test the difference in the proportion of children who received

appropriate antibiotics for pneumonia and ORS plus zinc for diarrhoea at baseline and in 2012

4.4.4 Principal components analysis (PCA)

Principal components analysis (PCA) is used to aggregate several indicators into one single measure. It uses orthogonal transformations to convert a set of variables in a dataset with possible correlations into a set of new values of linearly uncorrelated variables called principal components. The number of principal components is less than or equal to the number of original variables. This transformation is such that the first principal component has the largest possible variance followed by each succeeding component. PCA is limited by the fact that the directions maximising variance do not always maximise information; therefore a variable with high clinical significance but low contribution to variance can be overlooked (Everitt and Dunn, 2013). PCA can be used for measuring household wealth when income consumption and expenditure cannot accurately be measured (Vyas and Kumaranayake, 2006). Assets owned by households such as house construction materials, ownership of household items, land, animals and transport means, and water and sanitation infrastructure can be used to create a single indicator representing household wealth (Vyas and Kumaranayake, 2006). Principal components analysis, assigns a coefficient to each of the variables included in the asset index by means of an iterative model based on its importance in relation to the other variables (Everitt and Dunn, 2013). The sum of the coefficients for each household is then used to calculate an overall wealth index. Using household assets that were recommended by the Uganda demographic and health survey (Uganda Bureau of Statistics, 2011), PCA was used to construct a social economic status index in studies (II-III). Households were then categorised by their relative wealth (individual indices ranked from lowest to highest and grouped into quintiles) into socio-economic status quintiles that were used to make inferences about the status of households whose children access certain aspects of health care.

4.4.5 Factor analysis

Factor analysis reduces large numbers of explanatory variables into fewer distinct patterns known as factors (Izquierdo et al., 2014, Hand, 2008). Thus, factor analysis gives clear insights into the data and offers the possibility of using the output in subsequent analyses. The projection of the scores of the original variables on the factor leads to formation of factor scores and factor loadings. Factor scores are “the scores of a subject on a defined factor” while factor loadings are the “correlation of the original variable with a factor”. The factor scores can further be explored as new scores in multiple regression analysis while the factor loadings describe “the substantive importance of a particular variable to a factor”. Factor analysis can generate several factors and it may be hard to decide which factors should be kept for further analysis (Hand, 2008). It also groups variables together into factors however the interpretation of the meaning of these patterns is up to the analyst and interpretation of these patterns can vary from analyst to analyst (Izquierdo et al., 2014). Factor analysis was

used in study II to predict an overall perceived quality of care score for each caregiver from the various ratings of quality of care provided for each domain.

4.4.6 Wilcoxon rank-sum test

Wilcoxon rank-sum test is a non-parametric test used to assess whether an outcome varies between two exposure groups (Kirkwood, 2003). Wilcoxon rank-sum test was used in study II to compare the perceived quality of care scores between caregivers of children treated by CHWs and those treated by primary health facility based workers.

4.4.7 Logistic regression

In logistic regression a binary outcome is compared with two or more exposure groups (Kirkwood, 2003). In study III, logistic regression was used to explore the relationship between use of iCCM and appropriate treatment for pneumonia and diarrhoea. In study IV, logistic regression was used to explore the predictors of referral completion.

4.4.8 Linear regression

Linear regression explores the association between numerical normally distributed outcomes and exposure variables (Kirkwood, 2003). In study IV, the factors associated with willingness to pay for referral were explored through linear regression.

4.4.9 Multinomial logistic regression

Multinomial logistic regression is an extension of the conventional logistic regression model to data with polychotomous (>2) responses or outcomes. In this approach to multinomial data, one of the response categories is nominated as a baseline or reference cell and the log-odds for all other categories are calculated relative to the baseline as a linear function of the predictors (Chan, 2005, Kirkwood, 2003). Results from a multinomial regression take longer to interpret compared to results from a binary logistic regression (Chan, 2005). In study II, both the overall perceived quality of care score and quality of care scores for each domain for each caregiver were divided into the three categories based on the lower, median (middle two) and upper quartiles. These were then referred to as low, medium and high-quality respectively. Multinomial logistic regression models were used to specify the association between the categorised quality of care scores and service providers.

4.4.10 Modified Poisson regression

In studies with common outcomes, risk ratios can be estimated from adjusted odds ratios. Logistic regression models estimate odds ratios as the effect measure. These odds ratios are easy to interpret for case-control studies but not for cross-sectional studies. Prevalence ratios and cumulative incidence ratios, which are easier to interpret, can easily be estimated for cross-sectional studies. Modified Poisson regression and log binomial regression are some of the methods that can be used to estimate relative risk for cross-sectional studies (Zou, 2004, Lee et al., 2009). The modified Poisson regression model with a sandwich error term can be used to estimate relative risks with efficiency and consistency. The model uses a logarithm

link and hence the estimates it gives are robust to omitted covariates (Greenland, 2004, Zou, 2004, Zhang and Yu, 1998, Lee et al., 2009).

During data analysis for study II, independent multinomial regression models yielded high relative risk ratios that were consistent in the direction of association between perceived quality of care and health service providers among the three quality categories. Such high relative risks could be due to omitted covariates. To correct for these high relative risk ratios, a more robust modified Poisson regression model was fitted to establish the association between the overall predicted perceived quality of care score and service providers. In order to fit the modified Poisson regression model, the overall predicted quality scores (outcome variables) were dichotomised into “high quality” and “low quality” using a median split.

4.4.11 Concentration index

The concentration index is a measure of health inequalities in which the health variable assigned to an individual is a function of the socioeconomic status category the individual belongs to (Regidor, 2004, Wagstaff et al., 1991). The concentration index is based on a ‘concentration curve’ where the x-axis represents the cumulative proportion of individuals by socioeconomic level, beginning with those who have the lowest socioeconomic level and ending with those whose level is highest, while the y axis represents the cumulative total proportion of health in these individuals. Concentration curves can be used to identify existence of socioeconomic inequality in a health sector variable and to examine whether it is more pronounced at one point in time than another or in one area more than another. Concentration curves do not give a single measure of the magnitude of inequality that can be compared conveniently across many time periods, areas or desired variable of comparison. The concentration index, which is directly related to the concentration curve, quantifies and gives the magnitude of socioeconomic related inequality in a health variable (O'Donnell et al., 2008).

The concentration index is twice the area under the concentration curve and the line of inequality and takes on values between -1 and +1. Positive values imply that a situation disproportionately affects the richer groups and negative values imply that a situation affects the poorer groups more and the larger the value, the worse the degree of inequality.

However when the health variable is binary or value bound, the corrected version of the concentration index known as Erreygers concentration index is recommended (Erreygers, 2009, Kjellsson and Gerdtham, 2013, O'Donnell et al., 2008).

Since the concentration index summarises information from the concentration curve, it imposes value judgments about the weight given to inequality at different points in the distribution. The concentration index also loses some of the information that is contained in the concentration curve. A value of zero can arise either because the concentration curve lies everywhere on top of the 45-degree line or because it crosses the line and the areas above and below the line cancel out. It is important to distinguish between these two cases by examining the concentration index together with the concentration curve. Since the concentration index

reflects the relationship between the health variable and the living standards rank, it is important to choose an appropriate measure of living standards that influences the measured degree of socioeconomic-related inequality in the health variable of interest. The concentration index as a summary measure of inequality is not sensitive to the living standards measure in that it is not influenced by the variance of the living standards measure. This is both advantageous and disadvantageous. It is an advantage when the point of interest is the inequality at a certain place and time since the differing variances of alternative measures of living standards will not influence the concentration index. However when the measure of interest is the relationship between income and health, the concentration index is limited by its inability to distinguish between the degree of income-related health inequality in a place where income is distributed very unevenly from that of a place where income distribution is very equal. Nonetheless, the fact that the concentration index is based on ranking of the socioeconomic variables makes it relevant for evaluating policies that are aimed at modifying the distribution of health across socio-economic categories like iCCM (Regidor, 2004).

Erreygers corrected concentration index was used in study III to measure the socio-economic related inequalities in use of iCCM and uptake of appropriate treatments for pneumonia and diarrhoea. This concentration index was indirectly standardised by sex and age of the children.

4.4.12 Propensity score matching (PSM)

The purpose of an impact evaluation is to isolate effects that are attributable to a programme. Since no one can be in two states at the same time, we are constantly faced with the 'evaluation problem'. The evaluation problem is that we do not know the counterfactual scenario of what would have happened to the exact people who participate in the intervention had the intervention not been implemented (Khandker et al., 2010). We therefore find solace in study designs with control groups that will imitate the counterfactual scenario. The mainstay method for isolating programme effects is therefore a randomised control trial. However, randomised control trials are not always possible. In the absence of randomised control measures alternative methods with comparison groups are required in an evaluation (Victora et al., 2011). One such alternative method is propensity score matching (PSM) (Khandker et al., 2010).

The propensity score is a balancing score that is believed to imitate a randomised control trial with a valid control and treatment group due to its ability to eliminate systematic differences in the characteristics of individuals who choose to participate or not to participate in a programme (Rosenbaum PR, 1983, Austin, 2011). According to Rosenbaum (1983), conditional on the probability that a person participates in the programme based on observed characteristics (X), i.e. "propensity score ($\Pr(X) = \text{Prob}(P=1|X)$)", this person's participation decision (P) is also independent of the potential outcomes E (Y_1 and Y_0) where Y_1 is the expected outcome in the presence of the intervention and Y_0 is the expected outcome in the absence of the intervention. PSM methods, use only matched samples in the region of

‘common support’. Thus, individuals in the treatment and control groups have similar propensity scores

In study III, referring to children who used iCCM as the treated group and those who did not use iCCM as the control group, the average treatment effects among the treated (ATT) for participation in iCCM were computed for propensity scores within a radius calliper of 0.01. The ATT is the mean of individual differences between the outcome of individual participants and their matched pairs and are denoted as $E[Y_1 - Y_0 | X, P=1]$. The observable characteristics available from the dataset that were introduced into the PSM model included child’s age, sex of the respondent, education level of primary caretaker, socioeconomic status, concurrent infection with fever or diarrhoea, living in a peri-urban area, having no mode of transport at home, knowledge that CHWs have medicines, knowledge of danger signs for pneumonia, number of previous visits to CHWs in the past three months, history of hospitalisation in the last three months, and duration of illness. PSM is known to be superior to traditional logistic regression models which account for many possible confounders but for which the risk of selection bias often remains (Austin, 2011). It is however prone to bias arising from endogenous covariates and model misspecification (Rosenbaum PR, 1983, Austin, 2011).

For all studies II-IV data analysis adjusted for confounding variables and clustering at the village level and cluster robust standard errors are reported. All computations were done in Stata 12 (College Station, TX). In study IV, additional computations were made in excel spreadsheets. A summary of the research methods is provided in table 3 below.

Table 3: Summary of research methods

Study	Study design	Study population and sample size	Data analysis
1. Community acceptability and adoption of integrated community case management in Uganda	Qualitative	Caregivers <ul style="list-style-type: none"> • FGDs (n=7) • interviews (n=7) CHWs <ul style="list-style-type: none"> • KI interviews (n=7) Supervisors <ul style="list-style-type: none"> • KI interviews (n=7) LC1 chairmen <ul style="list-style-type: none"> • KI interviews (n=6) 	<ul style="list-style-type: none"> • Directed content analysis
2. Perceived quality of care for common childhood illnesses: Facility versus community based providers in Uganda	Comparative cross-sectional survey	Caregivers <ul style="list-style-type: none"> • CHWs (n=419) • Health facility group (n=399) 	<ul style="list-style-type: none"> • Chi-squares • Wilcoxon rank-sum test • Factor analysis • Multinomial regression • Modified Poisson regression
3. Impact of integrated community case management on uptake of appropriate diarrhoea and pneumonia treatments in Uganda: A propensity score matching and equity analysis study	Before and after study (cross-sectional)	Children from 40 cluster (villages) <ul style="list-style-type: none"> • 2009 (n=1178) • 2012 (n=1476) 	<ul style="list-style-type: none"> • Chi-squares • Logistic regression • Concentration index • Propensity score matching
4. Estimating the cost of referral and willingness to pay for referral to higher level health facilities: a case series study from an integrated community case management programme	Case series	Caregivers of 203 referred children	<ul style="list-style-type: none"> • Logistic regression • Linear regression • Average/case

4.5 ETHICAL CONSIDERATIONS

Ethical approval was obtained from the Institutional Review Board of the Makerere University School of Public Health, and the Uganda National Council for Science and Technology. Permission was sought from community leaders and informed consent was

obtained from individual participants. Autonomy of VHTs and other community members in deciding whether to participate in the study or not was strictly respected.

Risks were limited to time spent on interviews and inconveniences arising from some of the questions such as those that ask about earnings. However, efforts were made to limit such questions and participants reserved the right not to respond to questions that made them feel uncomfortable. Additionally, efforts were made to limit both household and qualitative interviews to less than an hour. The data collected was handled with extreme confidentiality. No individual names were mentioned in reports and data were kept in a safe place at the Malaria Consortium data centre.

5 RESULTS

Although the thesis is based on four separate studies, the results have been synthesised and are hereby presented under three broad themes which include a) perception of iCCM as a health innovation, b) institutionalisation of iCCM in the community and health system, and c) equity in the use of iCCM.

5.1 PERCEPTION OF iCCM AS A HEALTH INNOVATION

5.1.1 Qualitative exploration of perception of iCCM - Study I

Qualitative data from study I on acceptability and adoption of iCCM showed that overall, iCCM as a complex health innovation was perceived well by community members, CHWs and health facility based providers who supervise CHWs. An overview of the codes identified from the data fitted into the predefined categories of the theory of diffusion of innovations is provided in table 4.

With respect to compatibility of iCCM with social beliefs and values, local perceptions of illness served to enhance programme utilisation if the disease causes were believed to be biomedical (table 4, citation 2). The reverse was true when local perceptions deviated from the biomedical model of disease causation. Children with diseases perceived to be severe were more likely to be rushed to the health facility bypassing CHWs (table 4, citations 1). The perceived cost, accessibility, availability and quality of the services provided in terms of diagnostics services as well as perception of training qualifications of the CHWs promoted programme utilisation (table 4, citation3). The refusal to provide antimalarial drugs following a negative rapid test for malaria often incited clashes between CHWs and community members because of unmet expectations. Bad characteristics of CHWs such as alcoholism alienated communities from iCCM. The iCCM programme was well received even by the health facility supervisors and in some villages policies mandating consultation with a CHW before proceeding to a health facility were introduced.

Regarding perceived relative advantage, the programme made access to health care easier, in that caregivers no longer had to walk long distances in search of health care, the waiting times for the services offered by CHWs were also shorter (table 4, citation 4).

Table 4: Overview of citations in relation to the theory of diffusion of innovation

Core category	Subcategories	Examples of codes	Citations demonstrating category
Compatibility	Cultural construction of disease	-Disease is severe	1. “The caregivers rush [pneumonia cases] to health workers because it is a feared disease. It is a serious disease. No one tampers with it. 10 out of 10 caregivers rush to the health worker because pneumonia previously killed many children. Caregivers don’t go for local herbs to cure pneumonia.” Male VHT.
		-Disease is due to non-biomedical causes	2. “Care takers also have false beliefs of millet extraction “obulo” and when a child develops pneumonia they relate it to false millet in the chest that is stopping the child from breathing well, so they put cuts on the a child’s chest to extract it.” Male supervisor.
	Compatibility with expectations of health care	-Services are easily accessible -Adequate supply of the right drugs -Good quality of services -Training of CHW	3. “I expect VHTs to check and test children before giving them drugs so that they know exactly what they are treating and to advice on how and when to administer these drugs. ... For pneumonia, I expect her to give me drugs that suit my child’s age” Participant, female FGD
Relative Advantage	-Financial benefits -Non-financial benefits	-Services are free -Waiting time is shorter - Facility is nearer	4. “She makes follow-ups on the children she has treated yet she does all that free of charge. Some caregivers use a motorcycle to get to her place but sometimes we call her and she comes to our homes if we can’t make it to her place,” Female caregiver.
Trialability		-If the services are free -If a significant other recommends it	
Observability		-Reduced morbidity -Reduced mortality -Quick treatment -Quick recovery -Health facility decongestion	5. “Before the VHTs were selected and trained it was very difficult to have young children treated as sometimes, one had no money and once a child fell sick we could resort to the use of traditional herbs as we look for the money to go to the health facility or drug shop and this delay led to the death of many children. So with the coming of the VHT during the time when they had the drugs all that had changed as we could quickly run to the VHT in case of an illness,” Male caregiver.
Complexity		- Programme is not always functional -VHT possesses bad characteristics	6. “I didn’t have drugs so I referred her to the health center. After four days she came back with another child and I told her the same story. Now last week she came back and I still didn’t have drugs, this time she asked me a question “ what are you people doing if all the time you don’t have drugs, then we shouldn’t bother coming here because you just hold titles of ‘musawo’ yet in the actual sense you are not helping us.” Female VHT.

In communities where the iCCM programme was functioning well, the simplicity of the programme was expressed by caregivers who often mentioned that CHWs were quick, flexible and easy to approach, providing information to caregivers about their children in simple terms with practical demonstrations. In areas where iCCM attendance was low, programme complexity was expressed through mentioning of frustration over frequent drug stock outs, inappropriate selection of CHWs, inadequate performance of CHWs, community wrangles with CHWs and periodic absence of CHWs from their posts (table 4, citation 6).

Trialability was generally not a problematic attribute of the programme. Caregivers were often open to trying out iCCM services even within other villages and were attracted by the free access to effective drugs and the fact that the programme was officially recommended by health workers. The caregivers who had tried the services were even willing to recommend them to others. Trialability was more likely to be influenced by recommendation of a significant other and was limited to only disease conditions perceived as non-severe. However there was a common belief in the communities that intravenous drugs were better than injections and injections were better than syrups and syrups were stronger than tablets. Since the CHWs only had medicines administered in the dispersible forms, some community members were hesitant to experiment with iCCM.

With respect to observability, several observable results were mentioned by community members, CHWs and health facility based supervisors. Quick and tangible rewards of the iCCM programme included; quick treatment of children, quick recovery of children, reduced frequency of disease episodes among children, reduced child mortality, and reduced health expenditure (table 4, citation 6). Health facility based workers also observed reduced patient traffic and workload.

5.1.2 Quantitative exploration of perception of iCCM –study II

The individual components of iCCM as applied to the domains described in the Donabedian model were quantitatively explored in study II. The results showed that the quality of care provided by CHWs was perceived as high relative to care provided by primary health facility based workers. CHWs scored high in all domains of quality except for longitudinal and visit-based continuity of care. However, overall satisfaction which is an outcome of quality of care was lower for CHWs compared to health facility based providers (table 5).

Table 5: Difference in perceived quality of care between caretakers of children visiting community health workers and primary health facilities

DOMAIN ITEM	PHFWs		CHWs		Ranksum p-value
	Mean (SD)	Median (IQR)	Mean (SD)	Median (IQR)	
Structure					
Organisational access	52.4 (21.8)	53.3 (40.0- 66.7)	81.2 (14.8)	80.0 (73.3-3.3)	<0.0001*
Visit based continuity	38.3 (21.3)	40 (20.0-40.0)	17.2(17.8)	20.0 (0.0-20.0)	<0.0001*
Longitudinal continuity	64.6 (35.6)	75.0 (25.0-100)	42.0 (26.4)	50.0 (25.0-50.0)	<0.0001*
Financial access	66.5 (23.9)	60.0 (50.0-80.0)	85.0 (17.9)	90.0 (80.0-100)	<0.0001*
Process- comprehensiveness					
Patient competence	52.4 (22.2)	53.7 (33.7-68.7)	70.3 (17.2)	72.5 (58.7-83.7)	<0.0001*
Preventive counselling	51.8(38.4)	60.8 (21.6-100)	76.5 (30.4)	80.4 (60.8-100)	<0.0001*
Process-clinical interaction					
Physical examination	61.9 (23.9)	60.0 (60.0-80.0)	80.8 (16.2)	80.0 (80.0-100)	<0.0001*
Communication	60.7 (18.1)	63.3 (53.3-70.0)	76.7 (13.0)	76.7 (66.7-86.7)	<0.0001*
Interpersonal treatment	61.3 (21.2)	60.0 (48.0-80.0)	80.7 (15.2)	80.0 (68.0-96.0)	<0.0001*
Trust	69.6 (17.1)	67.8 (57.1-82.1)	79.4 (13.2)	78.6 (71.4-89.3)	<0.0001*
Process- integration					
Integration	57.7 (23.4)	58.3 (46.7-73.3)	57.6 (22.4)	53.3 (40.0-73.3)	0.2820
Overall quality score	-0.58 (0.94)	-0.50 (-3.77- 1.82)	0.58 (0 .66)	0.65 (-1.66- 1.79)	<0.0001*
Satisfaction (outcome)	24.4 (16.9)	16.7 (16.7-33.3)	14.5 (11.4)	16.7 (0.0-16.7)	<0.0001*

*Significant at p value 0.05

In multinomial regression models adjusting for potential confounders, the association between high rating of quality of care and a child being treated by CHWs was maintained

Table 6: Multinomial logistic regression model of association between categorised perceived quality of care and service provider for the overall perceived quality score and for each domain (N= 753)

Domain/Scale item	Quality category	CHWs vs PHFWs (unadjusted)	CHWs vs PHFWs (adjusted)
Financial access	Low quality	1.0	1.0
	Medium quality	4.6 (3.17-6.85)	5.2 (3.5-8.01)
	High quality	7.3 (4.94-10.88)	7.8(5.27-11.01)
Organisational access	Medium versus low	17.1(10.17-28.93)	19.2 (10.88-33.80)
	High versus low	78.5 (38.97-158.34)	87.5 (41.60-184.03)
Visit based continuity	Medium versus low	0.2 (0.14-0.31)	0.2 (0.13-0.31)
	High versus low	0.0 (0.02-0.09)	0.4 (0.03-0.10)
Patient competence	Medium versus low	4.9 (3.18-7.49)	4.7 (3.02-7.50)
	High versus low	10.9 (5.96-20.01)	9.1 (5.35-15.63)
Preventive counselling	Medium versus low	3.2 (2.14-4.72)	2.5 (1.70-3.98)
	High versus low	4.7 (3.13-7.02)	3.6 (2.37-5.73)
Physical examination	Medium versus low	4.4 (2.87-6.86)	4.7 (3.31-6.80)
	High versus low	7.4 (4.39-12.62)	8.2 (5.25-12.87)
Communication	Medium versus low	4.9 (3.28-7.28)	4.8 (3.08-7.47)
	High versus low	11.5(6.88-18.08)	16.4 (9.61-28.04)
Interpersonal treatment	Medium versus low	4.7 (3.27-6.74)	5.0 (3.42-7.41)
	High versus low	12.3 (7.66-19.87)	12.3 (7.38-20.41)
Trust	Medium versus low	3.1 (2.10-4.52)	3.1 (2.07-4.82)
	High versus low	5.4 (3.55-8.13)	4.5 (2.84-7.01)

*PHFWs= primary health facility based workers. Reference category for service provider is PHFWs; reference category for perceived quality is low quality and is always equal to one

†Integration and longitudinal continuity excluded because of sample size violation.

‡Other covariates included in the models were socio-economic status, previous visit to CHW or health facility, education level, type of disease and duration between the interview and the health provider visit

In the “modified” Poisson regression model, adjusting for potential confounding factors with the overall perceived quality of care score categorised as “high” and “low”, the proportion of caretakers reporting high perceived quality of care was higher for CHWs compared to PHFWs (RR=3.1; 95%CI 2.5-3.8).

5.2 INSTITUTIONALISATION OF iCCM IN THE COMMUNITY AND HEALTH SYSTEM

5.2.1 Impact of iCCM on the proportion of children accessing appropriate care for pneumonia and diarrhoea - study III

The adoption of iCCM as reflected by the utilisation of services provided by CHWs was fairly low. Data from study III show that only 47.5% (215/453) of children with a pneumonia classification and 54.7% (81/148) children with reported diarrhoea were taken to a CHW for treatment. There was an increase in the proportion of children accessing appropriate treatment for diarrhoea and pneumonia following introduction of iCCM (table 7).

Table 7: Change in key indicators for prevalence and treatment of cough with fast breathing (pneumonia) and diarrhoea treatment

Disease/treatment	2009		2012		Increase year on year percentage points	p-value
	N (1178)	%	N (1476)	%		
Cough + fast-breathing 2 week prevalence	263	22.3%	453	30.7%	8.4	0.000*
Diarrhoea 2 week prevalence	168	14.6%	229	15.6%	1.0	0.470
Pneumonia treated with appropriate antibiotics	147	55.9%	301	66.4%	10.5	0.000*
Diarrhoea treated with ORS	58	34.5%	117	51.1%	16.6	0.001*
Diarrhoea treated with ORS plus zinc	5	3.0%	27	11.8%	8.8	0.001*

* Significant at 95% level of significance

In the logistic regression models, children seeing CHWs as the first source of care were more likely to receive appropriate antibiotics for pneumonia (adjusted OR 6.3; 95% CI 3.4-11.8) and ORS for diarrhoea (adjusted OR 7.0; 95% CI 2.6-18.6) compared to those who did not see a CHW. There was however no difference in the proportion of children receiving ORS + zinc combination between the treatment and control groups (OR 0.5; 95% CI 0.1- 2.1).

PSM methods showed that on average, at a 5% significance level, more children in the treatment (iCCM) group received appropriate antibiotics for pneumonia (ATT=32.7%,

SE=5.0) and ORS for diarrhoea (ATT= 40.0%, SE=7.4) compared to the control group. No increase was observed for children receiving ORS + zinc combination (ATT=-0.14.5%, SE= 6.3).

Table 8: Average treatment effects among the treated (ATT) for appropriate pneumonia and diarrhoea treatment

Outcome	Number treated	Number in control	ATT	SE	t-statistic
Pneumonia treated with appropriate antibiotics	166	190	0.327	0.050	6.548
Diarrhoea treated with ORS	74	106	0.400	0.074	5.405
Diarrhoea treated with ORS and zinc	74	106	-0.145	0.063	-2.288

5.2.2 Referral under iCCM – study IV

Study IV showed that the adoption of the referral component of iCCM as reflected by referral completion was fairly low, with less than half (45.8%) of the 197 children referred by CHWs seeking care from higher level health facilities and completing referral. Children were often referred due to having fever and a negative malaria test (46.8%), danger signs (29.6%) and CHW drug shortages (37.4%).

On the whole, 91.8% of children were referred to the public sector, 5.1% were referred to other CHWs, and 3.0% were referred to the private sector. Referral completion was significantly higher among children with danger signs relative to those without such signs (adjusted OR=2.8; 95% CI 1.4-5.4). Children who received pre-referral treatment were less likely to complete referral compared to those who did not (adjusted OR=0.27; 95% CI 0.1-0.5).

Of the 110 children who did not complete referral, 28% stated that the child had improved at home, 25% reported that the health facility was closed, especially in the evenings or on the weekend, 21% were hindered by the long distances to the health facility, 12% anticipated a drug shortage at the health facility and 7% felt that the staff at the health facility could not be trusted.

From a societal perspective, the average cost per child referred was US\$4.89 per child referred and US\$7.35 per child completing referral. The average cost per case referred increased with the level of health facility; from US\$4.34 to US\$6.68 for HC II and HC IV, respectively. Similarly the average cost per case completing referral increased from US\$5.89 for HC IIs to US\$11.32 for HC IVs (table 9).

For each unit cost per case referred, caregiver out of pocket expenditure contributed 33.7%, caregivers' and CHWs' opportunity costs contributed 29.2% and 5.1% respectively and health facility costs contributed 39.6%. The overall median out of pocket expenditure was US\$0 (mean US\$1.65, range US\$0 to US\$12.45).

Table 9: Average cost per referred case overall and by health facility level

Type of cost/type of health facility	Overall mean (SD)	HC II mean (SD)	HC III mean (SD)	HC IV/ HOSPITAL mean (SD)	% contribution to unit cost
Per capita cost to health facility*	1.94	1.68	1.15	3.01	39.6
Opportunity cost for CHW	0.25 (0.12)	0.24 (0.11)	0.29 (0.14)	0.19(0.08)	5.1
Opportunity cost for caregiver	1.43 (2.02)	1.39 (1.91)	1.47 (1.78)	1.69 (3.10)	29.2
Out of pocket expenditure for caregiver	1.65 (3.25)	1.17 (2.53)	2.04 (3.89)	1.92 (3.08)	33.7
Total unit cost	4.89	4.34	4.80	6.68	
Costs among completed referrals					
Cost borne by health facility*	1.94	1.68	1.15	3.01	26.3
Opportunity cost for CHW	0.25 (0.12)	0.24 (0.11)	0.29 (0.14)	0.19(0.08)	3.4
Opportunity cost for caregiver	2.73 (2.17)	2.62 (2.09)	2.99 (1.51)	3.81 (3.73)	37.1
Out of pocket expenditure for caregiver	2.52 (3.50)	1.33 (1.95)	3.12 (4.3)	1.71 (2.38)	34.5
Total unit cost	7.35	5.89	7.63	11.32	

*average obtained from literature with no standard deviation

Among the children who completed referral, caregiver out of pocket expenditure contributed 34.5% to the unit cost per referral completed, caregivers' and CHWs' opportunity costs contributed 37.1% and 3.4%, respectively, and health facility costs contributed 26.3% (table 9). The median out of pocket expenditure for caretakers whose children completed referral was US\$1.29 (mean US\$2.52, range US\$0 to US\$11.68) compared to US\$ 0 (mean US\$0.92,

range US\$0 to US\$14.56) for those who did not complete referral. Median opportunity costs for caregivers amounted to US\$0.61 (mean US\$1.43, range US\$0 to US\$13.2). They varied from US\$0 (mean US\$0.33, range US\$0 to US\$19.62) for children who did not complete referral to US\$ 2.44 (mean US\$2.7, range US \$0.05-US \$13.12) for children who completed referral.

The mean (SD) and median (range) WTP for referral among caregivers whose children had been referred by a CHW to higher level facilities were US\$8.25 (14.70) and US\$3.92 (0.39-157.17) respectively. Caretakers of children who completed referral had a mean WTP of US\$9.56 (17.20), median US\$5.89 (0.39-157.17) compared to a mean of US\$7.13 (12.13) and median US\$3.92 (0.39-117.87) among those who did not complete referral. The overall median out of pocket expenditure was US\$ 0 (mean US\$1.65, range US\$0-12.45). The cost was positively associated with provision of pre-referral treatment, referral completion and education level of the caregiver

5.3 EQUITY IN USE OF iCCM

In study III, no inequalities were observed in the utilisation of iCCM by caregivers of children suffering from pneumonia or diarrhoea (table 10). Concentration indices for diarrhoea prevalence were not significantly different among the least poor in neither 2009 (CCI=0.044; SE=0.039), nor in 2012 (CCI= -0.007; SE=0.033). The change in proportion of children receiving appropriate treatment for pneumonia and diarrhoea across socioeconomic quintiles was not significantly different before and after introduction of iCCM. There was no evidence of socioeconomic inequalities in use of iCCM for children with reported symptoms of diarrhoea (CCI=-0.073; SE=0.085) or pneumonia (CCI=-0.099; SE=0.073), respectively. Zinc uptake in 2012 remained too low (11.8%; 27/229) to provide a sample large enough to warrant calculation of a concentration index.

In study I, there were several quotations made by the participants that pointed to iCCM being an equitable strategy serving families in times of poverty. An example of such a quote is citation 5 from table 4 above, which says.

“Before the VHTs were selected and trained it was very difficult to have young children treated as, sometimes, one had no money and once a child fell sick we could resort to the use of traditional herbs as we look for the money to go to the health facility or drug shop and this delay led to the death of many children. So with the coming of the VHT during the time when they had the drugs all that had changed as we could quickly run to the VHT in case of an illness,” Male caregiver.

Table 10: Erreygers' corrected concentration indices (CCI) of disease prevalence and treatment uptake and horizontal inequity index (I) for treatment uptake

Variable	CCI 2009	Standard error	(I)	CCI 2012	Standard error	(I)	Change 2009- 2012
Pneumonia prevalence	0.027	0.033	N/A	0.077*	0.033	N/A	0.050
Overall antibiotic treatment	0.152	0.092	0.075	-0.070	0.083	-0.021	-0.222
Use of iCCM for pneumonia classification	N/A	N/A	N/A	-0.099	0.073	-.099	N/A
Diarrhoea Prevalence	0.044	0.039	N/A	-0.007	0.026	N/A	-0.051
Overall ORS treatment	0.151	0.148	0.151	0.199	0.118	0.199	0.048
Use of iCCM for diarrhoea	N/A	N/A	N/A	-0.073	0.085	-0.012	N/A
ORS & zinc ⁺	N/A	N/A	N/A	N/A	N/A	N/A	N/A

6 DISCUSSION

6.1 MAIN FINDINGS

This thesis aimed to assess the uptake and impact of iCCM as a complex health innovation in terms of community acceptability and adoption. It was found that CHWs are seen as acceptable providers of child health services and that the communities appreciated the treatments provided. The quality of patient-provider interaction was perceived as high among caregivers of children treated by CHWs relative to those whose children were treated by health facility based workers. Using community referral and uptake of appropriate pneumonia and diarrhoea treatments as tracers for adoption of iCCM, it was found that there was significant and equitable increase in the proportion of sick children who received appropriate treatment as a result of iCCM. However, access to referral care was problematic and was hampered by both demand related factors among community members and other barriers in access to care within the health system. These key findings are further discussed in sections below.

6.2 PERCEPTION OF ICCM - STUDIES I & II

6.2.1.1 *Perception of the attributes of iCCM*

CHWs were generally accepted as providers of child health services and community members had positive attitudes towards the treatments provided under iCCM (study I). In the quest for theory driven research, various theories have been used to explain the process of adoption of interventions, such as the theory of diffusion of innovations and the theory of reasoned action and community readiness (Rogers, 1995, Fishbein, 1980, Oetting et al., 2001). However, the theory of diffusion of innovations, which relates to how prevailing conditions increase or decrease the possibility that members of social system will adopt an innovation or not is widely used in medical and public health science (Nielsen and Moldrup, 2007, Rogers, 1995). Therefore, this explanatory approach was applied to qualitatively confirm the association between the perceived attributes of iCCM and its adoption in the communities and further describe the barriers and facilitators for uptake of iCCM in communities with varying levels of programme uptake.

While the delivery of health services to sick children through CHWs was valued by community members, its acceptability and adoption was driven by context-specific factors (study I). Community perceptions and constructions of illness and disease entities together with the expected standard of health care influenced the type of health service provider utilised by child caregivers. Occasionally, there was a mismatch between the community's classification of the cause and severity of disease and the biomedical classification. At times some communities attributed possible cases of severe pneumonia or malaria to witchcraft (study I). This mismatch has been identified by earlier studies that have demonstrated need to understand and address local perceptions of illnesses in order to improve treatment strategies (Sabuni, 2007, Nsungwa-Sabiiti et al., 2004b, Kallander et al., 2006a). Additionally caregivers who perceived their children as having a severe disease were more likely to take the children directly to the health facility even though their classification was not necessarily based on severity of the symptoms but on understanding of what is defined as severe in the community. While going directly to a health facility is the most logical thing to do for a severely sick child, bypassing of CHWs in rural underserved areas may deprive a severely sick child the benefit of obtaining lifesaving pre-referral treatment. However this needs to be scrutinised further in the light of findings from Tanzanian studies that showed caregivers' reluctance to complete referral following improvement in the child's status after administration of rectal artesunate for severe malaria (Warsame et al., 2007, Simba et al., 2010).

In relation to programme simplicity, caregivers often found health services provided by the iCCM programme easy to use. Health system related factors, such as drug stock outs and non-successful referrals undermined programme adoption in several communities (study I). Irregularities in availability of drugs interrupted health service delivery and weakened trust between CHWs and community members. Additionally, community level factors and individual CHW characteristics, such as reciprocated trust between the communities and the

CHWs, interpersonal relationships, demotivation and undesired CHW behaviour affected adoption of iCCM in some areas. Since a sufficient competent work force is crucial in achieving fairness in health care, there is a need to keep CHWs well motivated and supported through supervision and provision of regular drug supplies (Strachan et al., 2012). Improved community ownership is also necessary and approaches such as community based monitoring could be helpful in empowering the communities to hold health workers accountable for the quality of health services delivered (Björkman and Svensson, 2009).

Overall, the programme was trialable and participants believed that the services offered under iCCM were attractive. However, the communities' perception of what constitutes "strong and effective medicine" did not favour iCCM among community members who believed that injectable drugs were more effective than syrups and tablet drug formulations. This hierarchical classification of medical formulations with systemically administered drugs being preferred over orally administered drugs has been described elsewhere (Janjua et al., 2006, Reynolds and McKee, 2011, Wyatt, 1984).

It is known from previous studies on community case management of malaria, that even when a community based health intervention is acceptable to communities, its uptake is only as good as the alternative health care options it is competing against (Akweongo et al., 2011). Community based innovations similar to iCCM compete against other sources of care such as drug shops and private clinics, where two thirds of Ugandan caregivers of febrile children first seek care (Rutebemberwa et al., 2009b) even though the quality of services provided by these alternative sources may be substandard and poorly regulated (Goodman et al., 2007, Akweongo et al., 2011). Although iCCM was generally well received in most communities based on its relative advantage and highly observable results compared to the status quo, innovation in addressing its limitations is required to make it the best alternative for health care at the community level (study I).

Such innovation entails strategies for increased programme ownership through provision of regular drug supplies to ensure uninterrupted service delivery as well as provision of information and education about availability of these health services and the processes of accessing them. There is also a need to offer guidance on the selection of CHWs to ensure that the people selected are not only trusted by the community members and health facility based supervisors but also have the capacity to conduct slightly technically challenging tasks that come with iCCM. It is therefore imperative for the MOH to carry out systematic programme sensitisation using behavioural change communication strategies adapted to the local context in terms of local belief systems. The behavioural change messages should clearly define 'what causes disease', 'what constitutes severe illnesses', "when should a child be taken to CHW?" and should discourage irrational beliefs surrounding hierarchical classifications of medicines. This will limit inappropriate health seeking behaviour from unqualified health providers and unnecessary self-referrals which congest health facilities.

6.2.1.2 Perception of the quality of care provided by CHWs

The findings from study II showed that the perceived quality of care provided by CHWs was rated high by child caregivers in the domains of accessibility, comprehensiveness, integration, clinical interaction, interpersonal treatment and trust, but was rated lower in the domains of continuity of care when compared to primary health facility workers.

The concept of quality of care is best defined when applied to the individual user who accesses the health service delivery structure, interacts with health providers and receives patient-centred care (Campbell et al., 2000b). The perceived quality of care for a health service is therefore important because it drives service utilisation by determining the types of health providers chosen by those seeking care (Hutchinson et al., 2011, Fotso and Mukiira, 2011, Baltussen and Ye, 2006). Additionally, coverage of a health intervention is often expressed in terms of the proportion of the target population who are able to receive, or can receive the health services delivered through a health intervention (Tanahashi, 1978). However, health service coverage spans across the interaction processes that occurs between the health service and the people for whom it is intended in order to embrace factors such as availability of technology and human resources, distribution of facilities, supply logistics, and people's attitudes to health care (Tanahashi, 1978).

Typically, a comprehensive assessment of quality follows a Donabedian approach spanning across measures of structure, process and outcomes (Donabedian, 1988, Opondo et al., 2009). Study II mainly looked at structural and process measures as perceived by child caregivers. Process measures of quality relate to what is actually done when giving and receiving care to embrace factors such as adherence to good standards in terms of asking about symptoms, physical examination, conducting diagnostic tests and therapy, technical competence, evidence of preventive management, co-ordination and continuity of care and interpersonal skills applied to the recipient (Donabedian, 1988, Mant, 2001). Direct or non-subjective evaluation of processes measures of quality of care against recommended standards can give additional insights into the performance of the health system although some aspects of these process measures, such as technical competence, can prove hard to observe (Mant, 2001).

In terms of access to health service delivery structures, iCCM is inherently associated with improved financial and geographical access as it uses CHWs based within the village who provide free health services to the communities served (de Sousa et al., 2012). Studies that have previously evaluated perceived quality among health service users have shown that accessibility and affordability are both associated with better perception of the quality of health services rendered (Fotso and Mukiira, 2011, Baltussen et al., 2002). With respect to financial access, both primary health facility workers and CHWs offer free services. However, differences in costs incurred by the users are likely to occur due to differences in health financing mechanisms at community level and health facility levels, and opportunity costs incurred by users as they seek care from the different providers. Illustratively, a study on user satisfaction with quality of health care in Uganda reported on unexpected health costs incurred by patients at the hospitals in the form of unforeseen investigations (Nabbuye-

Sekandi et al., 2011). Corruption in the form of under the table user-fees is also a well documented phenomenon among primary health facility workers in Uganda and other low income countries (McPake et al., 2011, James et al., 2006, The World Bank, 2010).

Organisational access to both CHWs and primary health facility based workers differs with respect to flexibility in working hours whereby the home based CHWs are more likely to be flexible compared to the facility based workers; a characteristic which is valued by caretakers (study I). In Uganda, staff absenteeism in health facilities is well documented, leading to facilities being unmanned during opening hours; a phenomenon that has been termed as “the quiet corruption” by the World Bank (The World Bank, 2010). While CHWs may occasionally be inaccessible for health service delivery, this absence is generally expected and accepted as they need to make a living besides being CHWs.

Longitudinal continuity which relates to the duration of a patient’s relationship with the health worker and inter-episode continuity of care were rated lower for CHWs compared to primary health facility based workers. Perhaps this is because iCCM was inaugurated in Uganda as late as June 2010, while primary health facility units might have had the same staff for longer durations. It is also possible that some users would like to experience care from different health workers on each visit. Visit-based continuity which relates to ‘how often the patient sees the same health worker when sick’ and intra-episode continuity of care was also rated lower for CHWs compared to primary health facility workers. Some studies have argued that visit based continuity can improve perceived quality of care through the establishment of provider-user relationships (Rodriguez et al., 2007, Rademakers et al., 2011). It is therefore not clear why CHWs were rated lower than primary health facility based workers despite implied higher continuity. It is possible that CHWs’ inability to treat a child who gets worse on treatment (as they are advised to refer) might be a contributing factor.

In relation to process measures of quality of care, which include patient competence, communication, physical examination, preventive counselling, interpersonal treatment and trust CHWs were rated higher than primary health facility based workers. This could be due to the fact that CHWs operate within their own community and are therefore more likely to behave as expected by the community members and to have established trusting relationships with caretakers (Brenner et al., 2011). They are more likely to communicate better with their already known patients during a clinical interaction session and hence the higher scores for process measures of quality of care. On the other hand health facilities in Uganda are known to be overcrowded with patients and the health workers are burdened with high workload. It is therefore unlikely that they are able to communicate and interact with patients effectively in a manner that the patients appreciate due to time constraints. High rating of trust in CHWs should be utilised by iCCM programmes as trust in health providers is known to influence health provider choices (Ozawa and Walker, 2011, Campbell et al., 2000b, Rodriguez et al., 2007).

From the user perspective, the outcomes of a patient-provider encounter span across recovery, symptom relief and overall satisfaction with the visit. The latter is more influenced

by the effectiveness of the patient-provider interaction (Campbell et al., 2000b). Satisfaction with the health provider as a visit outcome was rated higher among the primary health facility workers compared to CHWs. It is also likely that caregivers appreciate getting several opinions from different health workers such as laboratory workers, nurses and dispensers between and within illness episodes, and the ability of health facility workers to offer more comprehensive treatment options. It is possible that caretakers are more comfortable with the education level and professional skills of facility based workers compared to CHWs who undergo short training that is narrowed to a few diseases. However, there is a need to dig deeper into the low satisfaction with CHW visits despite high perceived quality.

6.3 INSTITUTIONALISATION OF iCCM IN THE HEALTH SYSTEM

6.3.1 Impact of iCCM on uptake of appropriate treatment

In line with studies which have established that iCCM can improve timely and appropriate treatment of fever (Kalyango et al., 2013a, Hamer et al., 2012, Yeboah-Antwi et al., 2010), study III showed that iCCM can also significantly increase the proportion of children appropriately treated for pneumonia and diarrhoea. After health services are made available and accessible, their acceptability is reflected by their uptake in target population (Tanahashi, 1978). More of the children with reported pneumonia symptoms who utilised a CHW received an appropriate antibiotic compared to the children who went to another source of care. There were also significantly more children receiving ORS for diarrhoea among children treated by CHWs compared to those who went elsewhere. However, the uptake of zinc remained low and did not improve with iCCM. These findings are consistent with studies in Eastern Uganda (Kalyango et al., 2013) and elsewhere in the world (Das et al., 2013, Mukanga et al., 2012) which demonstrated that CHWs improved access to prompt and appropriate treatment for pneumonia, diarrhoea and malaria. A recent systematic review by Das and colleagues shows that community based interventions for pneumonia and diarrhoea lead to improved health seeking behaviour, increased use of antibiotics for pneumonia, increased use of ORS and zinc for diarrhoea and decreased unnecessary use of antibiotics for diarrhoea (Das et al., 2013). Community case management has also been reported to significantly increase use of ORS and zinc for diarrhoea in various settings with the increase reported for ORS being higher than that reported for zinc. However, most studies on the use of zinc were conducted in Asian settings (Das et al., 2013). Since the impact of iCCM in the community depends on community members being able to use CHWs and to receive effective treatment from them, the health system needs to ensure effective and sustainable provision of medicines and diagnostics in order to sustain the gains in uptake of appropriate treatment attributable to iCCM. In a randomised control trial conducted in three African countries, iCCM for pneumonia and malaria led to improvement in the appropriate use of ACTs and to fewer prescriptions of antibiotics (Mukanga et al., 2012).

Although some authors have argued that there is insufficient evidence on efficacy and effectiveness of community case management for pneumonia (Druetz et al., 2013), the data from study III suggests that if the WHO-iCCM algorithm (WHO and UNICEF, 2008) is

followed by CHWs, the implementation of iCCM alone in this predominantly rural setting would lead to 32.7% increase in the number of children with pneumonia symptoms receiving appropriate antibiotics, and a 40.0% increase in the number of children with diarrhoea receiving ORS. The high ORS uptake combined with low zinc uptake highlights the need to explore the untapped strategy of co-packaging ORS and zinc, which has proven to improve uptake of diarrhoea treatment elsewhere (Habib et al., 2013).

This increase in access to appropriate antibiotics should however be examined through the lens of changing pneumonia aetiology as pertaining to local context. It is known that following *Streptococcus pneumoniae* and *Haemophilus influenza* vaccinations, pneumonia aetiology gradually shifted to predominantly viral in origin (Rudan et al., 2008). In Uganda *Haemophilus influenza* vaccine is administered as part of a pentavalent vaccine which is a combination of vaccines for diphtheria, pertusis, tetanus, *Haemophilus influenza* and Hepatitis B through routine immunisation programmes. The pneumococcal conjugated vaccine is available in Uganda on a limited basis and plans to scale it into routine immunisation programmes in the private and public health sector are underway (WHO, 2014). iCCM therefore makes sense in poor settings with limited access to diagnostic facilities where differentiation between bacterial pneumonia and other respiratory infections is difficult. Implementation of iCCM in the areas with both limited diagnostic capabilities and mortality among children due to bacterial pneumonia can be justified by the fact that the benefits of lives saved outweigh any potential drug wastage and possible emergency of antibiotic resistance (Bari et al., 2011, Adegbola and Obaro, 2000, Graham et al., 2008).

6.3.2 Impact of iCCM on equity in uptake of appropriate treatment and use of CHWs

Results from study III showed overall improvement in uptake of appropriate treatment for pneumonia and diarrhoea across all socioeconomic strata two and a half years after the introduction of iCCM. There were also no significant inequalities in the use of CHWs by more well-off and less well-off households observed. The evidence on equity in use of CHWs in Uganda is inconclusive. Studies conducted in Eastern Uganda showed that the use of CHWs was more common among poorer households for episodes of both malaria and pneumonia (Kalyango et al., 2012a, Rutebemberwa et al., 2012) while studies conducted earlier in Western Uganda showed that the use of CHWs for episodes malaria was more common among the less poor households (Nsungwa-Sabiiti et al., 2007). The findings of study III are in contrast to what has commonly been observed whereby the introduction of new health interventions has been followed by short term worsening in access to health services to the disadvantage of the less well-off (Callaghan-Koru et al., 2013, Victora et al., 2000). The occurrence of inequities in access to treatment within rural communities that are assumed to be uniformly poor has previously been ascertained (Schellenberg et al., 2003). However, in study III, which was also conducted in a predominantly rural area, no discrepancies in treatment uptake were observed among treatment eligible children from different socioeconomic groups. Masking of inequities in access to health services can occur

in circumstances where there is less and over reporting of ill health by poorer and less poor groups, respectively (Bonfrer et al., 2012). While this is a potential bias, it is unlikely to be the case given the nature of free treatment offered under iCCM. It can therefore be hypothesised that iCCM is a pro-poor strategy and when scaled up could serve to equitably increase the proportion of children with access to life-saving treatments for pneumonia and diarrhoea and other conditions.

6.3.3 Referral completion in iCCM

Findings from study IV showed that less than half of the children referred by CHWs to higher level health facilities completed referral. Functioning community referral systems are essential for maintaining linkages between CHWs and the formal health system to ensure children with potentially severe disease access more advanced care. However, ensuring improved referral completion is a complicated task as it influenced by several factors at interplay within the health system such as availability of health services, financial access to health care, availability of staff and medicines at the health facilities and the quality of services delivered at the health facilities (Simoes et al., 2003, Peterson et al., 2004).

Low referral completion among febrile children with negative rapid diagnostic test has previously been reported in a study from Sierra Leone (Thomson et al., 2011). Our study population was similar to that of Sierra Leone with respect to the fact that fever with a negative rapid diagnostic test for malaria was the predominant cause of referral. The majority of caregivers whose children did not complete referral opted to give treatment at home or seek care from drug shops or private clinic instead. This shows unreliability in the current referral policy which recommends referral of sick children to the nearest public health facility as the sole source of care when community case management is not possible.

Study IV also showed that among the referred children, those receiving pre-referral treatment were less likely to complete referral, compared to those who did not receive pre-referral treatment; a finding consistent with an earlier study from Tanzania in which the authors concluded that the dilemmas faced by caregivers following temporary improvement in a child's condition at home indicated a need to establish clear referral procedures (Simba et al., 2010). Clear referral procedures entail household follow up of children referred by CHWs to higher level health facilities and counter-referral of children referred to higher level health facilities to CHWs (The Earth Institute, 2011). It is necessary to ensure that referral messages are communicated effectively by CHWs. The creation of emergency funds and cash voucher programmes such as those employed in the maternal health programmes (Kanya et al., 2013) could be another viable option.

Since there is evidence on the ability of CHWs to handle severe cases of pneumonia (Soofi et al., 2012), and there is an ongoing debate as to whether treatment for severe pneumonia should be included into integrated community case management, the finding of low referral completion rates suggests that the need for community case management of severe

pneumonia may be firmly grounded. However, further research on aspects of safety and efficacy is needed from African contexts, as most evidence comes from Asian countries.

Although iCCM stipulates that referral is between CHWs and higher level health facilities, findings from study IV indicated different referral patterns, including CHW to CHW referral, CHW to private clinic referral, and health facility to private clinic referrals. This should be scrutinised in the light of delays in access to appropriate care that might potentially arise. CHW to CHW referral should only be encouraged if availability of drugs can be verified to the caretaker prior to referral. Mobile health solutions are one example of viable health system strengthening innovations for improved communication between CHWs and health facility based staff with a potential to improve referral outcomes (Källander et al., 2013). As much as the role of the private sector in health system strengthening cannot be underestimated (Adam et al., 2012, Waters et al., 2003, Goodman et al., 2007), caution should be taken as the mismanagement of patients by drug shops and clinics, which are often poorly regulated, is widely described in the literature (Awor et al., 2012, Goodman et al., 2007). Nonetheless, there is great potential for initiatives trying to improve case management of sick children among private providers, through initiatives aiming to increase access to and demand for quality-assured RDTs, and to improve private provider fever case management skills (Kitutu et al., 2014).

The median willingness to pay (WTP) for referral among caregivers of children referred to higher level facilities was higher than average out of pocket expenditure for a referral episode (study IV). Median WTP for referral was also higher than average out of pocket expenditure combined with opportunity costs incurred by caregivers. WTP was positively associated with provision of pre-referral treatment, referral completion and education level of the caregiver. WTP methods have been used in low income country context to establish demand for health services as well as to justify subsidies on commodities (Saulo et al., 2008, Akhter and Larson, 2010, Hansen et al., 2013). The presence of a high median WTP for referral compared to both out of pocket expenditure and opportunity costs combined implies that it is not only caretaker attitudes towards referral that are primarily affecting referral completion, but also health system barriers such as long distances to health facilities. This is backed up by the finding that caregivers of children who received pre-referral treatment were likely to have higher WTP for referral even though they were less likely to complete referral.

Overall total out of pocket expenditure constituted a significant proportion of the total cost among children referred to higher level health facilities (study IV). Previous studies on community referral and referral between health facilities in African contexts have conveyed the need to lower the cost of referral (Kallander et al., 2006b, Peterson et al., 2004) and to improve quality of care at referral facilities (Nolan et al., 2001, Simoes et al., 2003, English et al., 2004) in order to make referral care more obtainable. Overall, out of pocket expenditures incurred by caretakers in this study (IV) were generally lower than those observed in previous studies (Kallander et al., 2006b). The lower out of pocket expenditure might be an indication of improved financial and geographical access in iCCM areas since CHWs counsel

caregivers to take children to the nearest health facility. Higher costs per child completing referral were observed as the level of referral facility increased. Such variability in costs could be indicative of variability in quality of care provided at the various levels of health facilities (Collins et al., 2013).

6.3.4 Institutionalisation of iCCM in the Ugandan health system framework

Community members' acceptability, perceived quality of care and subsequent utilisation of iCCM largely depend on CHWs being trusted, respected, and equipped with sufficient skills and commodities to be able to care for sick children (study I, II, III). Therefore, supportive supervision, incentive schemes for motivation (financial or non-financial), regular commodity replenishment and refresher trainings are essential for continued community demand for CHW services.

Uganda adopted the iCCM policy in 2010 (WHO, 2010); VHTs also feature as a main human resource for both disease prevention and health promotion, as well as for the management of sick children and in the second health sector strategic and investment plan (HSSIP II). However, drug and commodity supplies are still not pushed through MOH systems but through donor funded channels with only a few districts budgeting for VHT supportive activities like supervision and training. This is consistent with observations from many other African countries that have recently implemented iCCM policies, where national governments have struggled to align iCCM with country health systems; neither managing to mobilise communities nor political leadership (Bennett et al., 2014).

For successful institutionalisation of iCCM into the Ugandan health system, high-level, political ownership of the iCCM policy could facilitate policy diffusion and scale up, including mobilisation of the financial resources needed to accomplish the iCCM strategy targets.

6.4 METHODOLOGICAL CONSIDERATIONS

6.4.1 The overall study design

This thesis draws on both a qualitative and quantitative study design to explore how iCCM was adopted at the community level. The attributes of iCCM as an innovation were explored in studies I & II while the adoption of iCCM was explored in studies III & IV from the perspective of uptake of appropriate treatments as well as access to referral services. The triangulation of both qualitative and quantitative methods enabled the thesis to explore the values attached by the study population to the attributes of the iCCM innovation while the quantitative methods were able to establish the effects of the innovation in the population.

6.4.2 Theory directed approach to research

Study I was conducted within the framework of the theory of diffusion of innovations. The main strength of deductive analysis directed by a theoretical framework is that existing

theories can be supported and extended. As the body of evidence on a particular topic grows, it becomes inevitable for researchers to depend on theory since it is very unlikely that they are working from a naive perspective that is the trademark of naturalistic designs (Hsieh and Shannon, 2005, Marshall and Rossman, 2006). Instead, researchers are expected to demonstrate evidence gaps while building on the work of others and this is where theory directed research comes in. However, using theory in qualitative research is inevitably limited by the fact that the researcher approaches the data with an informed but strong bias (Hsieh and Shannon, 2005, Marshall and Rossman, 2006). Hence, the researcher might be more inclined to find evidence that is supportive of rather than contradictory to the theory. Furthermore, when interview guides are developed within a theoretical framework, in answering the probe questions, some participants may feel more inclined to always agree with probe questions in order to please researchers. Efforts were made to mitigate these limitations by using well experienced and trained researchers for data collection. During data analysis, the researchers critically looked for alternative explanations of each category and were open to emergence of additional categories.

The theory of diffusion of innovations has been commended for its substantial contribution to understanding behavioural change and thus facilitating adaption of innovations to cultural needs and norms (Haider and Kreps, 2004, Greenhalgh T, 2004). Identifying strengths and weaknesses of innovations using the attributes of the theory of diffusion of innovations is central to effective health education and promotion in public health interventions (Haider and Kreps, 2004). However this theory is limited by individual rather than system blame, recall bias due to dependency of the diffusion process on time, and a pro-innovation bias (Haider and Kreps, 2004, Greenhalgh T, 2004). Nonetheless, the study was able to identify and highlight important system challenges as well as positive and negative attitudes towards attributes of iCCM despite its failure to establish iCCM adoption patterns over time.

6.4.3 Focus group discussions and interviews

Study I relied on both focus group discussions and in-depth interviews with both community members and key informants to collect data. Focus group discussions are used to assess trends in opinion about a topic of interest. They are however limited by participant inhibition. Well trained moderators were used to conduct the focus group discussion that ensured everyone's opinion was heard. Although interviews provide deeper insights into people's attitudes and beliefs about the topic of interest, they are unable to produce data on how people act outside the interview context. Nonetheless, the triangulation of participants, interviews and focus group discussions as well as the use of maximum variation sampling ensured that varied experiences were examined from community members and health facility staff.

6.4.4 Case definition and treatment indicators

As per WHO health worker guidelines, pneumonia was operationally defined as cough with difficult or fast breathing in study II and III. The algorithm used in IMCI and also by CHWs to classify pneumonia involves counting breathing rates in children with cough and

categorising the rate at different age-specific thresholds into normal or fast breathing. Caregivers' reports of fast breathing may not have met these thresholds. Caregivers' reports of pneumonia symptoms have been used in demographic health surveys and in multiple indicator cluster surveys (UNICEF, 2013b) and in other studies (Diaz et al., 2013) to identify children with suspected pneumonia, but they are likely to over-estimate the number of children with pneumonia (Campbell et al., 2013). However, this over-estimation is unlikely to have differed between the intervention (caregivers of children treated by CHWs) and the control arm (caregivers of children not treated by CHWs), thus providing valid comparisons of antibiotic use for the two arms.

Caregivers were also asked if their child received zinc, ORS or antibiotics. However some caregivers may not be able to recall or recognise zinc and other antibiotics (Fischer Walker et al., 2013, Campbell et al., 2013). Efforts were made to mitigate this recall bias by using a combination of visual aids with common zinc, ORS and antibiotic formulations and examination of prescription notes and drug leftovers or descriptions of the packages that could point to evidence of any of the drugs having been administered.

6.4.5 Recall bias

Studies II, III and IV were prone to recall bias as participants were asked to report illness symptoms that were experienced by their children as well as the actions that were taken when these symptoms occurred. Short recall periods have been found to decrease the reporting of milder episodes of diarrhoea (Fischer Walker et al., 2013, Campbell et al., 2013). Since the prevalence of pneumonia in the community is low, use of a two week recall period can increase the chances of having false cases compared to longer recall periods (Campbell et al., 2013). Efforts were made to minimise recall bias by using a two week period for all the studies as epidemiologists recommend that the shorter the time lapse the less the recall bias however this might have led to an over estimation of pneumonia cases (Rothman, 1986, Campbell et al., 2013).

6.4.6 Self selection of participants

In study II there was self-selection of individuals receiving care from health facilities and CHWs. This might have created an unavoidable bias of quality of care being rated lower for health facility based workers who might have been seeing sicker children. However, attempts were made to recruit children with similar disease conditions with regards to signs and symptoms. There was an inevitable possibility of caretakers perceiving quality of care as high in several domains for CHWs due to mere friendship. The study was also unable to establish the cadre of staff at the primary health facility level where more often than not several cadres of staff exist.

6.4.7 The effect of timing

Timing of the study has significant implications for study results. The reporting bias that arises over time could have had an effect on the ratings of quality of care. Furthermore

patients may rate quality of care higher after a health worker visit due to their improved health and not necessary due to the quality of care provided. Following the health worker visit, patients tend to get more time to reflect on the quality of care and quality of care ratings may go down (Jensen et al., 2010). In study II, which used a maximum of two weeks recall period, it is likely that some of the parents had had time to reflect further on the usability of health services and the quality of the consultation and might have given different ratings of quality of care than when asked immediately after consultation. Efforts were made to address this limitation by adjusting for the duration between the interview and health provider visit in the statistical models.

The term ‘inverse care law’ has been used to refer to the tendency of the availability of good medical care to vary inversely with the need for it in the population served (Tudor Hart, 1971). The term ‘inverse equity hypothesis’ has been coined to explain worsening, staying in status quo, or improvement over time of inequities (Victora et al., 2000). The hypothesis postulates that new public-health interventions and programmes initially reach people with higher socioeconomic status and only later affect the poor and as such there are early increases in inequity ratios for coverage, morbidity, and mortality indicators. These inequities only improve later when the better off have achieved new minimum achievable levels for morbidity and mortality and the poor gain greater access to the interventions (Victora et al., 2000). Study III which explored equity in uptake of appropriate treatments for pneumonia and diarrhoea over two years after the intervention was introduced was not able to look out for early existence of these inequities. Just because the study found no inequities two years post iCCM implementation does not mean that these inequities might not have been there when the intervention was first introduced.

6.4.8 Cluster sampling

In study II, III and IV data were obtained through cluster sampling techniques. Data obtained from cluster samples have been criticised for lack of representability compared to individual samples (Morris and Nguyen, 2008). However, cluster robust standard errors were used to adjust for clustering effects.

6.4.9 Principal components analysis and socioeconomic status

Principal components analysis was used to generate a socio-economic status (SES) index based on ownership of household assets. This measure relates more to long standing household wealth as opposed to wealth at disposal (Vyas and Kumaranayake, 2006). As such it fails to account for income shocks which inevitably affect households’ ability to utilise health services. Since the study population was predominantly made up of unemployed rural dwellers, the use of socio-economic status index was justifiable as there was no other reliable source of information on household income and expenditure. However, the use of principal components analysis to assess socio-economic status based on household asset ownership limits comparability among studies since assets common in one population may not be common in another population.

6.4.10 Model specification

Studies II and III used modified Poisson regression model and propensity score matching methods (PSM), respectively, to establish associations between the intervention and outcome variables. The use of modified Poisson regression model to explore the association between perceived quality of care and provider choice is reasonable since the study design was cross-sectional in nature. The model is robust to omitted covariates and thus gives more accurate measures of association.

PSM is known to be prone to bias arising from endogenous covariates and model misspecification (Rosenbaum PR, 1983, Austin, 2011). However, the use of PSM in this analysis to measure the effect of obtaining care from CHWs on appropriate treatment for pneumonia and diarrhoea is justifiable since CHWs were not treating diarrhoea and pneumonia before iCCM was introduced. It has been argued that the absence of baseline data on treatment sources for households make estimation of effects of community case management complicated. Consequently, before and after comparisons relying on comparison with baseline data are increasingly recommended for evaluation of the effects of community case management programmes on treatment coverage (Hazel et al., 2013). Although study III had the additional benefit of baseline data, PSM methods are sufficient for impact evaluation even in the absence of baseline.

PSM is also believed to be superior to traditional logistic regression models which account for many possible confounders but for which the risk of selection bias often remains (Austin, 2011). To mitigate the fear of model misspecification, efforts were made to include as many variables affecting programme selection as were available in the dataset.

6.4.11 Cost uncertainty

It has been argued even by epidemiology gurus that certainty is not always guaranteed and is therefore not the only prerequisite for action with decisions being made based on the best available evidence (Rose et al., 2008). One limitation of study IV was the reliance on the average national income for rural dwellers to calculate assumptions about earnings of CHWs. However, this was justifiable as other methods such as reported income foregone, can prove difficult to validate in rural settings (Agyei-Baffour et al., 2012). Assumptions were also made about the time worked by CHWs based on the official working time of a typical Ugandan, which may not be true for all CHWs. Health facility related costs were estimated from the literature; however, due to paucity of these data the best available data for the country context were used. The bidding method has been criticised for introducing a starting point bias and the open ended technique has been questioned, as patients who are naive about a health care programme may not be able to attach a valid value to it (O'Brien and Viramontes, 1994, Klose, 1999). To overcome this challenge the starting price in this study was established through interviews with a small sample of participants and it was subsequently made as low as possible, was the same for all participants and was followed by an open ended question on maximum WTP. The cost that a person claims to be willing to pay

may deviate from what they would actually be willing to pay should they be confronted with the actual situation. However the WTP interview was conducted only among respondents whose children had been referred and who were given a realistic choice of their preferred health centre of referral.

6.4.12 Study tools

Researchers are often discouraged from developing new data collection instruments when validated instruments already exist. Using previously validated and published questionnaires saves time and money and allows for comparability of one's findings with those from other studies (Rattray and Jones, 2007). Most of the questions in the questionnaires for studies II, III and IV were adopted from previously validated questionnaires. Specifically, the tool for study II was validated in non-African contexts; however, efforts were made to adapt the questionnaire through comparison with questions from the Uganda health service provision survey (Ministry of Health (MOH) [Uganda] and Macro International Inc, 2008).

6.4.13 Generalisability and transferability of the results

In quantitative studies the term study validity refers to the extent to which a study measures what it is intended to measure while study generalisability refers to the ability to apply results of one study population to other settings and the larger populations (Gordis, 2009). Generalisable studies arise from valid studies however we are constantly faced with a trade-off between validity and generalisability (Gordis, 2009). Balancing the trade-off between validity and generalisability requires proper selection of participants and using large enough samples whilst effectively monitoring adherence to study protocols (Gordis, 2009). In studies II, III, and IV efforts were made to recruit large enough sample sizes, use validated questionnaires and adhere to study protocols in an implementation area with different tribes of people. However, since health systems are complex adaptive systems whose effects cannot be predicted with consistency in different settings, generalisability of the results has a degree of uncertainty attached to it. Nonetheless by learning from the interactions that occur between the components of the health system to produce desired effects in one place, other places can try to improve their own systems (Plsek and Greenhalgh, 2001).

Qualitative research is based on the assumption that there is a reality external to our perception thus the main aim is to not falsify an observation relative to external validity (Dahlgren et al., 2004, Gilson, 2012). Qualitative research draws on transferability of results which does not make broad claims but gives the readers a fair chance to make connections between elements of the study and their own experiences (Dahlgren et al., 2004). In study I efforts were made to recruit participants from various backgrounds (urban, geographical location, sex, age) using maximum variation sampling and triangulation of participants who included community members, CHWs and health facility based workers so as to capture a wide variety of lived experiences.

6.5 CONCLUSIONS

- While iCCM, as a complex innovation, was well accepted by the community members, optimal functioning of iCCM at scale requires improved community ownership and targeted health system strengthening through supportive supervision of CHWs and provision of regular commodity supply (study I).
- iCCM has the potential to equitably increase the proportion of sick children treated appropriately (study III). If implemented at scale with high uptake by community members, the iCCM strategy could lead to increased fairness in access to life saving treatment perceived to be of high quality by community members (study II & III)
- Despite significant and equitable increase in the uptake of ORS for diarrhoea following iCCM, the uptake of zinc lagged behind (study III). Innovative approaches, such as co-packaging of ORS and zinc, may be necessary to improve zinc uptake and effective treatment of diarrhoeal diseases.
- Referral completion among caregivers of children referred to higher level health facilities was fairly low, despite expressed willingness to pay for referral (study IV). A functioning and integrated community referral system from the villages to the health centres is essential for the continuum of care of severely ill children; hence barriers in access to referral care at the community and health facility levels need to be addressed.
- While the iCCM policy has been well embedded in the communities, its alignment with the country health system framework is lagging behind (study I, II, III, IV). For successful institutionalisation of iCCM into the Ugandan health system, high-level, political ownership of the iCCM policy, including mobilisation of financial resources, could facilitate policy diffusion and sustainable implementation at scale.

6.6 IMPLICATIONS FOR POLICY, PRACTICE AND RESEARCH

As iCCM is a complex innovation that is being introduced into complex adaptive health systems, the effects cannot be predicted with precision. By carefully analysing the strengths and weaknesses of the innovation and its acceptability and adoption in the communities, the time is opportune to reflect on changes that could be made to its design, such as incentive schemes, coordination mechanisms, private sector involvement and community mobilisation strategies, which could produce the desired effects in the system as a whole.

In the ‘ideal’ world of universal health coverage (UHC), access to the best quality patient centred care is everyone’s right. iCCM as an interim health system strengthening intervention has the potential to increase fairness in access to good quality health services for the poor. However, research on fairness in use of iCCM should target elements of service delivery that will increase early uptake of the innovation among all income groups and particularly among the poorest of the poor.

Large-scale implementation of CHWs in areas where access to other formal health care structures is difficult could lead to significant gains in the proportion of sick children who

receive appropriate treatment for malaria, pneumonia, diarrhoea and other conditions. However, local pneumonia aetiology and investment in improved pneumonia diagnostic tools should be considered to avoid drug wastage and antibiotic resistance in the face of the emerging epidemic of antimicrobial resistance and the drying tap of new antibiotics.

The ultimate goal for referral is to ensure that the referred get appropriate treatment. Health system strengthening is needed to remove access barriers such as transport and medication costs that have long permeated the health system. Implementation research is also needed to establish the role of communities in the mobilisation of available resources to overcome locally specific access barriers to referral care. Innovative approaches, such as village health clubs and community dialogues using empowerment language for effective behaviour change communication should be tested.

iCCM in Uganda depends on voluntary CHWs providing health care in rural communities. Programme sustainability depends on addressing the problems that CHWs face in their day to day lives. Regular drug supplies, supportive supervision, refresher training of CHWs, functional referral systems and other non monetary incentives are all necessary for maintaining a sustainable, well motivated work force of CHWs. Such problems can only be addressed through holistic health systems strengthening as they cannot be traced to just one cause.

While the institutionalisation of iCCM into the health system is likely to solve some problems that exist in the formal health sector such as patient overload at the health facilities, there is also a risk that it can lead to health system imbalances by creating extra tasks for health workers who supervise the CHWs. The net benefit of integrating iCCM into the health system will depend on how well the health system will reorganise itself to ensure that iCCM services are provided, while making necessary adjustments such as drug redistribution and staff time reallocation. Context specific research is needed on the effect of iCCM on staff work load, case load mix, costs and savings for both community and health facility based services.

There is need for the MOH to mobilise a sense of ownership at the local, sub-national and national levels among community members, political leaders and other key stakeholders to ensure full institutionalisation of iCCM into the health system.

7 ACKNOWLEDGEMENTS

I wish to express my sincere gratitude to the following people:

The study participants: caregivers, community health workers and district health team members; thank you for having shared your experiences with us.

My main supervisor: Associate professor Karin Källander for having encouraged me to pursue a PhD, sharing your scientific knowledge and literature with me, and your dedication in carefully reviewing my papers, Kappa, abstracts and presentations even on weekends and for all the support offered while I juggled my doctoral studies with research officer duties. Much appreciated ☺

My co-supervisor: Professor Göran Tomson, thank you for your insightful comments, for dedicating time to review my work even while you were on vacation, for ensuring that the 'practicalities' were taken care of and for teaching me the importance of precision. Utmost thanks ☺

My co-supervisor: Associate Professor Fredrick Makumbi, for having shared with me your statistical knowledge and critically reviewing my papers and abstracts. Much appreciated ☺

My mentor: Dr. Sabrina Bakeera-Kitaka for having encouraged me to work with children, for your valuable advice and being available whenever I need you. ☺

The emerging voices programme 2012 tutors: for having mentored me in complexity science and introduced me to Pechakucha and Prezi presentations!

The health systems research group at IHCAR: thank you for picking interest in my work. Special thanks to Professor Rolf Wahlström, Professor Stefan Peterson, and Associate professor Birger Forsberg, for critiquing my work, and Dr. Andreas Mårtensson for your insightful comments during the research group presentations.

Dr. Max Pexold: thank you for reviewing my statistical methods.

Faculty at IHCAR: Professor Lucie Laflamme, Associate Professor Marie Hasselberg, and Dr. Asli Kulane ; thank you for helping me to organise my cover story. Thanks to Professor Vinod Diwan and Professor Cecilia Stalsby Lundborg. Thank you so much to Gun-Britt Eriksson, Kersti Rädmark, Bo Planstedt, Elisabeth Kaven, Marita Larsson, Marie Docken, Jessica Pafs, Sara Erikson, Isabel Litwin-Davis, and Dell Saulnier for having assisted me with all the administrative procedures.

Colleagues and former colleagues at IHCAR: Anna Bergström, Christine Nalwadda, Roy Mayega, Joan Nakayaga-Kalyango, Lisa Bloom, Kristi Sydney, Elin Larsson, Netta Beer, Sandeep Nerkar, Justus Barageine, Simon Walusimbi, Netta Beer, David Mukanga, Hanani

Tabana, Dorcus Kiwanuka, Sigga Baldursdottir and Rashmi Rodrigues thank you for all the little help you offered here and there.

I am highly indebted to the Bill & Melinda Gates Foundation which funded the field studies.

Dr. Peter Waiswa and Wilson Tusiime: I am grateful for the help you rendered in organising my predefense seminar at Makerere University.

The inSCALE study group: Sylvia Meek, James Tibenderana, and Karin Källander (Malaria Consortium); Zelee Hill and Daniel Strachan (University College London, London, UK) and Betty Kirkwood, Seyi Soremekun, Raghu Lingam, Anna Vassal and Frida Kasteng (London School of Hygiene and Tropical Medicine, London, UK); thank you for the insightful reviews of my protocols and manuscripts.

Colleagues and former colleagues at Malaria Consortium Uganda with special thanks to Stella Nalukwago Settumba, Maureen Nakirunda, Edmound Kertho, Patrick Lumumba Etou, Benson Bagorogoza, and Godfrey Ayebale for all the technical support and taking on my roles on the many on the many occasions I was away. I wish to specifically thank Leila Noisette for reviewing my presentation materials.

I am grateful to Eleni Capsaskis for having diligently edited my thesis and manuscripts. ☺

I am grateful to my ‘other mother’ Gunilla Karbasi and my siblings by default Alex, Anna, and Jasmine, thank you for encouraging me to go to Kyrkan, for introducing me to Swedish delicacies such as Surströmming and Kräfskiva, for loving me and spending time with me right from the time when I was a master student in Umeå ☺ ☺

To my ‘other aunties’ in Sweden Pheobe Berglund, Annie Mushoke, and Mrs Odette, Mrs Mulera thanks for encouraging me to study and to live a balanced life.

To my friends from Umeå Anna Lindström, Cramel Mbah, Lena Selbrand, and Amina Essie; thank you for being good friends and isn’t amazing that our paths crossed again in Stockholm?

I am grateful to my family and friends especially Rockie, Julie, Prosy and Teddy, thank you for all the help you rendered and for checking on me 24/7 while I was away.

To all the friends and the 24 research assistants not mentioned but certainly not forgotten: Asante sana!

8 REFERENCES

- Abbey, M., Bartholomew, L. K., Nonvignon, J., Chinbuah, M. A., Pappoe, M., Gyapong, M., Gyapong, J. O., Bart-Plange, C. & Van Den Borne, B. 2014. Factors related to retention of community health workers in a trial on community-based management of fever in children under 5 years in the Dangme West District of Ghana. *Int Health*, 6, 99-105.
- Acharya, L. B. & Cleland, J. 2000. Maternal and child health services in rural Nepal: does access or quality matter more? *Health Policy Plan*, 15, 223-9.
- Adam, T., Hsu, J., De Savigny, D., Lavis, J. N., Rottingen, J. A. & Bennett, S. 2012. Evaluating health systems strengthening interventions in low-income and middle-income countries: are we asking the right questions? *Health Policy Plan*, 27 Suppl 4, iv9-19.
- Adegbola, R. A. & Obaro, S. K. 2000. Diagnosis of childhood pneumonia in the tropics. *Ann.Trop.Med.Parasitol.*, 94, 197-207.
- Agyei-Baffour, P., Hansen, K. S., Browne, E. N. & Magnussen, P. 2012. The amount and value of work time of community medicine distributors in community case management of malaria among children under five years in the Ejisu-Juaben District of Ghana. *Malar J*, 11, 277.
- Akhter, S. & Larson, C. P. 2010. Willingness to pay for zinc treatment of childhood diarrhoea in a rural population of Bangladesh. *Health Policy Plan*, 25, 230-6.
- Akweongo, P., Agyei-Baffour, P., Sudhakar, M., Simwaka, B. N., Konate, A. T., Adongo, P. B., Browne, E. N., Tegegn, A., Ali, D., Traore, A., Amuyunzu-Nyamongo, M., Pagnoni, F. & Barnish, G. 2011. Feasibility and acceptability of ACT for the community case management of malaria in urban settings in five African sites. *Malar J*, 10, 240.
- Alam, K., Tasneem, S. & Oliveras, E. 2012. Performance of female volunteer community health workers in Dhaka urban slums. *Soc Sci Med*, 75, 511-5.
- Allotey, P., Reidpath, D. D., Ghalib, H., Pagnoni, F. & Skelly, W. C. 2008. Efficacious, effective, and embedded interventions: implementation research in infectious disease control. *BMC Public Health*, 8, 343.
- Arifeen, S. E., Blum, L. S., Hoque, D. M. E., Chowdhury, E. K., Khan, R., Black, R. E., Victora, C. & Bryce, J. 2004. Integrated Management of Childhood Illness (IMCI) in Bangladesh: early findings from a cluster-randomised study. *Lancet*, 364, 1595-602.
- Armstrong Schellenberg, J. R., Adam, T., Mshinda, H., Masanja, H., Kabadi, G., Mukasa, O., John, T., Charles, S., Nathan, R., Wilczynska, K., Mgalula, L., Mbuya, C., Mswia, R., Manzi, F., De Savigny, D., Schellenberg, D. & Victora, C. 2004. Effectiveness and cost of facility-based Integrated Management of Childhood Illness (IMCI) in Tanzania. *Lancet*, 364, 1583-94.
- Atun, R., De Jongh, T., Secci, F., Ohiri, K. & Adeyi, O. 2010a. Integration of targeted health interventions into health systems: a conceptual framework for analysis. *Health Policy Plan*, 25, 104-11.

- Atun, R., De Jongh, T., Secci, F., Ohiri, K. & Adeyi, O. 2010b. A systematic review of the evidence on integration of targeted health interventions into health systems. *Health Policy Plan*, 25, 1-14.
- Austin, P. C. 2011. An Introduction to Propensity Score Methods for Reducing the Effects of Confounding in Observational Studies. *Multivariate Behav Res*, 46, 399-424.
- Awor, P., Wamani, H., Bwire, G., Jagoe, G. & Peterson, S. 2012. Private sector drug shops in integrated community case management of malaria, pneumonia, and diarrhea in children in Uganda. *Am J Trop Med Hyg*, 87, 92-6.
- Bakeera, S. K., Wamala, S. P., Galea, S., State, A., Peterson, S. & Pariyo, G. W. 2009. Community perceptions and factors influencing utilization of health services in Uganda. *Int J Equity Health*, 8, 25.
- Balabanova, D., Mckee, M., Mills, A., Walt, G. & Haines, A. 2010. What can global health institutions do to help strengthen health systems in low income countries? *Health Res Policy Syst*, 8, 22.
- Baltussen, R. & Ye, Y. 2006. Quality of care of modern health services as perceived by users and non-users in Burkina Faso. *Int J Qual Health Care*, 18, 30-4.
- Baltussen, R. M., Ye, Y., Haddad, S. & Sauerborn, R. S. 2002. Perceived quality of care of primary health care services in Burkina Faso. *Health Policy Plan*, 17, 42-8.
- Bar-Zeev, N., ., MacLennan, C., ., Murray, J., Mañalac, E., . & Trias, M., . 2012. IMCI at the Referral Level: "Hospital IMCI". In: GROSS, R. (ed.) *Integrated Management of Childhood Illness (IMCI) Implementation in the Western Pacific Region*. WPRO.
- Bari, A., Sadruddin, S., Khan, A., Khan, I., Lehri, I. A., Macleod, W. B., Fox, M. P., Thea, D. M. & Qazi, S. A. 2011. Community case management of severe pneumonia with oral amoxicillin in children aged 2-59 months in Haripur district, Pakistan: a cluster randomised trial. *Lancet*, 378, 1796-803.
- Bennett, S., George, A., Rodriguez, D., Shearer, J., Diallo, B., Konate, M., Dalglish, S., Juma, P., Namakhoma, I., Banda, H., Chilundo, B., Mariano, A. & Cliff, J. 2014. Policy challenges facing integrated community case management in Sub-Saharan Africa. *Trop Med Int Health*, 19, 872-82.
- Bhattacharyya, K., Winch, P., Leban, K. & Tien, M. 2001. Community Health Worker Incentives and Disincentives: How They Affect Motivation, Retention, and Sustainability. Arlington, Virginia: Basic Support for Institutionalizing Child Survival Project (BASICS II) for USAID.
- Bhutta, Z. A., Ali, S., Cousens, S., Ali, T. M., Haider, B. A., Rizvi, A., Okong, P., Bhutta, S. Z. & Black, R. E. 2008. Alma-Ata: Rebirth and Revision 6 Interventions to address maternal, newborn, and child survival: what difference can integrated primary health care strategies make? *Lancet*, 372, 972-89.
- Bhutta, Z. A., Cabral, S., Chan, C. W. & Keenan, W. J. 2012. Reducing maternal, newborn, and infant mortality globally: an integrated action agenda. *Int J Gynaecol Obstet*, 119 Suppl 1, S13-7.
- Bhutta, Z. A., Chopra, M., Axelson, H., Berman, P., Boerma, T., Bryce, J., Bustreo, F., Cavagnero, E., Cometto, G., Daelmans, B., De Francisco, A., Fogstad, H., Gupta, N., Laski, L., Lawn, J., Maliqi, B., Mason, E., Pitt, C., Requejo, J., Starrs, A., Victora, C. G. & Wardlaw, T. 2010. Countdown to 2015 decade report (2000-10): taking stock of maternal, newborn, and child survival. *Lancet*, 375, 2032-44.

- Bhutta, Z. A. & Das, J. K. 2014. Interventions to address maternal and childhood undernutrition: current evidence. *Nestle Nutr Inst Workshop Ser*, 78, 59-69.
- Bhutta, Z. A., Das, J. K., Walker, N., Rizvi, A., Campbell, H., Rudan, I. & Black, R. E. 2013. Interventions to address deaths from childhood pneumonia and diarrhoea equitably: what works and at what cost? *Lancet*, 381, 1417-29.
- Björkman, M. & Svensson, J. 2009. Power to the people: evidence from a randomized field experiment of a community-based monitoring project in Uganda. *QUARTERLY JOURNAL OF ECONOMICS*, 124, 735-769.
- Black, R. E., Cousens, S., Johnson, H. L., Lawn, J. E., Rudan, I., Bassani, D. G., Jha, P., Campbell, H., Walker, C. F., Cibulskis, R., Eisele, T., Liu, L. & Mathers, C. 2010. Global, regional, and national causes of child mortality in 2008: a systematic analysis. *Lancet*, 375, 1969-87.
- Black, R. E., Morris, S. S. & Bryce, J. 2003. Where and why are 10 million children dying every year? *Lancet*, 361, 2226-2234.
- Bloom, G., Standing, H., Lucas, H., Bhuiya, A., Oladepo, O. & Peters, D. H. 2011. Making health markets work better for poor people: the case of informal providers. *Health Policy Plan*, 26 Suppl 1, i45-52.
- Bojalil, R., Kirkwood, B. R., Bobak, M. & Guiscafne, H. 2007. The relative contribution of case management and inadequate care-seeking behaviour to childhood deaths from diarrhoea and acute respiratory infections in Hidalgo, Mexico. *Trop Med Int Health*, 12, 1545-52.
- Bonfrer, I., Van De Poel, E., Grimm, M. & Van Doorslaer, E. 2012. Does health care utilization match needs in Africa? Challenging conventional needs measurement. *iBMG Working Paper W2012.02*. Erasmus University Rotterdam.
- Braveman, P. & Gruskin, S. 2003. Defining equity in health. *Journal of Epidemiology and Community Health*, 57, 254-258.
- Brenner, J. L., Kabakyenga, J., Kyomuhangi, T., Wotton, K. A., Pim, C., Ntaro, M., Bagenda, F. N., Gad, N. R., Godel, J., Kayizzi, J., Mcmillan, D., Mulogo, E., Nettel-Aguirre, A. & Singhal, N. 2011. Can volunteer community health workers decrease child morbidity and mortality in southwestern Uganda? An impact evaluation. *PLoS One*, 6, e27997.
- Bryce, J., Daelmans, B., Dwivedi, A., Fauveau, V., Lawn, J. E., Mason, E., Newby, H., Shankar, A., Starrs, A. & Wardlaw, T. 2008. Countdown to 2015 for maternal, newborn, and child survival: the 2008 report on tracking coverage of interventions. *Lancet*, 371, 1247-58.
- Bryce, J., El Arifeen, S., Pariyo, G., Lanata, C., Gwatkin, D. & Habicht, J. P. 2003. Reducing child mortality: can public health deliver? *Lancet*, 362, 159-64.
- Bryce, J., Gouws, E., Adam, T., Black, R. E., Schellenberg, J. A., Manzi, F., Victora, C. G. & Habicht, J. P. 2005a. Improving quality and efficiency of facility-based child health care through Integrated Management of Childhood Illness in Tanzania. *Health Policy Plan*, 20 Suppl 1, i69-i76.
- Bryce, J., Terreri, N., Victora, C., Mason, E., Daelmans, B., Bhutta, A., Bustreo, F., Songane, F., Salama, P. & Wardlaw, T. 2006. Count down to 2015: tracking intervention coverage for chld survival. *Lancet*, 368, 1067-78.

- Bryce, J., Victora, C. G., Habicht, J. P., Black, R. E. & Scherpbier, R. W. 2005b. 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.
- Bryce, J., Victora, C. G., Habicht, J. P., Vaughan, J. P. & Black, R. E. 2004. The multi-country evaluation of the integrated management of childhood illness strategy: lessons for the evaluation of public health interventions. *Am J Public Health*, 94, 406-15.
- Callaghan-Koru, J. A., Nonyane, B. A., Guenther, T., Sitrin, D., Ligowe, R., Chimbalanga, E., Zimba, E., Kachale, F., Shah, R. & Baqui, A. H. 2013. Contribution of community-based newborn health promotion to reducing inequities in healthy newborn care practices and knowledge: evidence of improvement from a three-district pilot program in Malawi. *BMC Public Health*, 13, 1052.
- Campbell, H., El Arifeen, S., Hazir, T., O'Kelly, J., Bryce, J., Rudan, I. & Qazi, S. A. 2013. Measuring coverage in MNCH: challenges in monitoring the proportion of young children with pneumonia who receive antibiotic treatment. *PLoS Med*, 10, e1001421.
- Campbell, M., Fitzpatrick, R., Haines, A., Kinmonth, A. L., Sandercock, P., Spiegelhalter, D. & Tyrer, P. 2000a. Framework for design and evaluation of complex interventions to improve health. *BMJ*, 321, 694-6.
- Campbell, S. M. & Roland, M. O. 1996. Why do people consult the doctor? *Fam Pract*, 13, 75-83.
- Campbell, S. M., Roland, M. O. & Buetow, S. A. 2000b. Defining quality of care. *Soc Sci Med*, 51, 1611-25.
- Carroll, C., Patterson, M., Wood, S., Booth, A., Rick, J. & Balain, S. 2007. A conceptual framework for implementation fidelity. *Implement Sci*, 2, 40.
- Chan, Y. H. 2005. Biostatistics 305. Multinomial logistic regression. *Singapore Med J*, 46, 259-68; quiz 269.
- Chanda, P., Hamainza, B., Moonga, H. B., Chalwe, V. & Pagnoni, F. 2011. Community case management of malaria using ACT and RDT in two districts in Zambia: achieving high adherence to test results using community health workers. *Malar J*, 10, 158.
- Chaudhury, N., Hammer, J., Kremer, M., Muralidharan, K. & Rogers, F. 2004. Teacher and health care provider absence: a multi-country study. *World Bank: DEC*.
- Chisti, M. J., Duke, T., Robertson, C. F., Ahmed, T., Faruque, A. S., Bardhan, P. K., La Vincente, S. & Salam, M. A. 2011. Co-morbidity: exploring the clinical overlap between pneumonia and diarrhoea in a hospital in Dhaka, Bangladesh. *Ann Trop Paediatr*, 31, 311-9.
- Christopher, J. B., Le May, A., Lewin, S. & Ross, D. A. 2011. Thirty years after Alma-Ata: a systematic review of the impact of community health workers delivering curative interventions against malaria, pneumonia and diarrhoea on child mortality and morbidity in sub-Saharan Africa. *Hum Resour Health*, 9, 27.
- Chuma, J., Okungu, V., Ntwiga, J. & Molyneux, C. 2010. Towards achieving Abuja targets: identifying and addressing barriers to access and use of insecticides treated nets among the poorest populations in Kenya. *BMC Public Health*, 10, 137.

- Collins, D. H., Jarrah, Z., Ndizeye, C. & Cros, M. 2013. The cost of scaling up primary health-care services? comparisons from studies in six countries: economic research using systematic sampling. *The Lancet*, 381, S30.
- Coyne, I. T. 1997. Sampling in qualitative research. Purposeful and theoretical sampling; merging or clear boundaries? *J Adv Nurs*, 26, 623-30.
- Crawley, J., Chu, C., Mtove, G. & Nosten, F. 2010. Malaria in children. *Lancet*, 375, 1468-81.
- D'alessandro, U., Talisuna, A. & Boelaert, M. 2005. Editorial: Should artemisinin-based combination treatment be used in the home-based management of malaria? *Trop Med Int Health*, 10, 1-2.
- Dahlgren, L., Emmelin, M. & Winkvist, A. 2004. *Qualitative Methodology for International Public Health*, Umeå, Print och Media.
- Darmstadt, G., Bhutta, Z., Cousens, S., Adam, T., Walker, N. & De-Bernis, L. 2005. Evidence-based, cost effective interventions: how many newborn babies can we save? . *Lancet*, 365, 977–88.
- Das, J. K., Lassi, Z. S., Salam, R. A. & Bhutta, Z. A. 2013. Effect of community based interventions on childhood diarrhea and pneumonia: uptake of treatment modalities and impact on mortality. *BMC Public Health*, 13 Suppl 3, S29.
- De Savigny, D., Mayombana, C., Mwageni, E., Masanja, H., Minhaj, A., Mkilindi, Y., Mbuya, C., Kasale, H. & Reid, G. 2004. Care-seeking patterns for fatal malaria in Tanzania. *Malar J*, 3, 27.
- De Sousa, A., Tiedje, K. E., Recht, J., Bjelic, I. & Hamer, D. H. 2012. Community case management of childhood illnesses: policy and implementation in Countdown to 2015 countries. *Bull World Health Organ*, 90, 183-90.
- Dekkers, O. M., Egger, M., Altman, D. G. & Vandenbroucke, J. P. 2012. Distinguishing case series from cohort studies. *Ann Intern Med*, 156, 37-40.
- Delgado-Rodriguez, M. & Llorca, J. 2004. Bias. *J Epidemiol Community Health*, 58, 635-41.
- Diaz, T., George, A. S., Rao, S. R., Bangura, P. S., Baimba, J. B., McMahon, S. A. & Kabano, A. 2013. Healthcare seeking for diarrhoea, malaria and pneumonia among children in four poor rural districts in Sierra Leone in the context of free health care: results of a cross-sectional survey. *BMC Public Health*, 13, 157.
- Donabedian, A., . 1988. The quality of care: how can it be assessed? *JAMA*, 260, 1743–1748.
- Druetz, T., Siekmans, K., Goossens, S., Ridde, V. & Haddad, S. 2013. The community case management of pneumonia in Africa: a review of the evidence. *Health Policy Plan*.
- Drummond, M., F., O'brien, B., Stoddart, G., L., Torrance, G., W. & Sculpher, M., J. 2005. *Methods for the Economic Evaluation of Health Care Programmes*, Oxford University Press.
- Edwards, N. & Di Ruggiero, E. 2011. Exploring which context matters in the study of health inequities and their mitigation. *Scand J Public Health*, 39, 43-9.
- Elmardi, A., Malik, M., Abdelgadir, T., Ali , S., Elsyed , A. & Mudather, M. 2009. Feasibility and acceptability of home-based management of malaria strategy adapted to Sudan's conditions using artemisinin-based combination therapy and rapid diagnostic test. *Malar J*, 8, doi:10.1186/1475-2875-8-39.

- English, M., Esamai, F., Wasunna, A., Were, F., Ogutu, B., Wamae, A., Snow, R. W. & Peshu, N. 2004. Assessment of inpatient paediatric care in first referral level hospitals in 13 districts in Kenya. *Lancet*, 363, 1948-53.
- Ensor, T. & Cooper, S. 2004. Overcoming barriers to health service access: influencing the demand side. *Health Policy Plan*, 19, 69-79.
- Erreygers, G. 2009. Correcting the concentration index. *J Health Econ*, 28, 504-15.
- Evans, T., Nishtar, S., Atun, R. & Etienne, C. 2008. Scaling up research and learning for health systems: time to act. *Lancet*, 372, 1529-31.
- Everitt, B. S. & Dunn, G. 2013. Principal Components Analysis. *Applied Multivariate Data Analysis*. John Wiley & Sons, Ltd.,
- Ewing, V. L., Lalloo, D. G., Phiri, K. S., Roca-Feltrer, A., Mangham, L. J. & Sanjoaquin, M. A. 2011. Seasonal and geographic differences in treatment-seeking and household cost of febrile illness among children in Malawi. *Malar J*, 10, 32.
- Fagbule, D. & Kalu, A. 1995. Case management by community health workers of children with acute respiratory infections: implications for national ARI control programme. *J Trop Med Hyg*, 98, 241-6.
- Fapohunda., Bolaji, M., Plowman, B., Azairwe, R., Bisorbowa, G., Langi, P., Kato, F. & Wang, X. 2004. Home-Based Management of Fever Strategy in Uganda: A Report of the 2003 Survey. . *Arlington, Virginia, USA: MOH, WHO and BASICS II*.
- Feldstein, A. C. & Glasgow, R. E. 2008. A practical, robust implementation and sustainability model (PRISM) for integrating research findings into practice. *Jt Comm J Qual Patient Saf*, 34, 228-43.
- Filmer, D., Hammer, J. S. & Pritchett, L. H. 2000. Weak Links in the Chain: A Diagnosis of Health Policy in Poor Countries. *The World Bank Research Observer*, 15, 199-224.
- Fischer Walker, C. L., Fontaine, O. & Black, R. E. 2013. Measuring coverage in MNCH: current indicators for measuring coverage of diarrhea treatment interventions and opportunities for improvement. *PLoS Med*, 10, e1001385.
- Fishbein, M. 1980. A theory of reasoned action: some applications and implications. *Nebr Symp Motiv*, 27, 65-116.
- Fixsen, D. L., Naoom, S. F., Blase, K. A. & Friedman, R. M. 2005. Implementation research: A synthesis of the literature.
- Fotso, J. C. & Mukiira, C. 2011. Perceived quality of and access to care among poor urban women in Kenya and their utilization of delivery care: harnessing the potential of private clinics? *Health Policy Plan*.
- Frankel, R. M. & Devers, K. 2000. Qualitative research: a consumer's guide. *Educ Health (Abingdon)*, 13, 113-23.
- Frenk, J. 1994. Dimensions of health system reform. *Health Policy*, 27, 19-34.
- Frenk, J. 2009. Reinventing primary health care: the need for systems integration. *Lancet*, 374, 170-3.
- Frenk, J. & Moon, S. 2013. Governance challenges in global health. *N Engl J Med*, 368, 936-42.

- Galea, S., Riddle, M. & Kaplan, G. A. 2010. Causal thinking and complex system approaches in epidemiology. *Int J Epidemiol*, 39, 97-106.
- Geldsetzer, P., Williams, T. C., Kirolos, A., Mitchell, S., Ratcliffe, L. A., Kohli-Lynch, M. K., Bischoff, E. J., Cameron, S. & Campbell, H. 2014. The recognition of and care seeking behaviour for childhood illness in developing countries: a systematic review. *PLoS One*, 9, e93427.
- Gilroy, K. E., Callaghan-Koru, J. A., Cardemil, C. V., Nsona, H., Amouzou, A., Mtimuni, A., Daelmans, B., Mgalula, L. & Bryce, J. 2013. Quality of sick child care delivered by Health Surveillance Assistants in Malawi. *Health Policy Plan*, 28, 573-85.
- Gilson, L. 2012. *Health Policy and Systems Research: A Methodology Reader*, Geneva, Switzerland, Alliance HPSR/WHO.
- Gilson, L., Walt, G., Heggenhougen, K., Owuor-Omondi, L., Perera, M., Ross, D. & Salazar, L. 1989. National community health worker programs: How can they be strengthened? *J Public Health Policy*, 10, 518-32.
- Glasgow, R., Lichtenstein, E. & Ca, M. 2003. Why Don't We See More Translation of Health Promotion Research to practice? Rethinking the Efficacy-to-Effectiveness Transition. *Public Health Matters*, 93, 1261-1267.
- Glenton, C., Scheel, I. B., Pradhan, S., Lewin, S., Hodgins, S. & Shrestha, V. 2010. The female community health volunteer programme in Nepal: decision makers' perceptions of volunteerism, payment and other incentives. *Soc Sci Med*, 70, 1920-7.
- Glewwe, P., Grosh, M. E. & World, B. 2000. *Designing household survey questionnaires for developing countries : lessons from 15 years of the living standards measurement study / edited by Margaret Grosh and Paul Glewwe*, Washington, D.C, World Bank.
- Goodman, C., Brieger, W., Unwin, A., Mills, A., Meek, S. & Greer, G. 2007. Medicine sellers and malaria treatment in sub-Saharan Africa: what do they do and how can their practice be improved? *Am J Trop Med Hyg*, 77, 203-18.
- Gordis, L. 2009. *Epidemiology*, Elsevier/Saunders.
- 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. *Bull World Health Organ*, 75 Suppl 1, 7-24.
- Graham, S. M., English, M., Hazir, T., Enarson, P. & Duke, T. 2008. Challenges to improving case management of childhood pneumonia at health facilities in resource-limited settings. *Bull World Health Organ*, 86, 349-55.
- Green, J. & Thorogood, N. 2013. *Qualitative methods for health research*, Sage.
- Greenhalgh T, R. G., Macfarlane F, Bate P, Kyriakidou O 2004. *Diffusion of innovations in service organizations: systematic review and recommendations.*, Blackwell Publishing.
- Greenland, S. 2004. Model-based estimation of relative risks and other epidemiologic measures in studies of common outcomes and in case-control studies. *Am J Epidemiol*, 160, 301-5.
- Gupta, G. R. 2012. Tackling pneumonia and diarrhoea: the deadliest diseases for the world's poorest children. *Lancet*, 379, 2123-4.

- Gwatkin, D. R. 2006. IMCI: what can we learn from an innovation that didn't reach the poor? *Bull World Health Organ*, 84, 768.
- Habib, M. A., Soofi, S., Sadiq, K., Samejo, T., Hussain, M., Mirani, M., Rehmatullah, A., Ahmed, I. & Bhutta, Z. A. 2013. A study to evaluate the acceptability, feasibility and impact of packaged interventions ("Diarrhea Pack") for prevention and treatment of childhood diarrhea in rural Pakistan. *BMC Public Health*, 13, 922.
- Haddad, S., Fournier, P., Machouf, N. & Yatara, F. 1998. What does quality mean to lay people? Community perceptions of primary health care services in Guinea. *Soc Sci Med*, 47, 381-94.
- Hadi, A. 2003. Management of acute respiratory infections by community health volunteers: experience of Bangladesh Rural Advancement Committee (BRAC). *Bull World Health Organ*, 81, 183-189.
- Haider, M. & Kreps, G. L. 2004. Forty years of diffusion of innovations: utility and value in public health. *J Health Commun*, 9 Suppl 1, 3-11.
- Haines, A., Sanders, D., Lehmann, U., Rowe, A., Lawn, J. J., S., Walker, D. & Bhutta, Z. 2007. Achieving child survival goals: potential contribution of community health workers. *thelancet*, Published Online March 6, 2007 DOI:10.1016/S0140-6736(07)60325-0.
- Hamer, D. H., Brooks, E. T., Semrau, K., Pilingana, P., Macleod, W. B., Siazeele, K., Sabin, L. L., Thea, D. M. & Yeboah-Antwi, K. 2012. Quality and safety of integrated community case management of malaria using rapid diagnostic tests and pneumonia by community health workers. *Pathog Glob Health*, 106, 32-9.
- Hand, D. J. 2008. Analysis of Multivariate Social Science Data, Second Edition by David J. Bartholomew, Fiona Steele, Irini Moustaki, Jane Galbraith. *International Statistical Review*, 76, 456-456.
- Hansen, K. S., Pedrazzoli, D., Mbonye, A., Clarke, S., Cundill, B., Magnussen, P. & Yeung, S. 2013. Willingness-to-pay for a rapid malaria diagnostic test and artemisinin-based combination therapy from private drug shops in Mukono District, Uganda. *Health Policy Plan*, 28, 185-96.
- Hanson, K., Ranson, M. K., Oliviera-Cruz, V. & Mills, A. 2003. Expanding access to priority health interventions: a framework for understanding the constraints to scaling-up. *J Int Dev*, 15, 1-14.
- Harvey, S. A., Jennings, L., Chinyama, M., Masaninga, F., Mulholland, K. & Bell, D. R. 2008. Improving community health worker use of malaria rapid diagnostic tests in Zambia: package instructions, job aid and job aid-plus-training. *Malar J*, 7, 160.
- Hawkes, M., Katsuva, J. P. & Masumbuko, C. K. 2009. Use and limitations of malaria rapid diagnostic testing by community health workers in war-torn Democratic Republic of Congo. *Malar J*, 8, 308.
- Hazel, E., Requejo, J., David, J. & Bryce, J. 2013. Measuring coverage in MNCH: evaluation of community-based treatment of childhood illnesses through household surveys. *PLoS Med*, 10, e1001384.

- Herbert, H. K., Lee, A. C., Chandran, A., Rudan, I. & Baqui, A. H. 2012. Care seeking for neonatal illness in low- and middle-income countries: a systematic review. *PLoS Med*, 9, e1001183.
- Hildenwall, H., Nantanda, R., Tumwine, J. K., Petzold, M., Pariyo, G., Tomson, G. & Peterson, S. 2009. Care-seeking in the development of severe community acquired pneumonia in Ugandan children. *Submitted*.
- Hill, Z., Kendall, C., Arthur, P., Kirkwood, B. & Adjei, E. 2003. Recognizing childhood illnesses and their traditional explanations: exploring options for care-seeking interventions in the context of the IMCI strategy in rural Ghana. *Trop Med Int Health*, 8, 668-676.
- Horton, R. & Lo, S. 2014. Protecting health: the global challenge for capitalism. *Lancet*, 383, 577-8.
- Hsieh, H. F. & Shannon, S. E. 2005. Three approaches to qualitative content analysis. *Qual Health Res*, 15, 1277-88.
- Hutchinson, P. L., Do, M. & Agha, S. 2011. Measuring client satisfaction and the quality of family planning services: a comparative analysis of public and private health facilities in Tanzania, Kenya and Ghana. *BMC Health Serv Res*, 11, 203.
- Izquierdo, I., Olea, J. & Abad, F. J. 2014. Exploratory factor analysis in validation studies: Uses and recommendations. *Psicothema*, 26, 395-400.
- James, C. D., Hanson, K., Mcpake, B., Balabanova, D., Gwatkin, D., Hopwood, I., Kirunga, C., Knippenberg, R., Meessen, B., Morris, S. S., Preker, A., Souteyrand, Y., Tibouti, A., Villeneuve, P. & Xu, K. 2006. To retain or remove user fees?: reflections on the current debate in low- and middle-income countries. *Appl Health Econ Health Policy*, 5, 137-53.
- Janjua, N. Z., Hutin, Y. J., Akhtar, S. & Ahmad, K. 2006. Population beliefs about the efficacy of injections in Pakistan's Sindh province. *Public Health*, 120, 824-33.
- Jegede, A. S. 2007. What led to the Nigerian boycott of the polio vaccination campaign? *PLoS Med*, 4, e73.
- Jensen, H. I., Ammentorp, J. & Kofoed, P. E. 2010. User satisfaction is influenced by the interval between a health care service and the assessment of the service. *Soc Sci Med*, 70, 1882-7.
- Joloba, M. L., Bajaksouzian, S., Palavecino, E., Whalen, C. & Jacobs, M. R. 2001. High prevalence of carriage of antibiotic-resistant *Streptococcus pneumoniae* in children in Kampala Uganda. *Int J Antimicrob Agents*, 17, 395-400.
- Jones, G., Steketee, R. W., Black, R. E., Bhutta, Z. A. & Morris, S. S. 2003. How many child deaths can we prevent this year? *Lancet*, 362, 65-71.
- Kallander, K., Nsungwa-Sabiiti, J. & Peterson, S. 2004. Symptom overlap for malaria and pneumonia--policy implications for home management strategies. *Acta Trop*, 90, 211-214.
- Källander, K., Tibenderana, J. K., Akpogheneta, O. J., Strachan, D. L., Hill, Z., Ten Asbroek, A. H., Conteh, L., Kirkwood, B. R. & Meek, S. R. 2013. Mobile health (mHealth) approaches and lessons for increased performance and retention of community health workers in low-and middle-income countries: a review. *Journal of medical Internet research*, 15.

- Kallander, K., Tomson, G., Nsabagasani, X., Sabiiti, J. N., Pariyo, G. & Peterson, S. 2006a. Can community health workers and caretakers recognise pneumonia in children? Experiences from western Uganda. *Trans R Soc Trop Med Hyg*, 100, 956-63.
- Kallander, K., Tomson, G., Nsungwa-Sabiiti, J., Senyonjo, Y., Pariyo, G. & Peterson, S. 2006b. Community referral in home management of malaria in western Uganda: a case series study. *BMC Int Health Hum Rights*, 6, 2.
- Kalter, H. D., Salgado, R., Moulton, L. H., Nieto, P., Contreras, A., Egas, M. L. & Black, R. E. 2003. Factors constraining adherence to referral advice for severely ill children managed by the Integrated Management of Childhood Illness approach in Imbabura Province, Ecuador. *Acta Paediatr*, 92, 103-10.
- Kalyango, J. N., Alfven, T., Peterson, S., Mugenyi, K., Karamagi, C. & Rutebemberwa, E. 2013a. Integrated community case management of malaria and pneumonia increases prompt and appropriate treatment for pneumonia symptoms in children under five years in Eastern Uganda. *Malar J*, 12, 340.
- Kalyango, J. N., Alfven, T., Peterson, S., Mugenyi, K., Karamagi, C. & Rutebemberwa, E. 2013b. Integrated community case management of malaria and pneumonia increases prompt and appropriate treatment for pneumonia symptoms in children under five years in Eastern Uganda. *Malar J*, 12, 340.
- Kalyango, J. N., Lindstrand, A., Rutebemberwa, E., Ssali, S., Kadobera, D., Karamagi, C., Peterson, S. & Alfven, T. 2012a. Increased use of community medicine distributors and rational use of drugs in children less than five years of age in Uganda caused by integrated community case management of fever. *Am J Trop Med Hyg*, 87, 36-45.
- Kalyango, J. N., Rutebemberwa, E., Alfven, T., Ssali, S., Peterson, S. & Karamagi, C. 2012b. Performance of community health workers under integrated community case management of childhood illnesses in eastern Uganda. *Malar J*, 11, 282.
- Kanya, L., Obare, F., Warren, C., Abuya, T., Askew, I. & Bellows, B. 2013. Safe motherhood voucher programme coverage of health facility deliveries among poor women in South-western Uganda. *Health Policy and Planning*.
- Kelly, J. M., Osamba, B., Garg, R. M., Hamel, M. J., Lewis, J. J., Rowe, S. Y., Rowe, A. K. & Deming, M. S. 2001. Community health worker performance in the management of multiple childhood illnesses: Siaya District, Kenya, 1997-2001. *Am J Public Health*, 91, 1617-24.
- Khan, J. A., Addiss, D. G. & Rizwan, U. 1990. Pneumonia and community health workers. *Lancet*, 336, 939.
- Khanal, S., Sharma, J., Gc, V. S., Dawson, P., Houston, R., Khadka, N. & Yengden, B. 2011. Community health workers can identify and manage possible infections in neonates and young infants: MINI--a model from Nepal. *J Health Popul Nutr*, 29, 255-64.
- Khandker, Shahidur R, Koolwal, Gayatri B, Samad & Hussain A 2010. *Handbook on Impact Evaluation : Quantitative Methods and Practices*. .
- Kidane, G. & Morrow, R. H. 2000. Teaching mothers to provide home treatment of malaria in Tigray, Ethiopia: a randomised trial. *Lancet*, 356, 550-5.
- Kiguli, J., Ekirapa-Kiracho, E., Okui, O., Mutebi, A., Macgregor, H. & Pariyo, G. W. 2009. Increasing access to quality health care for the poor: Community perceptions on quality care in Uganda. *Patient Prefer Adherence*, 3, 77-85.

- Kirkwood, B. (ed.) 2003. *Essentials of medical statistics*, Oxford: Blackwell Science Ltd.
- Kitutu, F., Mayora, C., Awor, P., Birger, F., Peterson, S. & Wamani, H. 2014. Inclusion of private sector in district health systems; case study of private drug shops implementing modified Integrated Community Case Management (iCCM) strategy in Rural Uganda. *BMC Health Services Research*, 14, P65.
- Kjellsson, G. & Gerdtham, U. G. 2013. On correcting the concentration index for binary variables. *J Health Econ*, 32, 659-70.
- Klose, T. 1999. The contingent valuation method in health care. *Health Policy*, 47, 97-123.
- Kolstad, P. R., Burnham, G., Kalter, H. D., Kenya-Mugisha, N. & Black, R. E. 1997. The integrated management of childhood illness in western Uganda. *Bull World Health Organ*, 75 Suppl 1, 77-85.
- Konde-Lule, J., Gitta, S. N., Lindfors, A., Okuonzi, S., Onama, V. O. & Forsberg, B. C. 2010. Private and public health care in rural areas of Uganda. *BMC Int Health Hum Rights*, 10, 29.
- Lee, J., Tan, C. S. & Chia, K. S. 2009. A practical guide for multivariate analysis of dichotomous outcomes. *Ann Acad Med Singapore*, 38, 714-9.
- Levin, K. A. 2006. Study design III: Cross-sectional studies. *Evid Based Dent*, 7, 24-5.
- Lewin, S., Dick, J., Pond, P., Zwarenstein, M., Aja, G., Van Wyk, B., Bosch-Capblanch, X. & Patrick, M. 2005. Lay health workers in primary and community health care (Review). *The Cochrane Library*.
- Lewin, S., Lavis, J. N., Oxman, A. D., Bastias, G., Chopra, M., Ciapponi, A., Flottorp, S., Marti, S. G., Pantoja, T., Rada, G., Souza, N., Treweek, S., Wiysonge, C. S. & Haines, A. 2008. 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*, 372, 928-39.
- Liu, L., Johnson, H. L., Cousens, S., Perin, J., Scott, S., Lawn, J. E., Rudan, I., Campbell, H., Cibulskis, R., Li, M., Mathers, C. & Black, R. E. 2012. Global, regional, and national causes of child mortality: an updated systematic analysis for 2010 with time trends since 2000. *Lancet*, 379, 2151-61.
- Ludwick, T., Brenner, J. L., Kyomuhangi, T., Wotton, K. A. & Kabakyenga, J. K. 2014. Poor retention does not have to be the rule: retention of volunteer community health workers in Uganda. *Health Policy Plan*, 29, 388-95.
- Mant, J. 2001. Process versus outcome indicators in the assessment of quality of health care. *Int J Qual Health Care*, 13, 475-80.
- Marmot, M. 2005. Social determinants of health inequalities. *Lancet*, 365, 1099-104.
- Marsh, D. R., Gilroy, K. E., Van De Weerd, R., Wansi, E. & Qazi, S. 2008. Community case management of pneumonia: at a tipping point? *Bull World Health Organ*, 86, 381-9.
- Marshall, C. & Rossman, G. (eds.) 2006. *Designing qualitative research*, London: Sage publications Ltd.
- Mcpake, B., Brikci, N., Cometto, G., Schmidt, A. & Araujo, E. 2011. Removing user fees: learning from international experience to support the process. *Health Policy Plan*, 26 Suppl 2, ii104-117.

- Ministry of Finance Planning and Economic Development 2013. Millennium Development Goals Report for Uganda 2013. Kampala.
- Ministry of Health, Health Systems 20/20 & Makerere University School of Public Health 2012. Uganda Health System Assessment 2011. Kampala.
- Ministry of Health (Moh) [Uganda] 2010. Health Sector Strategic & Investment Plan: Promoting People's Health to Enhance Socio-economic Development 2010/11 – 2014/15 In: M.O.H (ed.). Kampala.
- Ministry of Health (Moh) [Uganda] & Macro International Inc 2008. Uganda Service Provision Assessment Survey 2007. *Ministry of Health and Macro International Inc*. Kampala, Uganda.
- Moh Uganda 2009. A rapid assessment of community case management of childhood malaria, pneumonia and diarrhoea in the context of Home Based Management of Fever (HBMF) and Home Based Care (HBC) in Northern Uganda. Kampala: Ministry of Health.
- Molyneux, C. S., Mung'ala-Odera, V., Harpham, T. & Snow, R. W. 1999. Maternal responses to childhood fevers: a comparison of rural and urban residents in coastal Kenya. *Trop Med Int Health*, 4, 836-45.
- Morris, S. K. & Nguyen, C. K. 2008. A review of the cluster survey sampling method in humanitarian emergencies. *Public Health Nurs*, 25, 370-4.
- Mubi, M., Janson, A., Maganga, G., Kallander, K., Martensson, A., Massele, A., Ngasala, B., Petzold, M., Warsame, M., Tomson, G., Gustafsson, L., Premji, Z. & Bjorkman, A. 2008. Rapid malaria diagnostic tests by community health workers reduced prescription of artemisinin-based combination therapy – a randomized community-based trial in rural Tanzania. *Manuscript*.
- Muela, S. H., Mushi, A. K. & Ribera, J. M. 2000. The paradox of the cost and affordability of traditional and government health services in Tanzania. *Health Policy Plan*, 15, 296-302.
- Muela, S. H., Ribera, J. M., Mushi, A. K. & Tanner, M. 2002. Medical syncretism with reference to malaria in a Tanzanian community. *Soc Sci Med*, 55, 403-13.
- Muela, S. H., Ribera, J. M., Toomer, E. & Grietens, K. P. 2012. The PASS-model: a model for guiding health-seeking behavior and access to care research. *Malaria Reports*, 2, e3.
- Muhe, L. 1996. Mothers' perceptions of signs and symptoms of acute respiratory infections in their children and their assessment of severity in an urban community of Ethiopia. *Ann Trop Paediatr*, 16, 129-35.
- Mukanga, D., Babirye, R., Peterson, S., Pariyo, G. W., Ojiambo, G., Tibenderana, J. K., Nsubuga, P. & Kallander, K. 2011. Can lay community health workers be trained to use diagnostics to distinguish and treat malaria and pneumonia in children? Lessons from rural Uganda. *Trop Med Int Health*.
- Mukanga, D., Tiono, A. B., Anyorigiya, T., Kallander, K., Konate, A. T., Oduro, A. R., Tibenderana, J. K., Amenga-Etego, L., Sirima, S. B., Cousens, S., Barnish, G. & Pagnoni, F. 2012. Integrated community case management of fever in children under five using rapid diagnostic tests and respiratory rate counting: a multi-country cluster randomized trial. *Am J Trop Med Hyg*, 87, 21-9.

- Murray, C. J. & Frenk, J. 2000. A framework for assessing the performance of health systems. *Bull World Health Organ*, 78, 717-31.
- Mwenesi, H. A., Harpham, T., Marsh, K. & Snow, R. W. 1995. Perceptions of symptoms of severe childhood malaria among Mijikenda and Luo residents of coastal Kenya. *Journal of Biosocial Science*, 27, 235-244.
- Nabbuye-Sekandi, J., Makumbi, F. E., Kasangaki, A., Kizza, I. B., Tugumisirize, J., Nshimye, E., Mbabali, S. & Peters, D. H. 2011. Patient satisfaction with services in outpatient clinics at Mulago hospital, Uganda. *Int J Qual Health Care*, 23, 516-23.
- Nicoll, A. 2000. Integrated management of childhood illness in resource-poor countries: an initiative from the World Health Organization. *Transactions of the Royal Society of Tropical Medicine & Hygiene*, 94, 9-11.
- Nielsen, L. F. & Moldrup, C. 2007. The diffusion of innovation: factors influencing the uptake of pharmacogenetics. *Community Genet*, 10, 231-41.
- Nolan, T., Angos, P., Cunha, A. J., Muhe, L., Qazi, S., Simoes, E. A., Tamburlini, G., Weber, M. & Pierce, N. F. 2001. Quality of hospital care for seriously ill children in less-developed countries. *Lancet*, 357, 106-10.
- Nsungwa-Sabiiti, J., Burnham, G., Pariyo, G. & And the Uganda Imci Documentation Team 2004a. Implementation of a National Integrated Management of Childhood Illness (IMCI) Program in Uganda. *Journal of Health & Population in Developing Countries*, 5 November.
- Nsungwa-Sabiiti, J., Kallander, K., Nsabagasani, X., Namusisi, K., Pariyo, G., Johansson, A., Tomson, G. & Peterson, S. 2004b. Local fever illness classifications: implications for home management of malaria strategies. *Trop Med Int Health*, 9, 1191-1199.
- Nsungwa-Sabiiti, J., Peterson, S., Pariyo, G., Ogwal-Okeng, J., Petzold, M. G. & Tomson, G. 2007. Home-based management of fever and malaria treatment practices in Uganda. *Trans R Soc Trop Med Hyg*, 101, 1199-207.
- O'Brien, B. & Viramontes, J. L. 1994. Willingness to pay: a valid and reliable measure of health state preference? *Med Decis Making*, 14, 289-97.
- O'donnell, O. 2007. Access to health care in developing countries: breaking down demand side barriers. *Cad Saude Publica*, 23, 2820-34.
- O'donnell, O., Van Doorslaer, E., Wagstaff, A. & Lindelöw, M. 2008. *Analyzing health equity using household survey data: a guide to techniques and their implementation*, World Bank Publications.
- Oetting, E. R., Jumper-Thurman, P., Plested, B. & Edwards, R. W. 2001. Community readiness and health services. *Subst Use Misuse*, 36, 825-43.
- Okeke, I. N., Klugman, K. P., Bhutta, Z. A., Duse, A. G., Jenkins, P., O'Brien, T. F., Pablos-Mendez, A. & Laxminarayan, R. 2005. Antimicrobial resistance in developing countries. Part II: strategies for containment. *Lancet Infect Dis*, 5, 568-80.
- Ooms, G., Van Damme, W., Baker, B. K., Zeitz, P. & Schrecker, T. 2008. The 'diagonal' approach to Global Fund financing: a cure for the broader malaise of health systems? *Global Health*, 4, 6.
- Opondo, C., Ntoburi, S., Wagai, J., Wafula, J., Wasunna, A., Were, F., Wamae, A., Migiro, S., Irimu, G. & English, M. 2009. Are hospitals prepared to support newborn

- survival? - An evaluation of eight first-referral level hospitals in Kenya. *Trop Med Int Health*, 14, 1165-72.
- Orem, J. N. & Zikusooka, C. M. 2010. Health financing reform in Uganda: How equitable is the proposed National Health Insurance scheme? *Int J Equity Health*, 9, 23.
- Ozawa, S. & Walker, D. G. 2011. Comparison of trust in public vs private health care providers in rural Cambodia. *Health Policy Plan*, 26 Suppl 1, i20-9.
- Paina, L. & Peters, D. H. 2012. Understanding pathways for scaling up health services through the lens of complex adaptive systems. *Health Policy Plan*, 27, 365-73.
- Patel, A., Gauld, R., Norris, P. & Rades, T. 2010. "This body does not want free medicines": South African consumer perceptions of drug quality. *Health Policy Plan*, 25, 61-9.
- Patton, M. Q. 2002. *Qualitative research & evaluation methods*, Thousand Oaks, Sage Publication, Inc.
- Peabody, J., Taguiwalo, Mm., Robalino, Da., Frenk J., 2006. *Improving the Quality of Care in Developing Countries*, Washington (DC), The World Bank.
- Penchansky, R. & Thomas, J. W. 1981. The concept of access: definition and relationship to consumer satisfaction. *Med Care*, 19, 127-40.
- Perez, F., Ba, H., Dastagire, S. & Altmann, M. 2009. The role of community health workers in improving child health programmes in Mali. *BMC International Health and Human Rights*, 9, 9-28.
- Perkins, B. A., Zucker, J. R., Otieno, J., Jafari, H. S., Paxton, L., Redd, S. C., Nahlen, B. L., Schwartz, B., Oloo, A. J., Olango, C., Gove, S. & Campbell, C. C. 1997. Evaluation of an algorithm for integrated management of childhood illness in an area of Kenya with high malaria transmission. *Bull World Health Organ*, 75 Suppl 1, 33-42.
- Peterson, S., Nsungwa-Sabiiti, J., Were, W., Nsabagasani, X., Magumba, G., Namboozee, J. & Mukasa, G. 2004. Coping with paediatric referral--Ugandan parents' experience. *Lancet*, 363, 1955-6.
- Plsek, P. E. & Greenhalgh, T. 2001. Complexity science: The challenge of complexity in health care. *BMJ*, 323, 625-8.
- Plsek, P. E. & Wilson, T. 2001. Complexity, leadership, and management in healthcare organisations. *BMJ*, 323, 746-9.
- Posnett, J. & Jan, S. 1996. Indirect cost in economic evaluation: the opportunity cost of unpaid inputs. *Health Econ*, 5, 13-23.
- Rademakers, J., Delnoij, D. & De Boer, D. 2011. Structure, process or outcome: which contributes most to patients' overall assessment of healthcare quality? *BMJ Qual Saf*, 20, 326-31.
- Rahman, S. M., Ali, N. A., Jennings, L., Seraji, M. H., Mannan, I., Shah, R., Al-Mahmud, A. B., Bari, S., Hossain, D., Das, M. K., Baqui, A. H., El Arifeen, S. & Winch, P. J. 2010. Factors affecting recruitment and retention of community health workers in a newborn care intervention in Bangladesh. *Hum Resour Health*, 8, 12.
- Rattray, J. & Jones, M. C. 2007. Essential elements of questionnaire design and development. *J Clin Nurs*, 16, 234-43.

- Regidor, E. 2004. Measures of health inequalities: part 2. *J Epidemiol Community Health*, 58, 900-3.
- Republic of Uganda Moh 1999. National Health Policy. 4.2.2 ed. Uganda.
- Republic of Uganda Moh 2005. Health Sector Strategic plan 11.2005/06-2009/2010. In: UGANDA, M. O. H. (ed.). MOH.
- Requejo, J. H., Bryce, J., Barros, A. J., Berman, P., Bhutta, Z., Chopra, M., Daelmans, B., De Francisco, A., Lawn, J., Maliqi, B., Mason, E., Newby, H., Presern, C., Starrs, A. & Victora, C. G. 2014. Countdown to 2015 and beyond: fulfilling the health agenda for women and children. *Lancet*.
- Reynolds, L. & McKee, M. 2011. Serve the people or close the sale? Profit-driven overuse of injections and infusions in China's market-based healthcare system. *Int J Health Plann Manage*, 26, 449-70.
- Ribera, J. M. & Hausmann-Muela, S. 2011. The Straw That Breaks the Camel's Back Redirecting Health-Seeking Behavior Studies on Malaria and Vulnerability. *Medical Anthropology Quarterly*, 25, 103-121.
- Rodriguez, H. P., Rogers, W. H., Marshall, R. E. & Safran, D. G. 2007. The effects of primary care physician visit continuity on patients' experiences with care. *J Gen Intern Med*, 22, 787-93.
- Rogers, E. (ed.) 1995. *Diffusion of Innovations*, New York: The Free Place.
- Rogers, E. M. 2002. Diffusion of preventive innovations. *Addict Behav*, 27, 989-93.
- Rogers, E. M. 2004. A prospective and retrospective look at the diffusion model. *J Health Commun*, 9 Suppl 1, 13-9.
- Rosato, M., Laverack, G., Grabman, L. H., Tripathy, P., Nair, N., Mwansambo, C., Azad, K., Morrison, J., Bhutta, Z., Perry, H., Rifkin, S. & Costello, A. 2008. Community participation: lessons for maternal, newborn, and child health. *Lancet*, 372, 962-71.
- Rose, G., Khaw, K.-T. & Marmot, M. 2008. *Rose's Strategy of Preventive Medicine*, Oxford, Oxford University Press.
- Rosenbaum Pr, R. D. 1983. The central role of the propensity score in observational studies for causal effects. *Biometrika*, 70, 41-5.
- Rothman, K. J. 1986. *Modern epidemiology*, Diaz de Santos.
- Rowe, A. K., De Savigny, D., Lanata, C. F. & Victora, C. G. 2005. How can we achieve and maintain high-quality performance of health workers in low-resource settings? *Lancet*, 366, 1026-35.
- Ruano, A. L., Hernandez, A., Dahlblom, K., Hurtig, A. K. & Sebastian, M. S. 2012. 'It's the sense of responsibility that keeps you going': stories and experiences of participation from rural community health workers in Guatemala. *Arch Public Health*, 70, 18.
- Rudan, I., Boschi-Pinto, C., Biloglav, Z., Mulholland, K. & Campbell, H. 2008. Epidemiology and etiology of childhood pneumonia. *Bull World Health Organ*, 86, 408-416.
- Rutebemberwa, E., Kadobera, D., Katureebe, S., Kalyango, J. N., Mworozi, E. & Pariyo, G. 2012. Use of community health workers for management of malaria and pneumonia in urban and rural areas in eastern Uganda. *Am J Trop Med Hyg*, 87, 30-5.

- Rutebemberwa, E., Nsabagasani, X., Pariyo, G., Tomson, G., Peterson, S. & Kallander, K. 2009a. Use of drugs, perceived drug efficacy and preferred providers for febrile children: implications for home management of fever. *Malar J*, 8, 131.
- Rutebemberwa, E., Pariyo, G., Peterson, S., Tomson, G. & Kallander, K. 2009b. Utilization of public or private health care providers by febrile children after user fee removal in Uganda. *Malar J*, 8, 45.
- Rychetnik, L., Frommer, M., Hawe, P. & Shiell, A. 2002. Criteria for evaluating evidence on public health interventions. *J Epidemiol Community Health*, 56, 119-27.
- Sabuni, L. P. 2007. Dilemma with the local perception of causes of illnesses in central Africa: muted concept but prevalent in everyday life. *Qual Health Res*, 17, 1280-91.
- Safran, D. G., Kosinski, M., Tarlov, A. R., Rogers, W. H., Taira, D. H., Lieberman, N. & Ware, J. E. 1998. The Primary Care Assessment Survey: tests of data quality and measurement performance. *Med Care*, 36, 728-39.
- Saulo, E. C., Forsberg, B. C., Premji, Z., Montgomery, S. M. & Bjorkman, A. 2008. Willingness and ability to pay for artemisinin-based combination therapy in rural Tanzania. *Malar J*, 7, 227.
- Save the Children. 2009. The Next Revolution: Giving every child the chance to survive.
- Savigny D & Adam T (eds.) 2009. *Systems thinking for health systems strengthening. Alliance for Health Policy and Systems Research: WHO.*
- Sazawal, S. & Black, R. E. 1992. Meta-analysis of intervention trials on case-management of pneumonia in community settings. *Lancet*, 340, 528-33.
- Sazawal, S. & Black, R. E. 2003. Effect of pneumonia case management on mortality in neonates, infants, and preschool children: a meta-analysis of community-based trials. *Lancet Infect Dis*, 3, 547-556.
- Schellenberg, J. A., Victora, C. G., Mushi, A., De Savigny, D., Schellenberg, D., Mshinda, H. & Bryce, J. 2003. Inequities among the very poor: health care for children in rural southern Tanzania. *Lancet*, 361, 561-6.
- Scott, K., McMahon, S., Yumkella, F., Diaz, T. & George, A. 2014. Navigating multiple options and social relationships in plural health systems: a qualitative study exploring healthcare seeking for sick children in Sierra Leone. *Health Policy Plan*, 29, 292-301.
- Seidenberg, P. D., Hamer, D. H., Iyer, H., Pilingana, P., Siazeele, K., Hamainza, B., Macleod, W. B. & Yeboah-Antwi, K. 2012. Impact of integrated community case management on health-seeking behavior in rural Zambia. *Am J Trop Med Hyg*, 87, 105-10.
- Simba, D. O., Kakoko, D. C., Warsame, M., Premji, Z., Gomes, M. F., Tomson, G. & Johansson, E. 2010. Understanding caretakers' dilemma in deciding whether or not to adhere with referral advice after pre-referral treatment with rectal artesunate. *Malar J*, 9, 123.
- Simoës, E. A., Peterson, S., Gamatie, Y., Kisanga, F. S., Mukasa, G., Nsungwa-Sabiiti, J., Were, M. W. & Weber, M. W. 2003. Management of severely ill children at first-level health facilities in sub-Saharan Africa when referral is difficult. *Bull World Health Organ*, 81, 522-31.
- Sirima, S. B., Konate, A., Tiono, A. B., Convelbo, N., Cousens, S. & Pagnoni, F. 2003. Early treatment of childhood fevers with pre-packaged antimalarial drugs in the home reduces severe malaria morbidity in Burkina Faso. *Trop Med Int Health*, 8, 133-139.

- Smith, L. A., Bruce, J., Gueye, L., Helou, A., Diallo, R., Gueye, B., Jones, C. & Webster, J. 2010. From fever to anti-malarial: the treatment-seeking process in rural Senegal. *Malar J*, 9, 333.
- Soofi, S., Ahmed, S., Fox, M. P., Macleod, W. B., Thea, D. M., Qazi, S. A. & Bhutta, Z. A. 2012. Effectiveness of community case management of severe pneumonia with oral amoxicillin in children aged 2-59 months in Matiari district, rural Pakistan: a cluster-randomised controlled trial. *Lancet*, 379, 729-37.
- Strachan, D. L., Kallander, K., Ten Asbroek, A. H., Kirkwood, B., Meek, S. R., Benton, L., Conteh, L., Tibenderana, J. & Hill, Z. 2012. Interventions to Improve Motivation and Retention of Community Health Workers Delivering Integrated Community Case Management (iCCM): Stakeholder Perceptions and Priorities. *Am J Trop Med Hyg*, 87, 111-9.
- Sudhinaraset, M., Ingram, M., Lofthouse, H. K. & Montagu, D. 2013. What is the role of informal healthcare providers in developing countries? A systematic review. *PLoS One*, 8, e54978.
- Tanahashi, T. 1978. Health service coverage and its evaluation. *Bull World Health Organ*, 56, 295-303.
- Task Force on Health Systems Research 2004. Informed choices for attaining the Millennium Development Goals: towards an international cooperative agenda for health-systems research. *Lancet*, 364, 997-1003.
- Tawfik, Y., Nsungwa-Sabitii, J., Greer, G., Owor, J., Kesande, R. & Prysor-Jones, S. 2006. Negotiating improved case management of childhood illness with formal and informal private practitioners in Uganda. *Trop Med Int Health*, 11, 967-73.
- The Earth Institute 2011. One million health workers. *Technical task force report*. Columbia University.
- The World Bank. 2010. *Silent and Lethal: How quiet corruption undermines Africa's development efforts* [Online]. Available: http://siteresources.worldbank.org/AFRICAEXT/Resources/english_essay_adi2010.pdf [Accessed 2010].
- Theodoratou, E., Al-Jilaihawi, S., Woodward, F., Ferguson, J., Jhass, A., Balliet, M., Kolcic, I., Sadrudin, S., Duke, T., Rudan, I. & Campbell, H. 2010. The effect of case management on childhood pneumonia mortality in developing countries. *Int J Epidemiol*, 39 Suppl 1, i155-71.
- Thomson, A., Khogali, M., De Smet, M., Reid, T., Mukhtar, A., Peterson, S. & Von Schreeb, J. 2011. Low referral completion of rapid diagnostic test-negative patients in community-based treatment of malaria in Sierra Leone. *Malar J*, 10, 94.
- Travis, P., Bennett, S., Haines, A., Pang, T., Bhutta, Z., Hyder, A. A., Pielemeier, N. R., Mills, A. & Evans, T. 2004. Overcoming health-systems constraints to achieve the Millennium Development Goals. *Lancet*, 364, 900-6.
- Tudor Hart, J. 1971. THE INVERSE CARE LAW. *The Lancet*, 297, 405-412.
- Tulloch, J. 1999. Integrated approach to child health in developing countries. *Lancet*, 354 Suppl 2, SII16-20.
- Uganda Bureau of Statistics. 2010. Uganda National Household Survey. Kampala.

- Uganda Bureau of Statistics. 2011. Uganda Demographic and Health Survey 2011. Calverton, Maryland, USA: UBOS and ORC Macro.
- Uganda Bureau of Statistics. 2013. *Statistical Abstract*, Kampala, Government printers.
- UNICEF. 2012. Pneumonia and diarrhoea: tackling the deadliest diseases for the world's poorest children. New York: UN Children's Fund.
- UNICEF. 2013. Committing to Child Survival: A Promise Renewed, Progress Report 2013, UNICEF. *New York*.
- UNICEF/WHO. 2006a. Management of sick children by community health workers - Intervention models and programme examples New York/Geneva: UNICEF/WHO.
- UNICEF/WHO. 2006b. Pneumonia: The forgotten killer of children. New York/Geneva: UNICEF/WHO.
- Van Der Geest, S., Speckmann, J. D. & Streefland, P. H. 1990. Primary health care in a multi-level perspective: towards a research agenda. *Soc Sci Med*, 30, 1025-34.
- Van Olmen, J., Criel, B., Van Damme, W., Marchal, B., Van Belle, S., Van Dormael, M., Hoeree, T., Pirard, M. & Kegels, G. (eds.) 2012. *Analysing Health System Dynamics A framework*: ITGPress.
- Van Olmen, J., Van Damme, W., Marchal, B., Van Belle, S., Van Dormael, M., Hoeree, T., Pirard, M., Kegels, G. & Itgpress 2010. *Analysing Health Systems to Make Them Stronger*, ITGPress.
- Victora, C., Wagstaff, A., Schellenberg, J., Gwatkin, D., Claeson, M. & Habicht, J. P. 2003. Applying an equity lens to child health and mortality: more of the same is not enough. *Lancet*, 362, 233-41.
- Victora, C. G., Black, R. E., Boerma, J. T. & Bryce, J. 2011. Measuring impact in the Millennium Development Goal era and beyond: a new approach to large-scale effectiveness evaluations. *Lancet*, 377, 85-95.
- Victora, C. G., Fenn, B., Bryce, J. & Kirkwood, B. R. 2005. Co-coverage of preventive interventions and implications for child-survival strategies: evidence from national surveys. *Lancet*, 366, 1460-6.
- Victora, C. G., Huicho, L., Amaral, J. J., Armstrong-Schellenberg, J., Manzi, F., Mason, E. & Scherpbier, R. 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. *Bull World Health Organ*, 84, 792-801.
- Victora, C. G., Vaughan, J. P., Barros, F. C., Silva, A. C. & Tomasi, E. 2000. Explaining trends in inequities: evidence from Brazilian child health studies. *Lancet*, 356, 1093-8.
- Vyas, S. & Kumaranayake, L. 2006. Constructing socio-economic status indices: how to use principal components analysis. *Health Policy Plan*, 21, 459-68.
- Wagstaff, A. 2004. *The Millennium Development Goals for health: rising to the challenges*, World Bank Publications.
- Wagstaff, A., Claeson, M., Hecht, R., Gottret, P. & Fang, Q. 2006. Millennium Development Goals for Health: What Will It Take to Accelerate Progress? In: JAMISON DT, B. J., MEASHAM AR (ed.) *Disease Control Priorities in Developing Countries (2nd Edition)*. The World Bank.

- Wagstaff, A., Paci, P. & Van Doorslaer, E. 1991. On the measurement of inequalities in health. *Soc Sci Med*, 33, 545-57.
- Walker, C. L., Rudan, I., Liu, L., Nair, H., Theodoratou, E., Bhutta, Z. A., O'Brien, K. L., Campbell, H. & Black, R. E. 2013. Global burden of childhood pneumonia and diarrhoea. *Lancet*, 381, 1405-16.
- Wardlaw, T., You, D., Newby, H., Anthony, D. & Chopra, M. 2013. Child survival: a message of hope but a call for renewed commitment in UNICEF report. *Reprod Health*, 10, 64.
- Warsame, M., Kimbute, O., Machinda, Z., Ruddy, P., Melkisedick, M., Peto, T., Ribeiro, I., Kitua, A., Tomson, G. & Gomes, M. 2007. Recognition, perceptions and treatment practices for severe malaria in rural Tanzania: implications for accessing rectal artesunate as a pre-referral. *PLoS One*, 2, e149.
- Waters, H., Hatt, L. & Peters, D. 2003. Working with the private sector for child health. *Health Policy Plan*, 18, 127-37.
- WHO. 1991. The overlap in the clinical presentation and treatment of malaria and pneumonia in children: report of a meeting. Geneva: WHO.
- WHO. 1995. Integrated management of the sick child. *Bulletin of the World Health Organization*, 73, 735-740.
- WHO. 1997. Integrated Management of Childhood Illness: A WHO/UNICEF Initiative. *Bulletin of the World Health Organization*, 75, 5-128.
- WHO. 2000a. The Abuja declaration on Roll Back Malaria in Africa by the African heads of state and governments. Abuja: Nigeria: WHO/CDS/RBM.
- WHO. 2000b. The World Health Report. Health Systems Improving Performance. Geneva: WHO.
- WHO. 2004a. Child health in the community: "Community IMCI" reference document. Geneva: WHO.
- WHO. 2004b. Scaling up home-based management of malaria - from research to implementation. In: ECKERT, E. (ed.). Geneva: WHO.
- WHO. 2006. Integrated management of childhood illness for high HIV settings. Geneva, Switzerland.
- WHO. 2007. Everybody's Business: Strengthening Health Systems to Improve Health Outcomes: WHO's Framework for Action. Geneva.
- WHO. 2008. The World Health Report 2008: Primary Health Care – Now More Than Ever. Geneva: WHO.
- WHO. 2010. Integrated Community Case Management of Childhood Malaria, Pneumonia and Diarrhoea. In: UGANDA., M. O. H. (ed.). Kampala: WHO.
- WHO. 2013. World Malaria Report. Geneva: World Health Organization.
- WHO. 2014. *Uganda rolls out the Pneumococcal Conjugate Vaccine (PCV)* [Online]. [Accessed 2014].
- WHO & UNICEF. 2008. Integrated management of childhood illness chart booklet.

- WHO/UNICEF. 2004a. Joint Statement on the Clinical Management of Diarrhoea. Geneva - New York: WHO/UNICEF.
- WHO/UNICEF. 2004b. Joint statement: Management of pneumonia in community settings. Geneva/New York: WHO/UNICEF.
- WHO/UNICEF. 2012. Joint Statement: Integrated Community Case Management (iCCM) Geneva/Newyork: WHO/UNICEF.
- Whyte, S. R. 1992. Pharmaceuticals as folk medicine: transformations in the social relations of health care in Uganda. *Cult Med Psychiatry*, 16, 163-86.
- Winch, P. J., Gilroy, K. E., Wolfheim, C., Starbuck, E. S., Young, M. W., Walker, L. D. & Black, R. E. 2005. Intervention models for the management of children with signs of pneumonia or malaria by community health workers. *Health Policy Plan*, 20, 199-212.
- Winch, P. J., Leban, K., Casazza, L., Walker, L. D. & Percy, K. 2002. An implementation framework for household and community integrated management of childhood illness. *Health Policy & Planning*, 17, 345-353.
- Winch, P. J., Makemba, A. M., Kamazima, S. R., Lurie, M., Lwihula, G. K., Premji, Z., Minjas, J. N. & Shiff, C. J. 1996. Local terminology for febrile illnesses in Bagamoyo District, Tanzania and its impact on the design of a community-based malaria control programme. *Soc Sci Med*, 42, 1057-1067.
- Wolff, N. 2000. Using randomized controlled trials to evaluate socially complex services: problems, challenges and recommendations. *J Ment Health Policy Econ*, 3, 97-109.
- Wolff, N. 2001. Randomised trials of socially complex interventions: promise or peril? *J Health Serv Res Policy*, 6, 123-6.
- World Bank 2004. World Development Report 2004: Making services work for poor people. *Book World Development Report 2004: Making services work for poor people*.
- World Bank Group 2010. *Africa Development Indicators 2010; Silent and Lethal: How Quiet Corruption Undermines Africa's Development Efforts*, World Bank Publications.
- World Health Organization 2008. Integrated Health Services—What and Why? Technical Brief No. 1. Geneva: World Health Organization. Available online at http://www.who.int/healthsystems/technical_brief_final.pdf.
- Wyatt, H. V. 1984. The popularity of injections in the Third World: origins and consequences for poliomyelitis. *Soc Sci Med*, 19, 911-5.
- Xu, K., Evans, D. B., Kadama, P., Nabyonga, J., Ogwal, P. O., Nabukhonzo, P. & Aguilar, A. M. 2006. Understanding the impact of eliminating user fees: utilization and catastrophic health expenditures in Uganda. *Soc Sci Med*, 62, 866-76.
- Yamey, G. 2011. Scaling up global health interventions: a proposed framework for success. *PLoS Med*, 8, e1001049.
- Yeboah-Antwi, K., Pilingana, P., Macleod, W. B., Semrau, K., Siazeele, K., Kalesha, P., Hamainza, B., Seidenberg, P., Mazimba, A., Sabin, L., Kamholz, K., Thea, D. M. & Hamer, D. H. 2010. Community case management of fever due to malaria and pneumonia in children under five in Zambia: a cluster randomized controlled trial. *PLoS Med*, 7, e1000340.

- Zeitz, P. S., Harrison, L. H., Lopez, M. & Cornale, G. 1993. Community health worker competency in managing acute respiratory infections of childhood in Bolivia. *Bull Pan Am Health Organ*, 27, 109-119.
- Zhang, J. & Yu, K. F. 1998. What's the relative risk? A method of correcting the odds ratio in cohort studies of common outcomes. *JAMA*, 280, 1690-1.
- Zou, G. 2004. A modified poisson regression approach to prospective studies with binary data. *Am J Epidemiol*, 159, 702-6.