Use of oral rehydration therapy in children younger than five years of age with acute diarrhoea – Examples from Bangladesh and Uganda

Beatrice Teschner
Germany

Erasmus Mundus Scholar
European Masters in International Health (MIH)
10th September 2012 – 15th August 2013

Royal Tropical Institute
Development, Policy and Practice
Vrije Universiteit Amsterdam
Amsterdam, The Netherlands

15 August 2013

Number of words: 13,978

tropEd Network for Education in International Health Koninklijk Instituut voor de Tropen vrije Universiteit amsterdam

Use of oral rehydration therapy in children younger than five years of age with acute diarrhoea – Examples from Bangladesh and Uganda

A thesis submitted in partial fulfilment of the requirement for the degree in Master in International Health

by

Beatrice Teschner

Germany

Declaration:
Where other people's work has been used (either from a printed source, internet or any other source) this has been carefully acknowledged and referenced in accordance with departmental requirements.
The thesis 'Use of oral rehydration therapy in children younger than five years of age with acute diarrhoea – Examples from Bangladesh and Uganda' is my own work.

Signature:.....

European Master of Science in International Health (tropEd) (MIH)
10th September 2012 – 15th August 2013

KIT (Royal Tropical Institute)/ Vrije Universiteit Amsterdam
Amsterdam, The Netherlands

15 August 2013

Organised by:

KIT (Royal Tropical Institute), Development Policy & Practice
Amsterdam, The Netherlands

In co-operation with:

Vrije Universiteit Amsterdam/ Free University of Amsterdam (VU)
Amsterdam, The Netherlands

(Picture on cover page taken from UNICEF Child Mortality Report, 2012a.)

I dedicate this thesis to my niece
Elisabeth Marie Thomass

Table of contents

List of tables

List of figures

Acknowledgments

I would like to express my sincere thanks and appreciation to the troped Erasmus Mundus Consortium, especially to Denis Malvy, Deborah Didio, and Nicolas Goujon, for awarding me a scholarship to undertake a European Masters of International Health (troped) at Queen Margaret University in Edinburgh and at the Royal Tropical Institute in Amsterdam.

To my thesis supervisor and backstopper at the Royal Tropical Institute in Amsterdam for their guidance during the writing of this thesis.

To all the helpful staff at Queen Margaret University in Edinburgh, especially to my lecturers Anuj Kapilashrami, Oonagh O'Brien, Karina Kielmann, and Carola Eyber for their guidance during the programme and for their feedback on my thesis proposal.

To Arati Patel for her guidance and feedback on my thesis proposal.

To Margaret Ries and Leo Woods for all their help and advice.

To Mike Zangenberg from WHO, Geneva, and Iza Ciglenecki from MSF, Geneva, for their time, interest, and feedback on my thesis topic.

To Jonathan Latham, Karin Kalländer, Helena Hildenwall, and Sandy Cairncross for the invaluable information they contributed to my thesis topic.

To my course mates, but especially those at Queen Margaret University in Edinburgh for interacting and learning together, for their views on life, and, all in all, for making this year most joyful.

To all my friends for their support during this programme.

My very special thanks go to my family for the endless support and faith in my abilities.

I would like to acknowledge all of those people who have made this possible. Thank you so much indeed!

List of abbreviations

BDHS	Bangladesh demographic and health survey
BRAC	Bangladesh Rehabilitation Assistance Committee, formerly known as Bangladesh Rural Advancement Committee
CDD	Control of diarrhoeal disease
CHW	Community health workers
DHS	Demographic and health survey
GDP	Gross domestic product
Hib	Haemophilus influenzae type b
ICCM	Integrated community case management
ICDDR,B	International Centre for Diarrhoeal Disease Research in Bangladesh
IGME	Inter-agency group of child mortality estimation
IMCI	Integrated management of childhood illness
KAP	Knowledge, attitudes, and practice
MCE	Multi-country evaluation
MDG	Millennium Development Goal
MOH	Ministry of health
NGO	Non-governmental organisation
ORS	Oral rehydration salt
ORT	Oral rehydration therapy
SMC	Social marketing company
UDHS	Uganda demographic and health survey
UCG	Uganda clinical guidelines
UN	United Nations
UNICEF	United Nations International Children's Emergency Fund
WASH	Water, sanitation, and hygiene
WHO	World Health Organisation

Glossary

Acute watery diarrhoea: Lasts several hours or days, generally less than 14 days

Caregiver: A person, also called a caretaker, who primarily looks after a child, mainly mothers, but also relatives, siblings, and fathers

Caretaker: A person, also called a caregiver, who primarily looks after a child, mainly mothers, but also relatives, siblings, and fathers

Cholera: Very watery diarrhoea caused by the Vibrio cholerae bacteria

Dehydration: Excessive loss of water and electrolytes due to diarrhoea

Dysentery: Acute diarrhoea with bloody stool caused by the Shigella bacteria

Electrolytes: Salts, such as sodium, chloride, potassium, and bicarbonate

Incidence of diarrhoea: Episodes of diarrhoea per child-year

Infants: Children aged between one and 59 months

Malnutrition: Abnormal physiological condition caused by an inadequate, excessive, or an imbalanced intake of macro- and micronutrients

Neonates: Children aged between zero and 27 days

Oral rehydration salt: A newly formulated solution with low osmolarity; it is commercially available, ready-to-use mixture with a lower concentration of glucose and several electrolytes which is dissolved in water for use

Oral rehydration therapy: Consists of an increased intake of fluids (including oral rehydration salt), zinc administration, and continued (breast) feeding

Osmotic diarrhoea: Diarrhoea caused by the diffusion of fluids through a semi-permeable membrane, such as gut lumen as a result of a high intestine concentration of glucose or salts

Postneonatal: Children aged from 29 days to 11 months

Prevalence of diarrhoea: Percentage of children younger than five years of age with diarrhoea in the two weeks preceding the demographic and health survey

Persistent diarrhoea: Diarrhoea without blood which lasts at least 14 days or longer

Recommended homemade fluids: Non-commercially available liquids made at home, such as salted rice water, green coconut water, plain water, salted or unsalted yoghurt drink or chicken soup, sweetened or unsweetened weak tea or fresh fruit juice

Skin turgor: Also called wrinkled skin, an indicator of decreased cell fluid

Severe episode of diarrhoea: Diarrhoea with moderate to severe dehydration

Undernutrition: Result of insufficient intake and infectious diseases

Executive summary

Background: Although ORS has proven to be effective in preventing childhood deaths due to diarrhoea; in developing countries, only one-third of children younger than five years of age with diarrhoea received this treatment.

Method: This thesis is a desk study and relies solely on a review of the relevant literature available. The conceptual framework '*Use of Medicines in the Management of Childhood Illness'* was utilised.

Objectives: To explore caregivers' home-based treatment practices for children with acute diarrhoea and to explore healthcare services delivered by healthcare providers to caregivers' children with acute diarrhoea at healthcare facilities and existing guidelines and policies supporting the diarrhoeal treatment in children in Bangladesh and Uganda.

Findings: In most of the diarrhoeal cases caregivers in Bangladesh and Uganda decided that a child needed treatment and sought healthcare from a healthcare provider. Bangladeshi caregivers appear to recognise diarrhoea as watery and loose stools. Some of them may fail to observe signs of dehydration. In both countries caregivers may receive appropriate, such as oral rehydration salt and inappropriate treatment, such as antibiotics and antimotility drugs to a treat a child with diarrhoea.

Conclusion: ORS appears to be accessible, available, and affordable throughout Bangladesh. Bangladeshi caregivers seem to accept ORS as useful medicine for their children with diarrhoea.

Recommendation: Further research is needed on Bangladeshi and Ugandan caregivers' ability to recognise symptoms of diarrhoea. All caregivers should be included in research. Therapeutic interventions, such as oral rehydration therapy should be administered in the early stages of a diarrhoeal episode. Guidelines and policies need to support availability, accessibility and affordability of oral rehydration salt and zinc.

Key words: Bangladesh, children, childhood, diarrhoea, diarrhea, diarrhoeal disease, diarrhoeal episode, oral rehydration, oral rehydration therapy, ORT, oral rehydration salt, oral rehydration solution, ORS, and Uganda

Word count: 13,978

Introduction

As a pharmacist who has gained extensive knowledge and experience in the medical departments of pharmaceutical companies, hospital as well as commercial pharmacies, and on behalf of the non-governmental organisation, Pharmacists without Borders, I am passionate about improving people's health, especially in low- and middle-income countries.

My interest in the field of managing medicine for diseases has increased greatly during this year as a result of my enrolment in the Erasmus Mundus Master of Science Scholarship Programme in International Health. Some health issues, such as diarrhoeal mortality are deemed to be avoidable since cost-effective interventions are available. In order to address this, and to reduce the number of children who die from this disease, one needs to understand the broader context of what causes it. Preventative interventions, such as clean water and sanitation, need to be provided to reduce children's exposure to deadly pathogens. However, if an episode of diarrhoea does occur, therapeutic interventions, such as oral rehydration therapy (consisting of continued (breast) feeding, zinc, and increased intake of fluids including oral rehydration salt) should be administered at an early stage of the diarrhoea to avoid severe dehydration. Although oral rehydration salt has the potential to prevent most of the childhood deaths caused by dehydrating diarrhoea, its use as a therapeutic intervention to treat acute diarrhoea appears to be challenging in developing countries, where only one third of the children younger than five years of age who suffer from diarrhoea receive the recommended treatment (UNICEF, 2012b). As a pharmacist, I would argue, therefore, that oral rehydration salt can only reach its full potential as a therapeutic intervention for reducing child mortality if it is fully integrated into the healthcare system, by which I mean that oral rehydration salt is not only available, accessible, and affordable, but also accepted by caregivers and children as a treatment in the home and at healthcare facilities.

My purpose is to draw attention to existing life-saving and cost-effective therapeutic interventions, such as oral rehydration salt, which are available without a medical prescription and can be administered by caregivers in the home and by healthcare providers at healthcare facilities. The findings of this thesis will be used to advocate a higher uptake of oral rehydration salt in low- and middle-income countries especially.

In the first chapter, the thesis gives background information where and why children are dying, which preventative and therapeutic interventions are available for diarrhoeal disease and what evidence exists for an increased uptake of oral rehydration salt.

CHAPTER 1: Background information

1.1. The global burden of childhood deaths

In 2012, the United Nations International Children's Emergency Fund (UNICEF) reported that the rates in under-five child mortality had declined in all nine Millennium Development Goal (MDG) regions, decreasing from nearly 12 million in 1990 to 6.9 million in 2011 (UNICEF, 2012a). Five of these regions have reduced the number of child deaths by at least 50%; in Northern Africa, for example, the reduction was 68% and in Western Asia 52% (UNICEF, 2012a). However, Table 1 shows that, with 109 deaths per 1,000 live births, Sub-Saharan Africa continues to have the highest rate of under-five child mortality, followed by Southern Asia, with 61 deaths per 1,000 live births (UNICEF, 2012a). Appendix 1 depicts a child's risk of dying by country. These numbers need to decrease considerably in order to meet the United Nation's fourth MDG which aims to reduce the child mortality rate by two-thirds between 1990 and 2015, from 87 to 29 deaths per 1,000 live births (UNICEF, 2012a). Worldwide, as Table 1 illustrates, five countries, when taken together, account for half the number of under-five deaths. These are India, Nigeria, the Democratic Republic of the Congo, Pakistan, and China (Liu et al., 2012; UNICEF, 2012a). It might be more meaningful in order to set global priorities, however, to additionally rank countries by under-five child mortality per 1,000 live births, since some countries with small populations might dominate in numbers of child deaths related to population (Black et al., 2003). As Table 2 shows, in 2011, Sierra Leone, Somalia, Mali, the Chad, and the Democratic Republic of the Congo were the five leading countries ranked by under-five child mortality per 1,000 live births (UNICEF, 2013).

Table 1: Country ranked by total number of under-five mortality

Country ranked by total number of under-five mortality	Total number of under-five deaths (thousands) 2011	Under-five mortality rate* 1990	Under-five mortality rate* 2011	MDG for 2015
World	6,914	87	51	29
1. India	1,655	114	61	38
2. Nigeria	765	214	124	71
3. Democratic Republic of the Congo	465	181	168	61
4. Pakistan	352	122	72	41
5. China	249	49	15	16

*Deaths per 1,000 live births

(Extract from UNICEF, 2012a, pp.14-22)

Table 2: Country ranked by under-five mortality rate

Countries ranked by under-five morality rate* 2011	Total number of under-five deaths (thousands) 2011	Under-five mortality rate* 1990	Under-five mortality rate* 2011	MDG for 2015
World	6,914	87	51	29
1. Sierra Leone	42	267	185	89
2. Somalia	71	180	180	60
3. Mali	121	257	176	86
4. Chad	79	208	169	69
5. Democratic Republic of the Congo	465	181	168	61

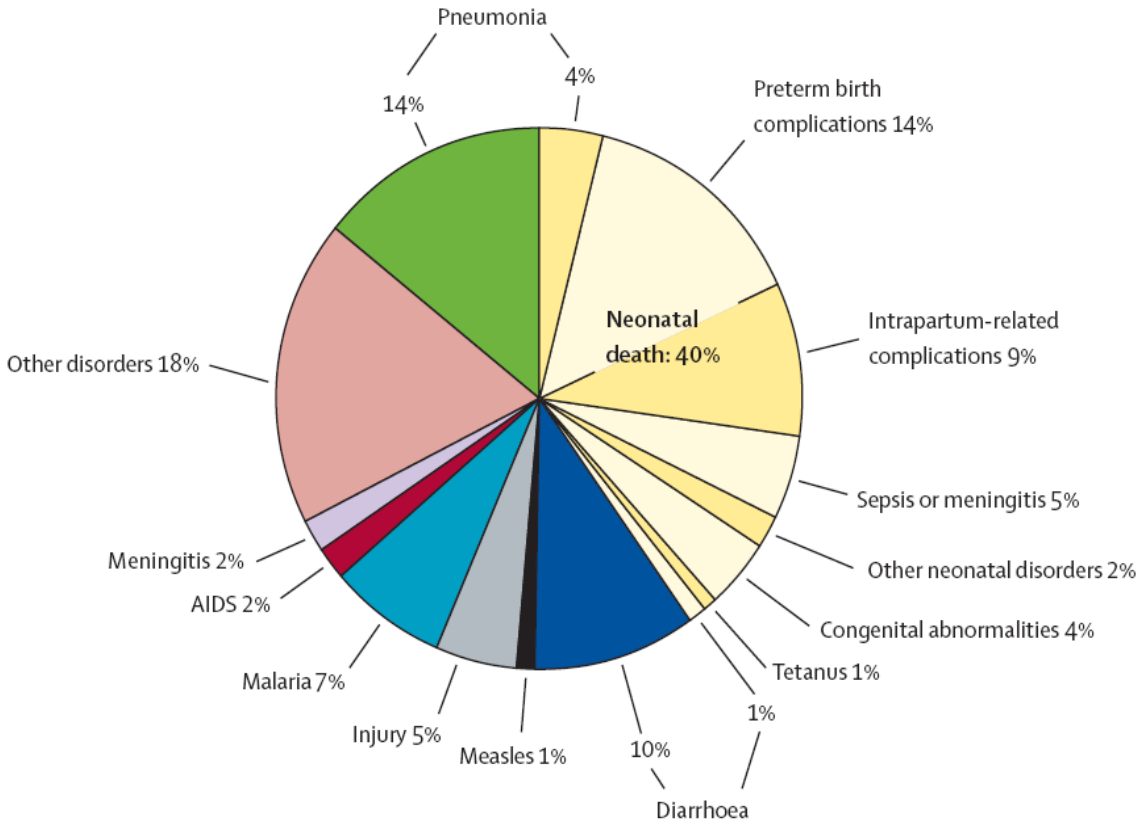
*Deaths per 1,000 live births

(Extract from UNICEF, 2012a, pp.14-22)

Of the 6.9 million annual child deaths that occurred across the world, about 40% took place in the neonatal period (children aged from zero to 27 days) due to preterm birth complications, intrapartum-related complications, and neonatal sepsis or meningitis, as Figure 1 shows (Liu et al., 2012). Almost two-thirds of the deaths in children younger than five years of age are caused by infectious diseases. The leading three diseases are pneumonia, diarrhoea, and malaria (Liu et al., 2012). Most of these diseases are preventable (Jones et al., 2003). Undernutrition has been identified as an underlying reason of childhood deaths associated with infectious diseases (Rice et al., 2000; Caulfield et al., 2004; Thapar and Sanderson, 2004). Deaths from other disorders may combine various causes, such as severe malnutrition, cancer, and prematurity complications (Liu et al., 2012).

Pneumonia and diarrhoea are the two leading causes of childhood deaths worldwide as shown in Figure 1. Similarly, these are the primary causes of child mortality in the World Health Organisation (WHO) regions of Africa (this includes both Northern and Sub-Saharan Africa), and Southeast Asia (Liu et al., 2012). This is mainly due to the higher total number of both episodes of diarrhoea and severe episodes of the diseases compared to other regions, such as Europe, where less severe episodes of diarrhoea occur (Fischer Walker et al., 2013). Diarrhoeal episodes per child-year (aged from zero to four years) vary only slightly across all regions, from 2.2 (1.3-2.5) in Western Pacific to 3.3 (2.1-5.0) in Africa. However, in the case of diarrhoea, children are more likely to die in low-income than in middle- and high-income countries, which is probably due to the severity of diarrhoeal episodes in low-income countries (Fischer Walker et al., 2013). Seventy-two per cent of the deadly episodes of diarrhoea occur in children younger than two years of age.

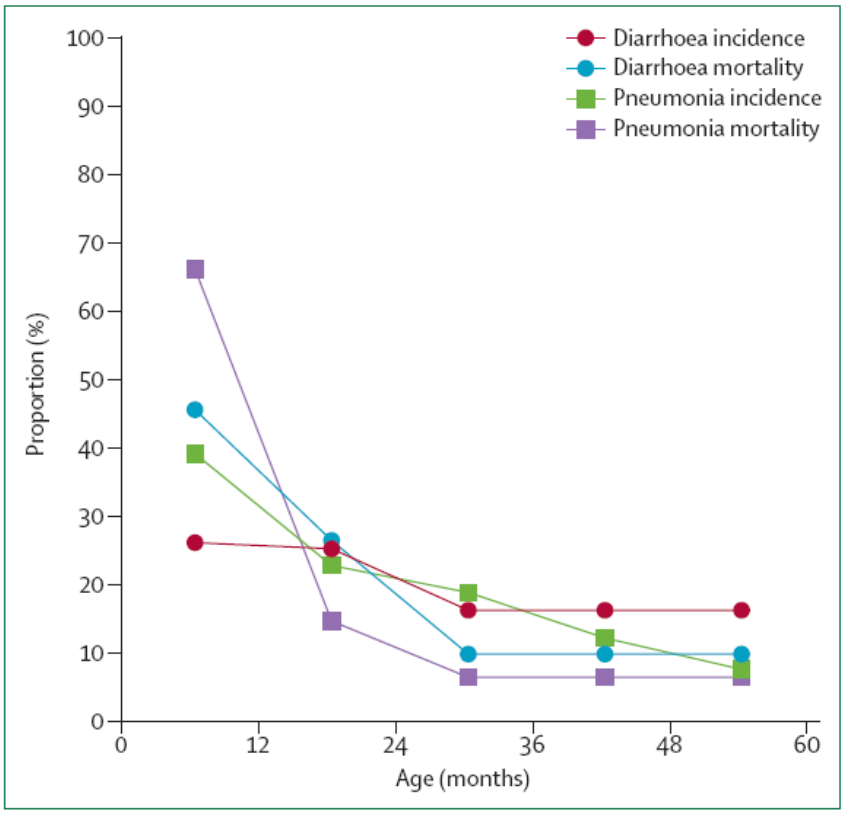
Figure 1: Global causes of childhood deaths in 2010
Causes that led to less than 1% of deaths are not shown.



(Liu et al., 2012, p.2155)

As Figure 2 shows, both the incidence of and mortality from diarrhoea decreases with a child's age. Therefore, the global burden of the disease could be characterised in terms of incidence and mortality rates with respect to geographic region, severity of episode, and per child-year. A child's sex has not been shown to be a consistent determinant for diarrhoea in the studies reviewed by Fischer Walker et al. (2013). To sum up, although children from zero to four years of age across the world experience a similar number of diarrhoeal episodes per year, the likelihood of a child suffering from a severe episode of diarrhoea and possibly dying from it is higher the lower his or her age, especially if that child lives in Africa or Southeast Asia.

Figure 2: Distribution of cases of, and deaths from, diarrhoea and pneumonia in children aged zero to four years



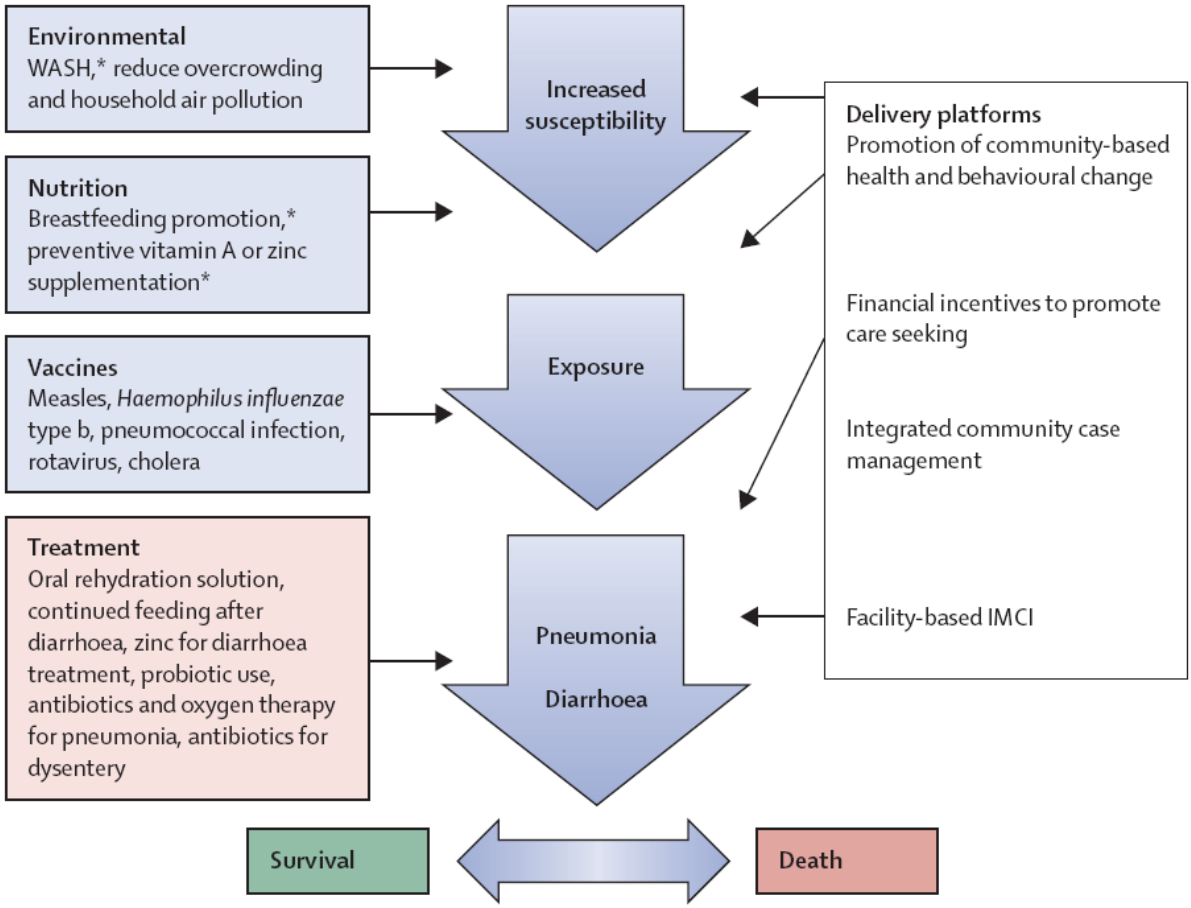
(Fischer Walker et al., 2013, p.1407)

Since differences in childhood mortality exist between regions, countries, and rural and urban areas within the same country, it appears to be important to implement preventative and therapeutic interventions on a large scale. As Figure 3 shows, community-based service delivery platforms, such as integrated community case management (ICCM) offer a means of ensuring that measures, such as delivery of oral rehydration salt (ORS) are not only available, accessible, and affordable, but also accepted by caregivers, children, and healthcare providers. In addition, it is useful to examine the causes of deaths in children younger than five years of age in terms of preventative and therapeutic interventions aimed at reducing susceptibility and exposure to microbial pathogens in order to lower child mortality stemming, for example, from dehydrating diarrhoea (Bhutta et al., 2013).

A detailed review of the preventative and therapeutic interventions used for diarrhoea is beyond the scope of this thesis and has been published elsewhere (Isanaka et al., 2012; Bhutta et al., 2013). Water, sanitation, and hygiene (WASH), (exclusive) breastfeeding practice, zinc administration, and vaccination against pathogens, such as rotavirus are all considered to be preventative interventions for diarrhoea. In the

following section, the thesis concentrates on the use of oral rehydration therapy (ORT) (consisting of increased fluids, such as ORS, continued feeding, and zinc) that are recommended if acute diarrhoea occurs in children younger than five years of age.

Figure 3: Conceptual framework of the effect of interventions for diarrhoea and pneumonia



*Interventions common in both diarrhoea and pneumonia

(Bhutta et al., 2013, p.1418)

This thesis analyses the use of ORT in children younger than five years of age with acute diarrhoea in two low-income countries within regions that demonstrate a high incidence of childhood diarrhoeal mortality. Uganda, in Sub-Saharan Africa and Bangladesh, in Southern Asia are well-performing examples of child mortality reduction. Table 3 details the child mortality rates of both countries compared to Sub-Saharan Africa and Southern Asia. From 1990 to 2011, Uganda was able to almost halve the mortality rate in children younger than five years of age, from 178 to 90

deaths per 1,000 live births, while Bangladesh's child mortality rate has declined by 67%, from 139 to 46 deaths per 1,000 live births (UNICEF, 2012c; Gill et al., 2013).

Table 3: Country and global estimates of under-five child mortality

Country and MDG regions ranked by total numbers of under-five deaths	Total number of under-five deaths (thousands) 2011	Under-five mortality rate* 1990	Under-five mortality rate* 2011	MDG for 2015
World	6,914	87	51	29
Sub-Saharan Africa	3,370	178	109	59
Uganda	131	178	90	59
Southern Asia	2,341	116	61	39
Bangladesh	134	139	46	46

*Deaths per 1,000 live births

(Extract from UNICEF, 2012a, pp.14-22)

According to the latest Demographic Health Surveys (DHS) of both countries presented in Table 4, 78% of Bangladeshi children younger than five years of age received ORS for diarrhoea as opposed to 44% of Ugandan children (UDHS, 2012; BDHS, 2013). In comparison to their MDG regions of Southern Asia (33%) and Sub-Saharan Africa (30%) both countries perform above average in terms of use of ORS in children (UNICEF, 2012b). Therefore, it seems logical to conclude that increasing the uptake of ORS may contribute beneficially to the reduction of child mortality. An analysis of the use of ORT in children younger than five years of age with acute diarrhoea in these countries may reveal important factors of success as well as issues hindering the use of ORT.

While the Ugandan government invests 9.5% of their total expenditure on health (as a percentage of the gross domestic product (GDP)), Bangladesh's government spends 3.7% on health (Worldbank, 2013). As a result, the private sector, in both countries, appears to play a dominant role since private health expenditure (mainly out-of-pocket payments) in both countries account for more than 60% opposed to less than 40% of general government expenditure (WHO, 2013a). For example, in Bangladesh the formal private sector (defined as licensed or registered) has been delivered considerable healthcare, in particular, non-governmental organisations (NGOs), such as the Bangladesh rehabilitation assistance committee (BRAC), formerly known as Bangladesh rural advancement committee. Table 4 gives background information on the healthcare situation in both countries. In Uganda, as Figure 4 illustrates, informal (defined as not-licensed or not-registered)

traditional practitioners and drugs shops appears to predominate (Konde-Lule et al., 2010; Balabanova et al., 2013).

Figure 4: Healthcare facilities by type of provider in Uganda

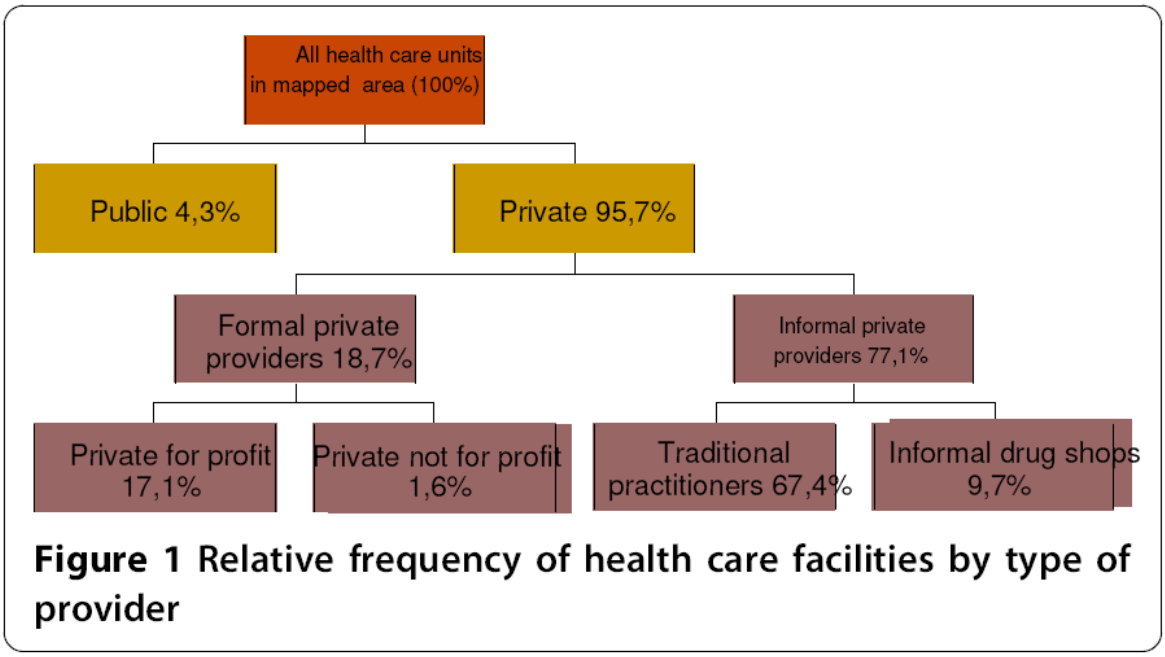


Figure 1 Relative frequency of health care facilities by type of provider

(Konde-Lule et al., 2010, p.3)

Bangladesh's climate is characterised by three main seasons, which are hot summer (from March to June), monsoon (from July to October), and dry winter (from November to February) (BDHS, 2013). Diarrhoeal prevalence varies seasonally and tends to be higher during the monsoon. When data was collected for the Demographic and Health Survey (DHS) in Bangladesh from July to December in 2011, 5% of children younger than five years of age suffered from diarrhoea in the two weeks preceding the survey, particularly children between six and 11 months (8.4%) (BDHS, 2013). Only 2% of children younger than five years of age died from diarrhoea compared to 11% worldwide (Liu et al., 2012; BDHS, 2013). As Table 4 shows, high uptake of ORT and low diarrhoeal child mortality in Bangladesh may be associated one another.

Table 4: Indicators describing Bangladesh and Uganda in 2011

Country Indicators	Bangladesh	Uganda
Human Development Index	146	161
GDP growth rate (2008-2012)	6.3%	3.4%
Healthcare System Financing		
Total expenditure on health (THE) as % of GDP	3.7%	9.5%
External resources on health as % of THE	6.6%	27%
General government expenditure on health as % of THE	36.6%	26.3%
Private expenditure on health (PvtHE) as % of THE	63.4%	73.7%
Out of pocket expenditure as % of PvtHE	96.6%	64.8%
Private security funds as % of PvtHE	0.3%	0.2%
Demographic and Health Indicators		
Total population (millions)	150,494	34,509
Total under-five population (millions)	14,427	6,643
Births (millions)	3,016	1,545
Urban population (%)	27.0	12.3 (2002 data)
Infant mortality rate (per 1,000 live births) (< 1 year)	37	58
Prevalence of diarrhoea (< 5 years)	5%	23%
Prevalence of bloody diarrhoea (< 5 years)	n.d.	4%
Prevalence of diarrhoea (6-11 months)	8.4%	43%
Diarrhoea as cause of under-five deaths	2%	n.d.
Child Immunisation (measles, DTP, Hib)	96%	>75%
Exclusive breastfeeding (<6 months)	64%	63%
Wasting prevalence (moderate and severe) (< 5 years)	16%	5%
Underweight prevalence (< 5 years)	36%	14%
Stunting prevalence (< 5 years)	41%	33%
Diarrhoeal treatment in children under five years		
Some form of oral rehydration therapy or fluids	83%	48%
Increased fluids	25%	18%
Oral rehydration salt (packets commercially available)	78%	44%
Homemade fluids	10%	12%
Continued feeding	51%	34%
Zinc	34%	2%
Other treatment, such as antibiotics	n.d.	32%
Other treatment, such as antimotility drugs	n.d.	6%
Other treatment, such as intravenous solutions	n.d.	1%

(UDHS, 2012; BDHS, 2013; Countdown to 2015, 2013; WHO, 2013a; Worldbank, 2013)

Uganda's climate varies from one rainy season in the northern region of the country to two rainy seasons per year, with heavy rains from March to May and light rains from September to December, in the Central, Eastern, and Western regions of the country (UDHS, 2011). Twenty-three per cent of children younger than five years of age, and 43% of children between six and 11 months, suffered from diarrhoea in the two weeks preceding the survey, figures appear to be higher than in Bangladesh.

Although there are lower usage rates of ORT in Uganda compared to Bangladesh, Uganda has similar child immunisation rates and even better nutritional status in children younger than five years of age. Therefore, differences in performance between both countries may exist in other interventions, such as service delivery models, for example integrated community case management (ICCM). In Bangladesh, packets of ORS, for example, are not only available at healthcare facilities, but also in drug shops, and in pharmacies, all of which are supplied by the Social Marketing Company (SMC) (BDHS, 2013).

1.2. Therapeutic interventions for acute diarrhoea

Diarrhoea is described by the WHO as "loose or watery stools, usually at least three times in a 24-hour period." (WHO, 2005a, p.4) transmitted by a faecal-oral route and mainly caused by viruses (such as rotavirus), protozoa (such as Cryptosporidium), or bacteria (such as Echerichia coli and Shigella). For a healthy child, a single episode of diarrhoea is mainly self-limiting, while five or more episodes in one year can lead to nutritional deficiencies with long-term consequences, such as stunting, particularly in children younger than two years of age (Fischer Walker et al., 2013). An excessive loss of water and salt can cause dehydration, which is often the reason for deaths (WHO, 2005a). Diarrhoea-related deaths are generally deemed to be preventable. If for example, a therapeutic intervention, such as ORS is administered at an early stage of an episode, it can avert severe dehydration and possible death (Sack, 1991; Victoria et al., 2000; Jones et al., 2003). ORS is a well-balanced mixture of glucose and several salts named electrolytes (such as sodium, chloride, potassium, and bicarbonate) which are dissolved in a watery solution. A co-transport system of glucose and sodium carries these across the epithelial layer in the small intestine (Schedl and Clifton, 1963; Schultz and Zalusky, 1964). The proportion of salt to glucose (for example, the home-made solution consists of 3g/l of table salt (one level teaspoonful) and 18g/l of common sugar) in the watery dilution is essential (WHO, 2005a). If the proportion is not correct, the ORS solution will not be fully effective. In fact, the use of such a badly balanced solution may lead to a case of osmotic diarrhoea. Appendix 2 gives background information about the ORS solution and its exact composition.

According to the current WHO treatment guidelines for healthcare workers, home-based management of childhood diarrhoea consists of the following elements. The first step is to prevent dehydration by drinking more fluids, such as ORS, salted drinks, or salted soups. Secondly, zinc should be administered every day, for 10 to 14 days. Thirdly, to prevent malnutrition, a child should continue to be (breast) feed with small amounts of food. Lastly, professional treatment should be sought if there are signs of dehydration, repeated vomiting, fever, bloody stools (dysentery), or very watery stools (indicates of cholera). Here, additional therapeutic interventions, such as antibiotics or intravenous supplementation, may be necessary.

As Table 5 shows, the WHO treatment guidelines have been based on positive evidence for the use of ORS, zinc, and feeding (Bhutta et al., 2013). Munos et al. (2010) reviewed the effect of ORS and recommended home-made fluids on diarrhoeal mortality in children younger than five years of age. They found ORS reduced the number of diarrhoea-related deaths by 69% (95% CI: 51-80%); while insufficient data were available to estimate the effect of recommended home-made fluids on child mortality.

Table 5: Interventions for the prevention and management of diarrhoea

	Evidence reviewed	Effect estimates
Preventive interventions		
Rotavirus vaccine	Existing review of six randomised trials and quasi-experimental studies[34]	Rotavirus vaccines were 74% (95% CI 35–90) effective against very severe rotavirus infection and 61% (38–75) against severe infection. Effectiveness against hospital admission for rotavirus was 47% (22–64)
Cholera vaccine	New review of 12 randomised trials and quasi-experimental studies[35]	Cholera vaccine was 52% (RR 0·48, 95% CI 0·35–0·64) effective against cholera infection. Vibriocidal antibodies increased by 124% (2·24, 1·32–3·80). Relative risk of one or more adverse events was 1·42 (1·06–1·89)
Therapeutic interventions		
ORS and recommended home fluids	Existing review of 205 studies mostly from developing countries[36]	Use of ORS reduced diarrhoea mortality by 69% (51–80) and treatment failure by 0·2% (0·1–0·2). Evidence for the benefit of recommended home fluids was insufficient
Zinc	Existing review of 13 randomised trials from developing countries[37]	Zinc administration for diarrhoea management significantly reduced all-cause mortality by 46% (RR 0·54, 95% CI 0·32–0·88) and hospital admission by 23% (0·77, 0·69–0·85). Zinc treatment resulted in a non-significant reduction in diarrhoea mortality by 66% (0·34, 0·04–1·37) and diarrhoea prevalence by 19% (0·81, 0·53–1·04) Zinc administration for diarrhoea management resulted in a 28% reduction in pneumonia-specific mortality (RR 0·72, 95% CI 0·23–2·09), a 50% reduction in hospital admissions for pneumonia (0·50, 0·18–1·39), and an observed 23% reduction in pneumonia prevalence (0·77, 0·47–1·25)
Feeding strategies and improved dietary management of diarrhoea	New review of 29 randomised trials from developing countries[38]	In acute diarrhoea, lactose-free diets significantly reduced the duration of diarrhoea compared with lactose-containing diets (SMD −0·36, 95% CI −0·62 to −0·10). Treatment failure was also significantly reduced (RR 0·53, 0·40–0·70). Weight gain did not have any significant effect (SMD 0·05, −0·22 to 0·33)
Antibiotics for treatment of shigella	New review of four randomised trials from developing countries[39]	Antibiotic treatment of shigella reduced clinical failure by 82% (RR 0·18, 0·10–0·33), whereas bacteriological failure decreased by 96% (0·04, 0·01–0·12)
Antibiotics for treatment for cholera	New review of two randomised trials[39]	Findings showed a 63% (RR 0·37, 95% CI 0·19–0·71) reduction in clinical failure and a 75% (0·25, 0·12–0·53) reduction in bacteriological failure
Antibiotics for treatment for cryptosporidiosis	New review of three randomised trials[39]	Findings showed a 52% (RR 0·48, 0·30–0·75) reduction in rates of clinical failure, a 38% (0·62, 0·46–0·83) reduction in parasitological failure, and a 76% (0·24, 0·04–1·45) non-significant reduction in all-cause mortality

RR=relative risk. ORS=oral rehydration solution. SMD=standardised mean difference.

(Bhutta et al., 2013, p.1420)

In summary, ORS is a simple and proven life-saving therapeutic intervention, available without a medical prescription, for the home-based treatment of acute diarrhoea. Administered early enough it will save children's lives (Munos et al., 2010).

Chapter 2: Problem statement, justification, objectives, and methodology

2.1. Problem statement

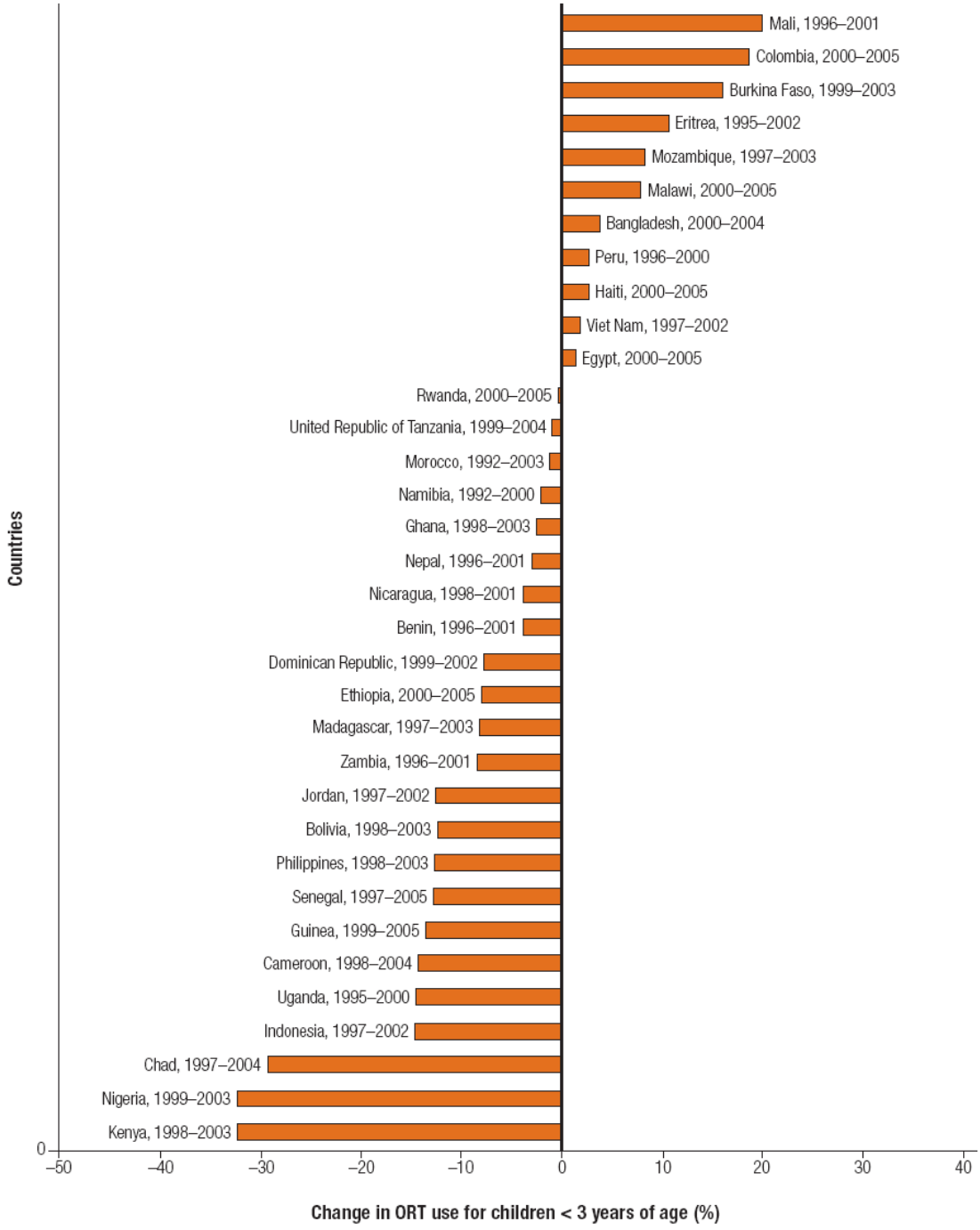
Although ORS has proven to be effective in preventing childhood deaths due to diarrhoea; in developing countries, only one-third of children younger than five years of age with diarrhoea received this treatment (Munos et al., 2010; UNICEF, 2012b). ORT shows a similar picture on a slightly higher level since increased intake of home-made fluids and continued (breast) feeding were included along with ORS. Zinc administration was not included since data collection has been limited (UNICEF, 2012b). This thesis analyses the use of oral rehydration therapy in children younger than five years of age with acute diarrhoea in order to be able to identify factors of success and issues hindering the use of ORT as well as suggest areas of investment to further reduce child mortality due to diarrhoea.

2.2. Study justification

Since 1980, controlling diarrhoea has been the focus of both national and international attention, which has resulted in several programmes for the Control of Diarrhoeal Disease (CDD) being implemented, most of which promoted ORS (Victoria et al., 2000). In the first few years of this strategy, an increased use of oral rehydration was reported in most of countries worldwide. The CDD programme was augmented and improved to become the Integrated Management of Childhood Illness (IMCI); furthermore, the definition of oral rehydration was expanded to not only include ORS, but also recommended home-made fluids and continued feeding (Victoria et al., 2000; Forsberg et al., 2007). Forsberg et al. (2007) conducted an analysis of diarrhoea case management, comparing data from several DHS from 1986 to 2003, and concluded that, despite all global efforts, progress in the use of ORS, recommended home-made fluids, or increased fluids has been slow. Worldwide, the use of ORS seems to have stagnated on average between 20% and 40% (UNICEF, 2012b). In fact, as Figure 5 shows, the rate of ORT use has declined in numerous countries, such as Uganda, and only some countries, such as Bangladesh, have been able to increase their use of ORT (Rum et al., 2008). Therefore, research investigating why ORT is not sufficiently administered in some countries compared to others where ORT is well-implemented may reveal important factors of success for the use of ORT. Munos et al. (2010) claimed that research is needed to better understand how to deliver ORS effectively in terms of promoting the use of ORS in the home and at healthcare facilities as part of an IMCI programme including diarrhoeal disease (Munos et al., 2010). Moreover, the researchers suggest that caregivers must be able to assess whether a

child is dehydrated and correctly determine whether to provide care in the home or to seek care at healthcare facilities since fluid replacement should start in the home at the onset of diarrhoea (Munos et al., 2010; UNICEF, 2012b).

Figure 5: Percent change in use of oral rehydration therapy during the two most recent Demographic and Health Surveys, 1992-2005



(Rum et al., 2008,n.p.)

In the following section, this thesis gives details about the overall objective as well as specific objectives of this research. The paragraphs of methodology include the chosen conceptual framework, its adaptation to the analysis of the thesis, the strategy for reviewing the literature, including the inclusion and exclusion criteria and the limitations of the methodology used.

2.3. Objective

Overall objective

To explore caregivers' home-based treatment practices for children with acute diarrhoea and to explore healthcare services delivered by healthcare providers to caregivers' children with acute diarrhoea at healthcare facilities and existing guidelines and policies supporting the diarrhoeal treatment in children in Bangladesh and Uganda.

Specific research objectives

- To analyse Bangladeshi and Ugandan caregiver's use of ORT for children younger than five years of age with acute diarrhoea in the home.
- To analyse Bangladeshi and Ugandan healthcare providers' prescription and recommendation practices at healthcare facilities with regard to ORT for caregivers' children younger than five years of age with acute diarrhoea.
- To describe existing guidelines and policies in Bangladesh and Uganda supporting the use of ORT for children younger than five years of age with acute diarrhoea.
- To identify factors of success and issues hindering the use of ORT for children younger than five years of age with acute diarrhoea
- To suggest areas of investment to further reduce child mortality due to diarrhoea.

2.4. Methodology

This thesis is a desk study and relies solely on a review of the relevant literature available aiming to analyse and describe defined specific objectives in order to identify factors of success and issues hindering the use of ORT, and to suggest areas of investment to further reduce child mortality due to diarrhoea.

Systematic literature review and conceptual framework

In order to explore the overall objective, this thesis tries to analyse and describe specific research objectives related to the use of ORT in children younger than five years of age with acute diarrhoea. Figure 6 illustrates the conceptual framework *'Use of Medicines in the Management of Childhood Illness',* which has been used provide systematic guidance for the literature review and analysis of relevant research results. The aim is to identify factors that promote the successful use of ORT and issues that hinder the use of ORT for childhood diarrhoea (Ross-Degnan et al., 2008).

The framework determines the structure of the thesis in terms of headings and subheadings as well as the methodology of the desk study, which is based on existing published literature. A systematic literature review has been conducted by using keywords and their combinations. These comprise: "Bangladesh", "children", "childhood", "diarrhoea", " diarrhea", "diarrhoeal disease", "diarrhoeal episode", "oral rehydration", "oral rehydration therapy", "ORT", "oral rehydration salt", "oral rehydration solution", "ORS", and "Uganda". The research results were limited to cases of acute diarrhoea in children younger than five years of age in either Bangladesh or Uganda.

The libraries of Queen Margaret University as well as those at Vrije Universiteit Amsterdam have been used to search for English reviews and articles in peer-reviewed journals in relevant databases, such as Cochrane Library, Medline and Cinahl. Furthermore, Google Scholar and organisational websites, such as those of the United Nations and the WHO, have been consulted. Researchers currently working in this area have been contacted in order to receive further relevant information. Cited publications from the reference list of highly regarded articles and book chapters have been considered in the search strategy, beginning with those published in 1963.

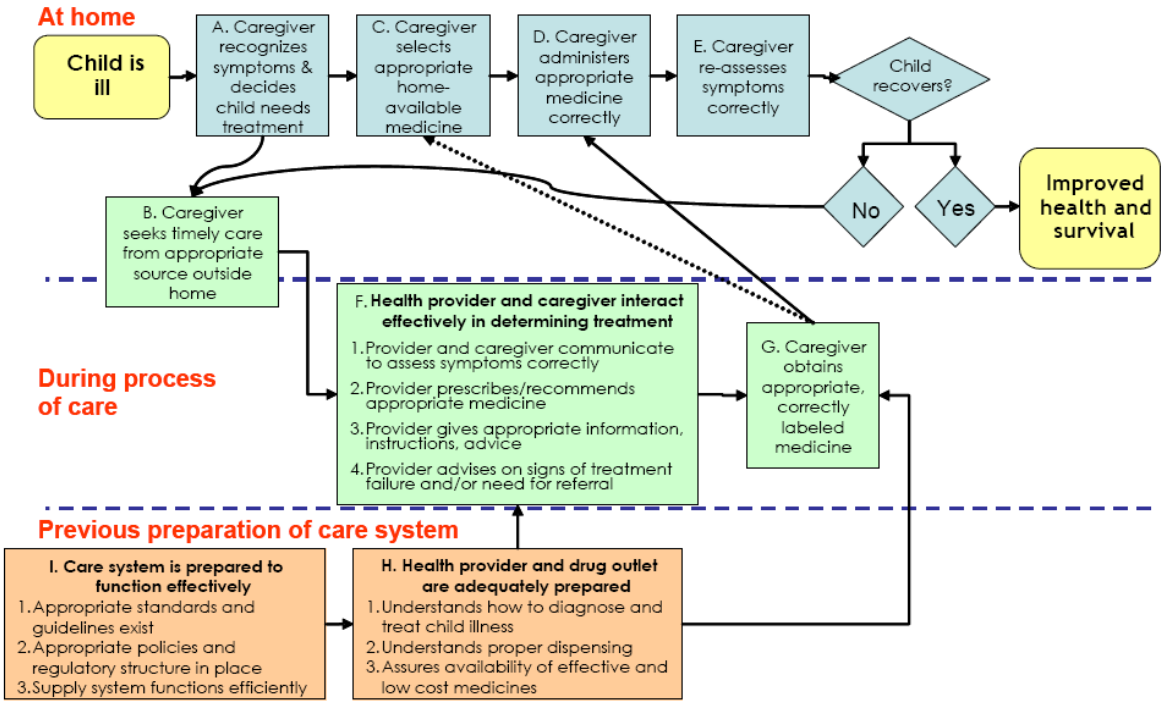
Criteria for including and excluding literature in the review

The literature review includes English reviews and articles published about Bangladesh and/or Uganda in peer-reviewed journals that discuss the use of ORT, or components of ORT, preferably in children younger than five years of age. No time limit was applied to the literature. However, in order to include the most up-to-date research findings available, recent publications were given preference included wherever possible, provided that a variety of these existed on a given research objective. The reason for this was that a caregiver's and healthcare provider's current knowledge and behaviour, as well as the respective healthcare system in which they work, may change over time.

Limitations and critiques on the conceptual framework

Since there was only limited data available on some components of the framework, this thesis elaborates solely on those questions that could be answered by published research data. The available literature may not mirror the diverse reality of caregivers and healthcare providers since qualitative and quantitative studies are often designed to elucidate different aspects of the same research question. For example, data collection using structured questionnaires jeopardise the possibility of capturing gaps in recognition and knowledge that occur in actual practice (Divon and Bergstrøm, 2012). The chosen framework limits the research to specific elements that emphasise an external look at the issue of the use of ORT in childhood diarrhoea while excluding the individual perspectives of caregivers, healthcare providers, and children. These are important because they may reveal additional reasons for the insufficient use of ORS, such as impractical package sizes or unpleasant-tasting solutions, which were reported in two Indian studies (Vashishtha, 2001; Quereshi et al., 2010).

Figure 6: Management of medicines in childhood illnesses



(Ross-Degnan et al., 2008, p.8)

Conceptual framework adapted to the context of childhood diarrhoea

Using this framework, the first part of the analysis, gives details about caregivers' ability to recognise the symptoms of diarrhoea, such as unusually loose or watery stools in a 24-hour period, bloody stools, or signs of dehydration in children. Researchers believe this to be important in terms of a caregiver's ability to make decisions about a child's treatment/Recognition of symptoms has been considered as a requirement in order to be able to decide in the next step for a child's treatment (Ross-Degnan et al., 2008). A caregiver, also called a caretaker, is defined as primarily looking after a child, mainly mothers, but also relatives, siblings, and fathers. Caregivers will be considered as able to recognise symptoms of acute diarrhoea in children, if they remember diarrhoea as unusually loose or watery stools in a 24-hour period, which would be in accordance with the WHO definition (WHO, 2005a). Furthermore, caregivers will be perceived as able to recognise symptoms of acute diarrhoea in children if they remember one or more types of the following three diarrhoeal diseases: acute watery diarrhoea (including cholera), which lasts several hours or days, but generally less than 14 days; acute bloody diarrhoea, commonly known as dysentery; or persistent diarrhoea, which lasts 14 days or longer. During diarrhoea an excessive loss of water and electrolytes (such as sodium, chloride, potassium, and bicarbonate) can cause dehydration, which is often the reason for deaths (WHO, 2005a). In addition, caregivers will be considered as able to recognise symptoms of acute diarrhoea in children if they can remember two of the following signs of dehydration: sunken eyes; pinched skin goes, that returns very slowly; not able to drink or drinking poorly eagerly or thirstily; restlessness or irritability; and lethargy or unconsciousness (WHO, 2005a).

The first part of the analysis also gives details about caregivers' ability to decide on a child's treatment by selecting any diarrhoeal treatment intervention and/or decide for seeking healthcare for a child with diarrhoea by consulting a healthcare provider. First of all, caregivers will be considered to be able to decide on a child's treatment in the case of acute diarrhoea, if this disease was the motive for any treatment intervention available in the home (such as home-made fluids and feeding) or at healthcare facilities (ORS, zinc, antibiotics). It is assumed that caregivers who decide on a diarrhoeal treatment intervention were able to recognise symptoms of acute diarrhoea and, furthermore, perceived that a child required help.

Secondly, caregiver's will be considered to be able to select an appropriate treatment, if they choose one or more of the following interventions: continued (breast) feeding, more fluids as well as any recommended medicines (such as ORS, zinc, and, in some specific cases, antibiotics). According to the WHO guidelines for health workers, suitable

fluids are defined as salted and unsalted fluids. These would include ORS, salted drinks (salted rice water or a salted yoghurt drink), vegetable or chicken soup with salt, and unsalted fluids (such as plain water, rice water, soup, yoghurt drinks, green coconut water, unsweetened weak tea, and unsweetened fresh fruit juice). In terms of antibiotics, as long as there are administered by caregivers due to bloody diarrhoea caused by bacteria it will be considered as an appropriate medicine. All other treatment options for children suffering from diarrhoea are defined as inappropriate, if used by caregivers. For example, sweetened drinks (such as commercial carbonated beverages, commercial fruit juices, and sweetened tea) may, in fact, cause osmotic diarrhoea (WHO, 2005a). Furthermore, since neither the safety nor effectiveness of many traditional methods has been proven, nor the WHO treatment guidelines recommend their use, this treatment option will be considered as inappropriate. This is the for antimotility drugs, which are not allowed to use for children with diarrhoea.

The first part of the analysis in the last section describes when, and from whom, caregivers seek help in case of a child suffering from diarrhoea. According to the current WHO treatment guidelines for healthcare workers, professional treatment should be sought if there are any signs of dehydration, repeated vomiting, fever, bloody stools (dysentery), or very watery stools (an possibly indication of cholera). A licensed or registered healthcare provider either operating in the public (governmental healthcare facilities) or formal private sector (drug shops, pharmacies, private clinics) will be considered as being able to deliver an adequate level of care since additional therapeutic interventions, such as antibiotics or intravenous supplementation, may need to be administered by skilled staff. This would include staff registered as clinical and medical officers, nurses and midwives, nursing assistants and aides. Informal private providers, such as traditional practitioners and drug shops are often un licensed and unregistered, and staff are not trained for the service they offer. Therefore, in terms of the level of training staff have received and how well equipped the facility are, the level of healthcare delivered to caregivers' children suffering from diarrhoea by these informal private providers will be considered as inadequate.

The second part of the analysis describes a healthcare provider's ability to assess the symptoms of diarrhoea, to prescribe or recommend appropriate medicine, and to give information and advice. Both types of providers, formal and informal, will be considered as able to assess symptoms of childhood diarrhoea, if they are familiar with the signs of diarrhoea set out in the IMCI standards, which derived from the WHO guidelines (WHO, 2005a; WHO, 2008). Originally developed for public governmental healthcare facilities, the IMCI is a strategy, which consists of three components: improving the case management skills of healthcare staff (such as IMCI training courses, follow-up visits, guidelines),

improving the healthcare system (such as availability of drugs and improved referral), and improving family and community practices (such as providing health education and counselling mothers about feeding children). The IMCI strategy aims to reduce mortality rates due to diarrhoea, pneumonia, malaria, measles, and malnutrition in children younger than five years of age (Tulloch, 1999). According to the IMCI standards, public healthcare providers should prescribe ORS, zinc, and antibiotics, if indicated, in the case a child is suffering from diarrhoea (WHO, 2008). Advice on extra fluid and continued feeding should be given to the caregiver. Irrespectively of the presence of diarrhoea, all children under two years of age and those with very low body weight should be checked and question should be asked about their caregiver's feeding practice, which may reveal malnutrition and therefore prevent children dying from a severe diarrhoeal episode. Furthermore, according to the IMCI standards, public healthcare providers should explain to caregivers how to administer a prescribed drug to a child. For the purpose of this thesis, it is assumed, if healthcare providers tend to give advice and information to caregivers on a regular basis, the caregiver most probably receives most probably similar advice and information in the case of childhood diarrhoea. Children should receive their first dose of treatment prescribed by a public healthcare provider at the healthcare facility. It is assumed, if medicine is available on a general basis, children would be more likely to receive ORS, zinc, and antibiotics equally in the case of a diarrhoeal episode.

The third and last section of the analysis looks at existing guidelines and policies supporting the use of ORT in children with acute diarrhoea in terms of the accessibility and availability of affordable ORS and zinc.

Chapter 3: Study results and findings

3.1. Caregivers' use of oral rehydration therapy

In the following section, the thesis analyses Bangladeshi and Ugandan caregivers' use of ORT in children with diarrhoea. Their ability to recognise symptoms of diarrhoea, to decide on a child's treatment, to select appropriate diarrhoeal treatment interventions, and/or to seek healthcare from an appropriate healthcare provider will be analysed. Table 6 details studies examining caregiver's use of oral rehydration therapy in children with diarrhoea in Bangladesh and in Uganda.

Example from Bangladesh

Available evidence suggests that Bangladeshi caregivers may be able to recognise some symptoms of a diarrhoeal episode in children. From May to June 2007, a household survey was conducted to investigate caregivers' healthcare seeking behaviour for children younger than five years of age with diarrhoea in Mirzapur, a rural area of Bangladesh (Das et al., 2013). A total of 1,128 primary caregivers were given a pre-tested and structured questionnaire asking them whether they remembered one of the children in their care suffering from diarrhoea (described as three or more abnormally loose stools within a 24-hour period), during the previous 14 days. Following on from this, caregivers who were able to remember such a diarrhoeal episode were interviewed (Das et al., 2013). According to them, 95 (7.4%) children experienced a diarrhoeal episode accompanied by one or more of the following symptoms: dry mouth (84.8%), lethargy (77.8%), eyes sunken more than usual (67.3%), excessive thirst (69.8%), and visible bloody stools (24.2%). However, the presence of wrinkled skin (an indicator of decreased skin turgor) has not been reported as mentioned by primary caregivers. Therefore, wrinkled skin appears to be less well-known as one of the signs of dehydration. In addition, some primary caregivers may not perceive a diarrhoeal episode as a disease, or have failed to observe symptoms, such as invisible or even visible blood in stool (Ferdous and Roy, 2011). According to the current DHS, diarrhoeal prevalence ranged from 5.0% to 8.4% either in children younger than five years of age or between six and 11 months, which would be inline with the diarrhoeal prevalence presented by Das et al. (2013). However, seasonal variations due to monsoon including possible flooding between June and October may influence drinking water quality and therefore diarrhoea prevalence. Therefore, Das et al. (2013) argued that data of diarrhoea prevalence may be less comparable since data collection has not been harmonised across surveys.

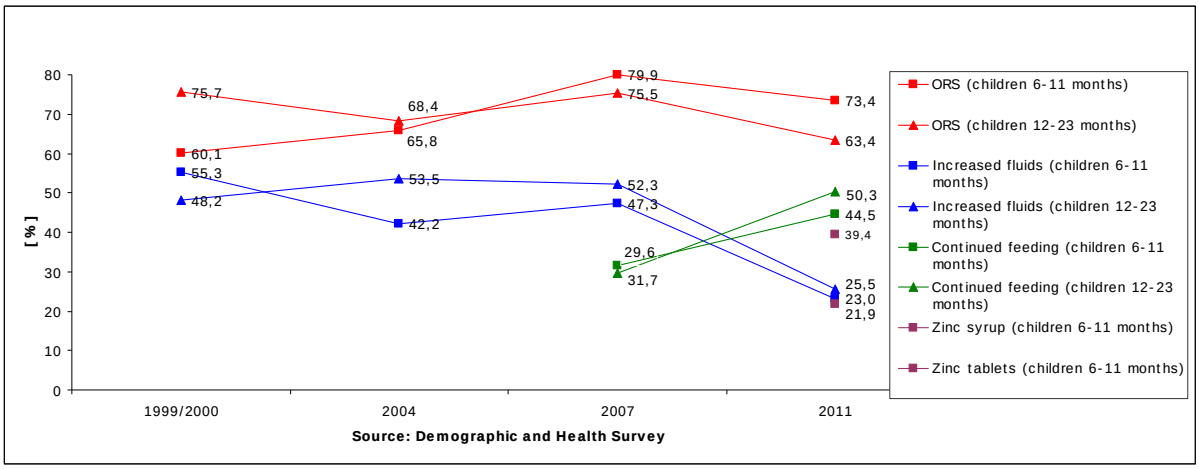
In order to reveal Bangladeshi caregivers' perception of a diarrhoeal episode and their ability to observe symptoms of diarrhoea, Ferdous and Roy (2011) conducted a qualitative study, which has been described in an abstract, using focus group discussions and in-depth interviews. Their findings revealed that only 2% of caregivers were able to distinguished diarrhoea-related signs of dehydration while all caregivers recognised loose stools as a symptom of diarrhoea (Ferdous and Roy, 2011). Therefore, apart from being able to recognise some symptoms of a diarrhoea, such as loose or watery stools in a 24-hour period or blood in stools, it is equally important that caregivers are able to correctly recognise at least two signs of dehydration (such as sunken eyes; pinched skin goes back very slowly; not being able to drink or drinking poorly, eagerly or thirstily; restlessness or irritability; and lethargy or unconsciousness) in order to correctly assess the severity of childhood diarrhoea.

These findings regarding the Bangladeshi caregivers' ability to recognise symptoms of diarrhoea have been substantiated by another household study designed to assess the knowledge, attitudes, and practices specifically related to cholera among urban families in a high cholera prevalence area of Mirpur, Dhaka, Bangladesh (Wahed et al., 2013). From December 2010 to February 2011, only 23% of the 2,830 families surveyed were able to correctly recognise cholera as acute watery diarrhoea. However, in-depth interviews revealed that 27 of 30 participants were able to list other symptoms possibly accompanying cholera, such as dehydration, loss of appetite, lethargy, unconsciousness, hypothermia, and loss of energy. Wahed et al. (2013) argue that the more common usage of the term 'diarrhoea' rather than 'cholera', e.g. in the mass media, may explain the discrepancies between the study's quantitative and qualitative results. It seems that 'cholera' is a less well-known term. Since this research did not study childhood diarrhoea specifically, limited conclusions can be drawn. Qualitative research methods, such as focus group discussions and in-depth interviews, may reveal further relevant information. For example, which symptoms of diarrhoea are more recognised than others opposed to a quantitative research using a structured questionnaire, in which caregivers have to select between given answers without any priority.

Once a caregiver has recognised diarrhoea and has decided that a child needs treatment, she or he may choose either to use treatment interventions available in the home and/or seek advice from a healthcare provider at a healthcare facility. Few Bangladeshi children aged from six to 23 months (between 8.5% and 12.9%) did not receive any treatment for diarrhoea (BDHS, 2013). In fact, in 2011, as Figure 7 illustrates, between 63.4% and 73.4% of all children aged from six to 23 months were treated with ORS. Although Bangladeshi caregivers are able to recognise only some symptoms of diarrhoea, such as loose and watery

stools or bloody stools, this appears to be sufficient, for the majority of caregivers, in order to decide on appropriate treatment (BDHS, 2013). However, the DHS does not indicate how long it takes caregivers to decide on a diarrhoeal treatment and at which point in time the caregiver's children receive the treatment interventions illustrated in Figure 7. Therefore, some children may be at risk of dying as a result of diarrhoea because caregivers may delay making a decision on appropriate treatment.

Figure 7: Oral rehydration therapy in Bangladesh



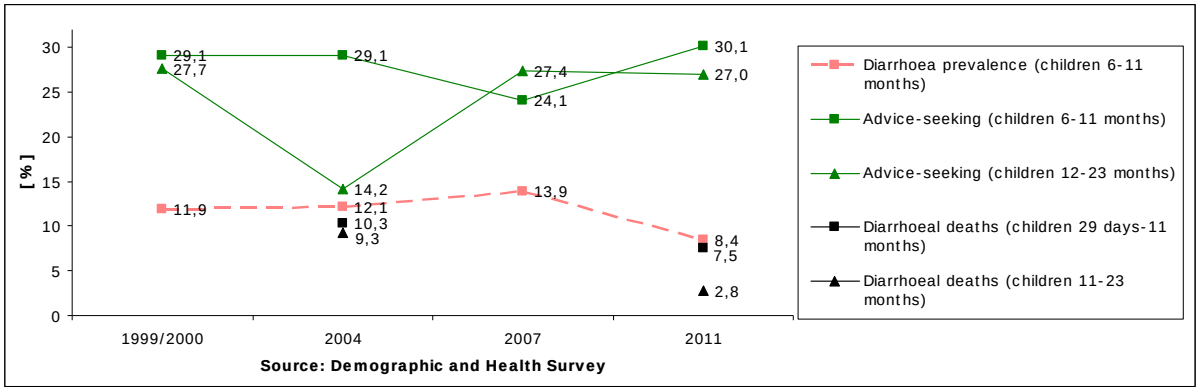
Evidence reviewed suggested that caregivers may select both appropriate and inappropriate treatment interventions for children with diarrhoea. This may be a cause of childhood mortality. Firstly, as Figure 6 shows, caregivers may not be taking advantage of all the appropriate treatment interventions in terms of ORT available in the home (BDHS, 2013). For example, less than half of the children aged between six and 23 months received the same amount of food than usual. Between 2007 and 2011, as Figure 6 illustrates, administration of more fluids decreased as a treatment from 47.3% to 23.0% of children aged from six to 11 months, and from 52.3% to 25.5% in children aged from 12 to 23 months. During the same period, zinc has been implemented by governmental leaders and accounts for treatment in one-third of children aged from six to 11 months (BDHS, 2013). In addition, two-thirds of caregivers are able to select ORS as an appropriate medicine for a child with diarrhoea in both rural and urban areas over the past two decades (BDHS, 2013).

Edgeworth and Collins (2006) presented some evidence that caregivers probably not only utilise appropriate treatment interventions but also inappropriate medicines for the purpose of self-treatment. Researchers conducted a household study in three villages in the Nilphamari district of North West Bangladesh. The objective of the study was to analyse the

socioeconomic factors that influence the adoption of self-care in the event of diarrhoea. Of the 208 individuals surveyed, 43% relied on self-care in the event of diarrhoea, while 33% accessed healthcare facilities. Self-treatment behaviour was associated with both biomedical and traditional practices, such as the use of traditional drinks (for example, a pulse- or sugar-cane juice) and medicinal plants (which are crushed into a paste and mixed with water, for example). In this research self-care in the event of diarrhoea and not childhood diarrhoea was studied. If it were, the research may have produced different results in terms of the selection of diarrhoea treatment available in the home for children younger than five years of age. However, it seems to be possible that some Bangladeshi caregivers may select those inappropriate treatment interventions for their children with diarrhoea, possibly in addition to appropriate ORT or solely.

Ferdous et al. (2013) explored the factors and barriers influencing whether caregivers of children under five with diarrhoea living in rural Bangladesh will seek help from tertiary healthcare facilities. In the period from January 2010 to December 2011, 1,919 (83%) out of 2,324 children received treatment before consulting a health professional at the Kumudini Women's Medical College and Hospital, Mizapur, Tangail. Seventy-eight per cent received ORS, 38% antibiotics, 30% zinc, and 2% herbal medication, which would be in accordance with data from the latest DHS regarding ORS and zinc treatment (BDHS, 2013). Clinical features, such as fever, vomiting, and higher stool frequency (<10 times/24 hours) influenced caregivers to decide on prior treatment before going to the hospital, while specific symptoms, such as blood in the stool, were perceived as more severe since caregivers decided that early treatment from a skilled professional in a healthcare facility was needed (Ferdous et al., 2013). Research based on a hospital setting may not capture reality since those caregivers consulted a healthcare facility who were able to recognise child's diarrhoeal symptoms and to decide a child requires further help. Also a caregiver's individual perception of illness severity and other factors, such as distance from a healthcare facility, for example are significant factors (Ferdous et al., 2013). Researchers did not collect any data on which source has been consulted previously. Das et al. (2013) showed that, although children had suffered from diarrhoea with signs of dehydration, caregivers did not consult a licensed provider. In addition, as Figure 8 illustrates, in 2011, only one-third of caregivers sought advice for their children from a healthcare facility or provider (BDHS, 2013). However, since data from the DHS excludes pharmacies, drug shops, and traditional practitioners; caregivers may prefer to consult some of those healthcare providers.

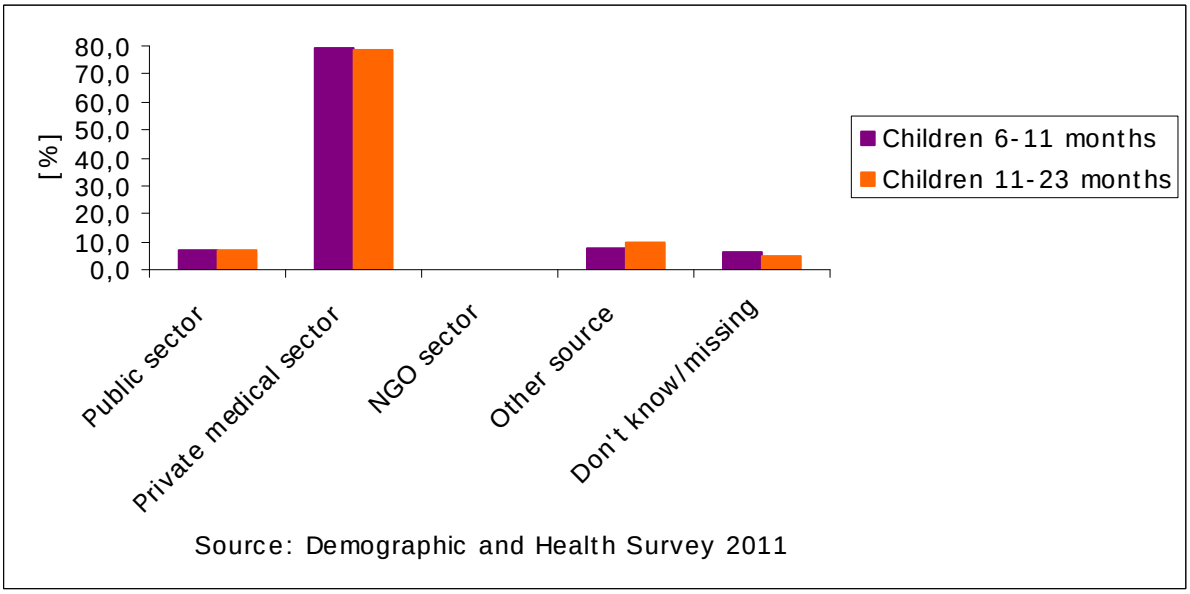
Figure 8: Seeking advice or treatment for diarrhoea from a healthcare facility or provider[1] in Bangladesh



[1]Excludes pharmacies, drug shops, and traditional practitioners according to the DHS

Figure 9 supports the fact that private providers were consulted, since almost 80% of caregivers received ORS treatment for children aged six to 23 months from the private medical sector. Therefore, the evidence reviewed suggests that Bangladeshi caregivers may seek help from appropriately licensed public healthcare providers, amongst others. This will usually not occur, however, before treatment interventions available in the home and outside the home from formal or informal private sources have been utilised (Larson et al., 2006).

Figure 9: Source of ORS treatment in Bangladesh

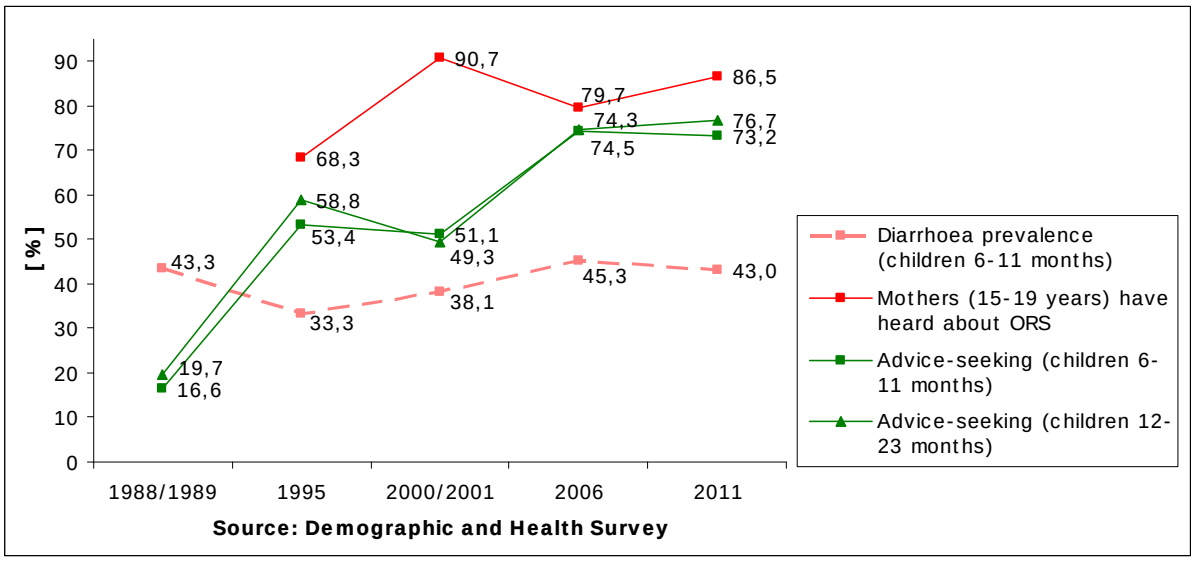


Example from Uganda

Mbonye (2003) gives some hints that Ugandan mothers may be able to recognise some symptoms of a diarrhoeal episode in children. The researcher conducted a study to assess women's healthcare-seeking practices for their children under two years of age with fever, diarrhoea, or upper respiratory tract infections in Sembabule, a rural district of Central Uganda. Data were obtained from 300 women with 323 children by using a structured questionnaire supplemented by in-depth interviews. Women reported that 40.3% of children had experienced a diarrhoeal episode, defined as watery stools occurring at least three times a day, in the 14 days preceding the survey. As Figure 10 shows, identified diarrhoeal prevalence in children younger than two years of age may reflect the trend given by the data from the DHS in 2001, which reports diarrhoea from 17.8% to 38.1% in the children younger than 23 months. Specific symptoms, such as dry mouth, sunken eyes, decreased urine output, prolonged diarrhoea, vomiting, and weakness, prompted between 64.5% and 86.8% of the mothers to seek healthcare immediately. However, since this study was based on recall, similar concerns as those described above are probably applicable. For example, Mbonye (2003) revealed that, although 33.1% of mothers sought care for a child with diarrhoea, relatives (27.6%), older children (20.4%), or fathers (17.3%) also took responsibility for a sick child, all of which indicates that may more than one person may be the caregiver. Therefore, some children may have been erroneously excluded from the study because their mothers have not been present to observe the diarrhoeal symptoms in the 14 days preceding the survey. This may have influenced the results. Very limited and out-dated evidence does not allow conclusion to drawn about caregivers' current ability to recognise symptoms of diarrhoea and differentiate between them in order to recognise signs of dehydration as a symptom of diarrhoea.

It appears that only 12% of the Ugandan children aged from six to 23 months did not receive any treatment for diarrhoea (UDHS, 2012). This may indicate that some of the interviewed caregiver's may able to recognise diarrhoea and decide that a child needs treatment. As Figure 9 illustrates, 52.8% of children between 12 and 23 months with diarrhoea received ORS. However, the use of ORS for children between six and 11 months decreased, from 46.5% in 2006 to 41% in 2011. Data from the DHS (2007; 2012) reported that about 30% of all children were treated with antibiotic drugs, which may provide further evidence of a caregiver's ability to take a treatment decision, this, however, may also indicate an inappropriate treatment decision since the prevalence of bloody diarrhoea only accounts for 4% of the children younger than five years of age. Therefore, selected treatment interventions may not always be appropriate for children younger than five years of age.

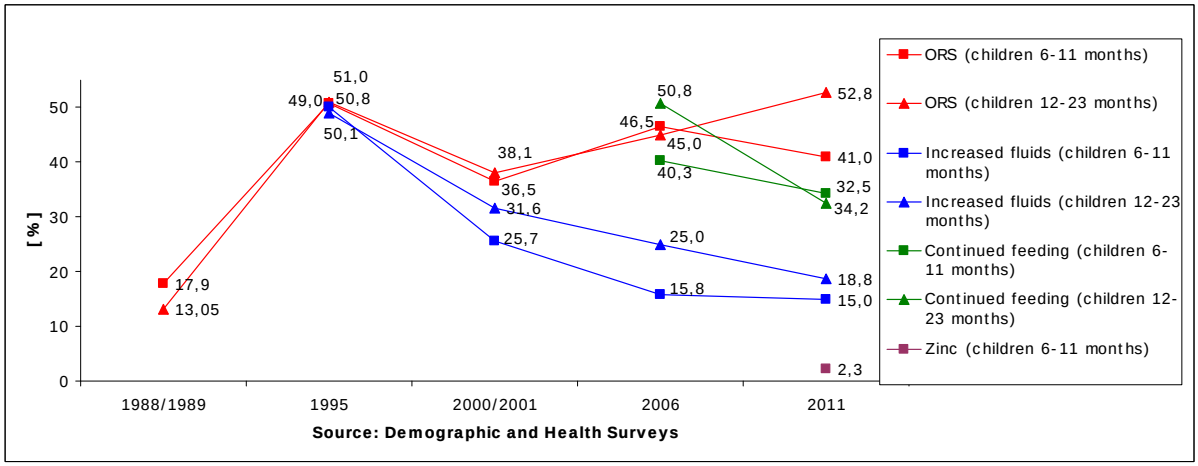
Figure 10: Seeking advice or treatment for diarrhoea from a healthcare facility or provider[1] in Uganda



[1]Excludes pharmacies, shops, and traditional practitioners

As Figure 11 shows, children may not be benefitting from all appropriate treatment interventions available in the home (UDHS, 2012). For example, the administration of more fluids has been decreasing steadily since 1995, from half to less than one-fifth of children between six and 23 months of age. A similar trend can be seen with continued feeding, which has decreased from half to one-third of the children, while zinc administration has not yet been implemented by governmental leaders on a large scale. Overall, ORS uptake has increased over the past two decades in both rural and urban areas.

Figure 11: Oral rehydration therapy in Uganda



Therefore, very limited evidence suggests that some caregivers may able to decide whether a child needs treatment for diarrhoea by selecting some appropriate treatment interventions, such as ORS; that few decide on intervention, such as increased fluids and continued feeding; and that some caregivers select inappropriate treatment interventions, such as antibiotics, either as the sole treatment or as an additional treatment.

The evidence reviewed suggests that Ugandan caregivers tend to treat children with diarrhoea in the home, and may seek healthcare from a healthcare provider when the child developed life-threatening symptoms. For example, in 2001, most children suffering from diarrhoea were initially treated in the home (Mbonye, 2003). When they developed life-threatening symptoms, such as dry mouth, sunken eyes, decreased urine output, prolonged diarrhoea, vomiting, or weakness, they were taken to healthcare facilities. A possible reason may be that 32.8% of Ugandan women perceived diarrhoea as being a less serious health problem than malaria (82.7%) or respiratory diseases (38.1%). Subsequently, only one third (31.3%) of women sought care for diarrhoea (Mbonye, 2003), which was less than recorded in the DHS in 2001. As Figure 11 shows, UDHS (2001) reported that about half of the caregivers sought advice or treatment for diarrhoea from a healthcare provider. However, since 2006 however, this figure has increased significantly, with caregivers seeking help for more than 70% of children between six and 23 months with diarrhoea (UDHS 2007; 2012). This figure becomes even more significant in light of the fact that UDHS excluded healthcare providers as pharmacies, drug shops, and traditional practitioners from its survey, some of which may have been consulted by caregivers in addition to or in lieu of those surveyed healthcare providers. For example, in 2001, the study conducted by Mbonye (2003) reported that while 49.5% of children were treated by public healthcare facilities, healthcare was sought at private clinics for 31.7% of children. Furthermore, mothers consulted drug shops (15.8%), relatives (14%), or traditional practitioners (11.9%). Divon and Bergstrøm (2012) interviewed households in Ruhirra, Uganda, in an effort to primarily identify unintended consequences of development interventions, such as an increased risk for diarrhoea. Irrespective of their findings, which are beyond the purpose of this thesis, the study recorded the parallel practice of using traditional medicine, such as herbal remedies in the home and seeking help from healthcare centres.

Table 6: Studies examining caregiver's use of oral rehydration therapy in children with diarrhoea in Bangladesh and in Uganda

Author	Year	Sample	Study Design	Relevant Study Results
Das et al.	2013	N=1,128 caregivers with children 0-59 months of age in Mirzapur, rural Bangladesh	From May to June 2007, household survey based on caregivers' recall of a child's diarrhoeal episode and using a structured questionnaire	• 7.4% (95) of children suffered from diarrhoea • Caregivers recognised symptoms, such as 84.8% recognised dry mouth, 67.3% sunken eyes, 69.8% excessive thirst, 24.2% blood in the stool • Children received: 12.2% ORS, 27.6% recommended home-made fluids, but none of them received zinc • 87.9% of caregivers sought care outside the home: 49.9% from a pharmacy, 22.1% from a hospital or healthcare centre
Divon and Bergstrøm	2012	Five schools, four healthcare centres, nine water sources, four markets, and 25 households with children under five with cases of diarrhoea in Ruhirra, Uganda	Household study, cross-sectional analysis using qualitative methods such as interviews, observations, and focus group discussions with randomly selected locations and purposively selected samples of households	• Household used traditional medicine and sought help from healthcare centres
Edgeworth and Collins	2006	N=208 individuals (93 males and 115 females) living in three villages in the Nilpharmari district, North West Bangladesh	Household study based on caregivers' recall of a diarrhoeal episode and using a questionnaire, 20 semi-structured interviews, and 10 focus group discussions	• 43% of individuals used self-care in the event of diarrhoea • 33% of individuals accessed healthcare facilities
Ferdous et al.	2013	N=2,324 children under five attending a hospital, in Mirzapur, Tangail, Bangladesh	From January 2010 to December 2011, hospital-based prospective study	• 83% (1,919) of children received treatment in the home before consulting the hospital • Children received: 78% ORS, 38% antimicrobials, 30% zinc, and 2% herbal medication • Caregivers recognised symptoms, such as higher stool frequency, vomiting, and blood in stool
Larson et al.	2006	N=7,308 children with prevalent diarrhoea in rural and urban Bangladesh	From November 2003 to June 2004, cross-sectional, cluster-sample survey based on interviews of randomly selected primary caregivers	• Care-seeking in 61% of the cases (90% private sector) • Disparities favouring males and higher income households • Higher income household associated with care-seeking from any provider, ORS and antibiotic treatment • Females in rural households received less antibiotics

Continuing Table 6: Studies examining caregiver's use of oral rehydration therapy in children with diarrhoea in Bangladesh and in Uganda

Author	Year	Sample	Study Design	Relevant Study Results
Mbonye	2003	N=300 women with 323 children under two years with fever, diarrhoea, or upper respiratory tract infections in Sembabule, rural Uganda	Structured questionnaire and in-depth interviews	• 40.3% of children suffered from diarrhoea • Caregivers recognised symptoms, such as dry mouth, sunken eyes, and vomiting • 64.5% to 86.8% of caregivers sought care
Wahed et al.	2013	N=2,830 in Mirpur, Dhaka, urban Bangladesh	From December 2010 to February, 2011, cross-sectional study, household survey using quantitative and qualitative data-collection methods related to cholera	• 23% of families recognised symptoms of cholera as acute watery diarrhoea • 27 to 30 interviewees able to list further symptoms, such as dehydration, loss of appetite, and loss of energy

3.2. Healthcare provider's prescribing and recommendation practices

In the following section, this thesis analyses Bangladeshi and Ugandan healthcare providers' prescription and recommendation practices concerning ORT for children with diarrhoea. Their ability to assess symptoms of diarrhoea, prescribe or recommend appropriate diarrhoeal treatment interventions, and give advice and information to caregivers will be analysed. This will all be reviewed in accordance with the IMCI standards or the WHO guidelines. Table 7 details studies reporting on healthcare providers' prescribing and recommendation practices at healthcare facilities in Bangladesh and Uganda.

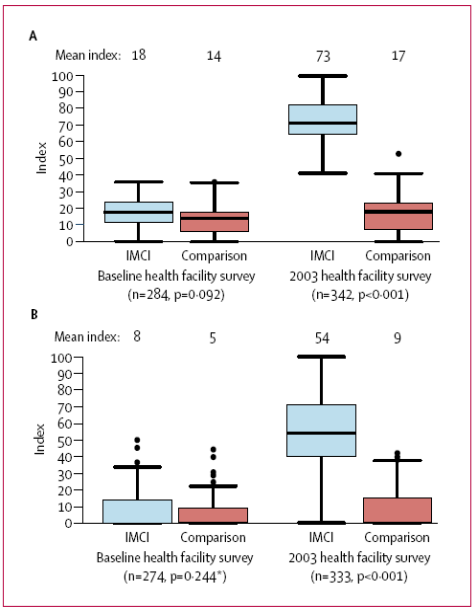
Example from Bangladesh

The available evidence reviewed suggests that the majority of public healthcare providers trained in the IMCI strategy appear to be more capable of conducting a comprehensive assessment of a sick child, while other, not IMCI-trained healthcare providers may be less focused on diarrhoea-related issues. In 2009, the WHO's Department of Maternal, Newborn, Child and Adolescent health (MCA) conducted the Multi-Country Evaluation (MCE) to determine the effectiveness, cost and impact of IMCI. The study aimed to provide insights into the quality of care delivered to sick children younger than five years of age when visiting first-level government healthcare facilities, either one of 10 IMCI facilities or one of 10 not IMCI-trained facilities in Bangladesh (Arifeen et al., 2009). A total study population of 350,000 individuals were researched. Within three years, as Figure 12 shows, general improvements in the quality of care were reported, and these continued over time, as evidenced in the final evaluation when these improvements were measured against IMCI standards used at IMCI facilities versus not IMCI-facilities (Arifeen et al., 2004). In order to document changes in the assessment, classification, and treatment of a sick child, and to document the advice counselling given to the person who accompanied the sick child on the day of the visit (assumed to be the caregiver of the child), investigators observed the healthcare provider's management of a sick child, then reassessed sick children and interviewed caregivers at both types of healthcare facilities (Arifeen et al., 2009).

When they were collected together in 2005, the study results of the IMCI-evaluation indicated that public healthcare providers at IMCI healthcare facilities who received all three components of the IMCI strategy, such as IMCI training courses, performed better overall, on average, than their colleagues at public healthcare facilities without IMCI training (Arifeen et al., 2009). In terms of assessing a sick child, for example, healthcare providers at IMCI facilities checked 94.6% of the children younger than

five years of age for the three danger signs (inability to drink or breastfeed, vomiting, convulsions). Healthcare worker at facilities without IMCI training, on the other hand, examined none of the children for these signs (Arifeen et al., 2009). One out of the three danger signs namely, inability to drink and breastfeed would indicate dehydration. However, other signs of dehydration, such as sunken eyes, pinched skin, restlessness or irritability, and lethargy or unconsciousness would be equally useful to check for since some children may suffer from dehydration without presenting IMCI-defined symptoms. Furthermore, 82.9% of the children at IMCI facilities were checked for the presence of cough, diarrhoea, or fever whereas only 4.4% were at not IMCI-trained healthcare facilities. Aggregated data collection about diarrhoea together with cough and fever does not give in-depth information about how individual healthcare providers assessed the several possible symptoms of diarrhoea. Therefore, some diarrhoeal episodes may have been overlooked. Only fifty per cent of IMCI healthcare providers assessed other indicators, such as feeding practice, for children younger than two years of age and for those with very low body weight, versus none of their counterparts at other not IMCI-trained healthcare facilities (Arifeen et al., 2009).

Figure 12: Index of correct assessment (A) and of correct treatment and counselling assessment (B) in 10 IMCI (only nine at baseline) and 10 comparison healthcare facilities in Bangladesh



p values based on *t* test.*p=0.217 using Mann-Whitney test since distribution is skewed.

(Arifeen et al., 2004, p.1599)

Evidence from the IMCI evaluation revealed that public healthcare providers at IMCI facilities who had received IMCI training courses generally treated children more appropriately than their colleagues at not IMCI-trained healthcare facilities (Arifeen et al., 2009). For example, two-thirds of healthcare providers at IMCI facilities correctly prescribed an oral antibiotic for children versus 2.4% at healthcare facilities without IMCI training. However, since specific data on bloody diarrhoea were not published, limited conclusions can be drawn in terms of healthcare providers' ability to prescribe a correct treatment for dysentery. At IMCI healthcare facilities in 2006 and 2007, 48% of 125 children suffering from diarrhoea within the 14 days preceding the survey received ORS as opposed to 30% of 108 children at not IMCI-trained healthcare facilities. This appears much less than household surveys have reported, where 78% of caregivers described treating their children with ORS (BDHS, 2013). In terms of rehydration, 28.7% of the children were treated correctly, compared to none of the children at healthcare facilities without IMCI training (Arifeen et al., 2009).

In 2005, Arifeen et al. (2009) evaluated the IMCI impact on healthcare providers' ability to give appropriate information and advice to caregivers at both IMCI and not IMCI healthcare facilities. Overall, IMCI-trained providers performed better than their counterparts who were not IMCI-trained. For example, 78.3% of caregivers knew how to administer ORS or an oral antibiotic prescribed by providers working at IMCI healthcare facilities versus 13.6% of caregivers attended by colleagues at the not IMCI healthcare facilities. However, aggregated data of ORS and oral antibiotics may jeopardise gaps in caregivers' knowledge about one of the medicines since the proportion of ORS to antibiotic would be useful to know. Healthcare providers appear to be able to advise a sick child's caregiver on extra fluid and continued feeding (67.2% of the IMCI-trained healthcare providers versus none of the providers at not IMCI-trained facilities). Reviewed evidence suggests that IMCI training generally appears to have a positive impact on the quality of care delivered at first-level governmental healthcare facilities.

Example from Uganda

Available evidence reviewed suggests that public healthcare providers may be able to assess more symptoms of diarrhoea, such as loose and frequent stools and signs of dehydration. Löfgren et al. (2012) conducted a study aiming to investigate the knowledge and practices of diarrhoea case management among public and private healthcare providers working at 31 healthcare centres (21 of which were run by the government and 12 by non-governmental organisations (NGOs)) and in 46 drug shops in Namutumba district, a rural district of Uganda. Researchers used a semi-structured questionnaire to ask healthcare providers to elucidate the symptoms and danger signs of childhood diarrhoea. Overall, providers at health centres (65% of whom were nursing assistants, 26% nurses/midwives, and 15% clinical officers) appeared to be more familiar with diarrhoea. For example, in terms of the symptoms and danger signs of diarrhoea, all of the participating clinical officers and nurses and 75% of the nursing assistants mentioned dehydration symptoms (sunken eyes, decreased skin turgor, and thirst) compared to only 30% of their colleagues working in drug shops (83% of whom were nursing assistants and 15% nurses and midwives) (Löfgren et al., 2012). However, no statistically significant differences in knowledge about gastrointestinal symptoms (such as vomiting, loose and frequent stools) and general conditions (such as loss of appetite and weakness) were found between providers working at health centres and drug shops. Bloody stools have not been included as a symptom of dysentery. That would have been important to know in order to assess if public and private healthcare providers are able to differentiate between diarrhoea and dysentery since caregivers receive antibiotics to treat a child's diarrhoea in both sectors.

Evidence suggests that, in terms of managing childhood diarrhoea, both public and private healthcare providers' knowledge and prescribing practices vary. In 2011, for example, a survey involving 163 exit interviews with workers at 40 licensed drug shops was conducted to determine the appropriateness of the treatment provided in Kaliro and Kamuli, two rural districts in eastern Uganda (Awor et al., 2012). From the 34.4% of the 163 children suffering from diarrhoea, 14.3% received ORS and none of them received zinc. According to the data delivered by the DHS, this study may underreport the use of ORS since no additional information was given on the general availability of ORS and zinc in the surveyed areas. This fact is supported by Löfgren et al. (2010), who revealed that 87% of providers at healthcare centres and 67% of providers at drug shops mentioned ORS as the primary treatment for children with diarrhoea, and more than half of the providers at both types of facilities had heard about zinc. None, however, mentioned zinc as a recommended treatment (Löfgren et al., 2012). However, another possible explanation would be that mothers may not authorise to seek help for their children and to spend money for healthcare. According to

Awor et al. (2012), although half of the mothers made the decision to seek help for a child, 73.1% of fathers or husbands authorised expenditure for the treatment. Presumably, caregivers may be able to recognise symptoms and decide for treatment, fathers or husbands could still deny healthcare expenditure for a child. However, on the other hand, discrepancies between knowledge about possible treatment and actual practice may be a possible explanation as well. Nine per cent of the staff in drug shops referred to antimotility drugs as a treatment option for children with diarrhoea compared to none of the staff at healthcare facilities (Löfgren et al., 2012). In 2011, the UDHS confirmed these study findings by showing that about 8% of children younger than five years of age were treated with antimotility drugs for a diarrhoeal episode by caregivers. In terms of the practice of prescribing antibiotics for childhood diarrhoea, 87% of staff working in drug shops recommended antibiotic drugs as compared to 81% of staff at healthcare centres (Löfgren et al., 2012). This appears too much considering that bloody diarrhoea accounts for 4% of cases recorded. Even healthcare workers trained in the IMCI strategy about the use of antibiotics for children with diarrhoea younger than five years of age performed inadequately in this area (Gouws et al., 2004). For example, in 2000, as part of a study focussing on 80 first-level healthcare facilities in 10 districts in Uganda, researchers recorded and evaluated the treatment healthcare providers delivered to 516 sick children. Findings showed that, although IMCI training was provided, only 41% of the healthcare workers prescribed an antibiotic correctly for a child in need compared to 25% of those who did not receive this training. However, IMCI data does not specifically report on childhood dysentery treatment. In 2011, UDHS reported between 26.5% and 38.8% of children younger than five years of age with diarrhoea received an antibiotic drug: once again, with a prevalence of bloody diarrhoea of 4% it appears that antibiotics were overused. Therefore, reviewed evidence suggests that the majority of Ugandan healthcare providers, regardless of whether they are working in the public or private sector, may prescribe inappropriate medicine, such as antibiotics and antimotility drugs and may recommend appropriate medicine, such as ORS and zinc insufficiently.

The reviewed evidence indicates that few Ugandan healthcare providers, irrespective of whether they are working in the public or private sector, are able to give appropriate information and advice. In 2000, an IMCI-study was carried out to assess public healthcare providers' ability to give appropriate information and advice to caregivers at 19 healthcare facilities in Mukono district, Uganda (Karamagi et al., 2004). By observing 161 counselling sessions involving 37 IMCI-trained providers (15 of whom were clinical officers, 14 enrolled nurses and midwives, five nurse's aides, and three registered nurses and midwives), researchers noted that between 95% and 100% of them were generally described by researchers as being interested in caregivers, that they were able to listen actively,

and that they used a kind tone of voice and simple language. In terms of diarrhoea management, 65% of caregivers were generally asked about feeding and of these, 76% received advice on this matter from healthcare providers. On the other hand, only half of the healthcare providers explained the feeding problem to detail to the caregivers. In addition, 44% of caregivers received advice on fluid intake and in 39% on medication during the counselling sessions (Karamagi et al., 2004). Gouws et al. (2004) provided evidence that roughly the same percentage of IMCI-trained healthcare providers (31%) advise caregivers on how to administer a prescribed antibiotic for a child as their colleagues that were not IMCI-trained (29%). Afterwards, 15% of caregivers were able to reiterate the advice they had received from an IMCI-trained staff compared to 9% of healthcare provider were not IMCI-trained. In 2002, similar results were obtained in a study assessing the effects of IMCI on the quality of care received by sick children in eight government and non-government healthcare facilities in Uganda (Pariyo et al., 2005). From 500 counselling observations, 67.9% of IMCI-trained healthcare providers explained to caregivers how to administer oral medicine to children compared to 30.6% of colleagues without IMCI-training; afterwards, 47% of caregivers knew how to use a treatment, such as ORS or antibiotics as opposed to 29.9% of caregivers who were attended by a healthcare provider who had not received IMCI training. However, these IMCI-studies did not focus on childhood diarrhoea treatment in specifically, nor did they give any information about the person, assumed to be the caregiver, who accompanied the child on the day of the visit. This may be of interest since diarrhoea treatment requires a significant amount of attention. Therefore, very limited conclusions can be drawn.

In 2003, a study of 104 formal and informal private practitioners measured the quality of their case management of childhood diarrhoea, acute respiratory infection, and malaria before and after a set of interactive learning sessions. For each participant, one session lasted for 18 hours stretched out over three days (Tawfik et al., 2006). The participating practitioners were 43 nurses or assistants or aides, 33 nurses and midwives, 13 medical officers or assistant physicians, nine drug sellers, and six physicians. The monitoring and supporting visits, which took place between one and two months after the training session revealed statistically significant improvements. For example, in the case of simple diarrhoea, after the training, 55% of caregivers were asked by practitioners about blood in the stool as opposed to 11% at baseline. Other diarrhoeal issues showed similar improvements. Counselling about continued feeding, for example, increased from 4% to 20%, using ORS from 11% to 45%, including explaining how to prepare ORS (from 7% to 39%), and increasing fluid intake from zero to 45%. However, despite improvements overall, treatment practices remain low in cases of simple diarrhoea. The reason may be that there were too few learning session, especially for informal healthcare providers. On the other hand, learning

session with regard to severe diarrhoea and dehydration, measuring a higher level of knowledge in the beginning reported only a slight impact on practices after learning sessions, which may indicates that learning session needs to be tailored to healthcare providers needs. Differentiation between informal and formal healthcare providers would perhaps have been effective since different needs to be addressed (Tawfik et al., 2006).

Table 7: Studies reporting on healthcare providers' prescribing and recommendation practices at healthcare facilities

Author	Year	Sample	Study Design	Relevant Study Results
Arifeen et al.	2004	N=20 first-level outpatient facilities in Matlab sub-district, Bangladesh	Household and healthcare facility surveys, IMCI-trained (intervention) facilities vs. non-IMCI-trained (comparison) facilities	• 94% of healthcare workers were IMCI-trained at intervention facilities • Healthcare system support available • Community activities slow implementation • Mean index for correct treatment 54 at IMCI facilities vs. 9 at comparison facilities (range 0-100) • 19% of sick children taken to IMCI vs. 9% to non-IMCI-trained facilities • Use of IMCI facilities increased from 0.6 to 1.9 visits per child per year
Arifeen et al.	2005	N=19 healthcare facilities in Bangladesh	Multi-country evaluation using facility survey tools, observation, exit interviews, inventories, and interviews with facility healthcare workers	• Few children fully accessed and correctly treated at healthcare facilities • Lower-level workers classified children correctly compared to higher-level workers
Arifeen et al.	2009	N=20 first-level government healthcare facilities in Matlab sub-district, Bangladesh	Cluster randomised trial, healthcare facilities were paired and randomly assigned to either IMCI-trained (10 intervention areas) and usual, non-IMCI-trained (10 comparison areas) facilities Primary endpoint: child mortality rate (from 7 days to 59 months)	• Child mortality rate fell in both areas (no significant difference) • Exclusive breastfeeding at 76% of IMCI facilities vs. 65% at comparison facilities
Awor et al.	2012	N=1,604 households in two rural districts of Kaliro and Kamuli in eastern, Uganda	May, 2011, cluster sampling, community household survey and 163 exit interviews at drug shops based on caregivers' recall of the management of children under five with malaria, pneumonia, or diarrhoea in children	• 24.4% (228) of caregivers managed a sick child in the home • 53.2% (854) of mothers made the decision to seek treatment for a child, 73.1% (1,173) of fathers/husbands authorised expenditure for treatment • Caregivers sought help first of all for a sick child: 53.1% (496) in the private sector (private clinics and drug shops) including 34,4% (56) at drug shops due to childhood diarrhoea; 16.5% (154) at a government healthcare facility, 3.3% (31) from community healthcare workers, 1,4% (13) from traditional healers, 1.3% (12) from spiritual healers • 14.3% (8) children with diarrhoea received ORS, none of them received zinc

Continuing Table 7: Studies reporting on healthcare providers' prescribing and recommendation practices at healthcare facilities

Author	Year	Sample	Study Design	Relevant Study Results
Gouws et al.	2004	Healthcare workers and sick children under five at 80 first-level healthcare facilities in Uganda	Multi-country evaluation of IMCI case management in the use of antibiotics in children, observation-based surveys conducted at randomly selected first-level facilities	• IMCI-trained healthcare workers are more likely to prescribe antibiotics correctly, give the first dose of treatment at a healthcare facility, advise caregivers on how to administer the drug, and caregivers are more likely to be repeat instructions, all of which healthcare workers not trained in IMCI were unlikely to do • 35% (516) of children were classified for antibiotic treatment by healthcare providers (89% for pneumonia, 7% for acute ear infection, 7% for dysentery)
Karamagi et al.	2004	N=19 health units with 37 healthcare providers in Mukono district, Uganda	In 2000, cross-sectional study using quantitative and qualitative methods, such as observation of 161 counselling sessions	• 85% of providers assessed a sick child correctly • 76% of providers gave feeding advice • 65% of providers asked feeding questions, 50% explained feeding problems • 61% of providers advised on medication • 44% of providers advised on fluid intake • 12% of children were referred • Most facilities did not administer the first dose of treatment before referral
Lögfren et al.	2012	N=532 recorded cases of childhood diarrhoea at healthcare centres, Staff at 31 healthcare centres (21 run by the government, 12 by NGOs) and 10 drug shops in rural district of Namutumba, Uganda	Cross-sectional survey, record review of case management of childhood diarrhoea and structured interviews	• 68% of staff at healthcare centres more familiar with symptoms of diarrhoea as well as danger signs (77%) versus 30% of staff at drug shops (43%) • 78% rehydration therapy and 76% antibiotic treatment according to record review at healthcare centres • 77% of healthcare centres and 63% of drug shops had ORS in stock • 81% of staff at healthcare centres and 87% of staff in drug shops prescribed antibiotics • 9% of staff in drug shops mentioned antimotility drugs versus none of the staff at healthcare centres • 55% of staff at healthcare centres and 50% of staff in drug shops knew about zinc, but never mentioned it as a treatment

Continuing Table 7: Studies reporting on healthcare providers' prescribing and recommendation practices at healthcare facilities

Author	Year	Sample	Study Design	Relevant Study Results
Pariyo et al.	2005	Eight government and non-government healthcare facilities in 10 study districts in Uganda	From July to December in 2000, 2001 and 2002 randomly selected healthcare facilities, healthcare facilities surveyed to assess effects of IMCI on the quality of care of sick children (from 2 months to 5 years)	• Increased percentage of observed children (from 42% in 2000 to 79% in 2002) at districts managed by IMCI-trained workers • Significantly better performance in assessment and classification of a sick child by IMCI-trained healthcare workers versus colleagues not trained in IMCI
Tawfik et al.	2006	N=104 private clinics or drug shops with formal and informal practitioners (six physicians, 12 medical officers, 33 nurses/midwives, 43 nurse assistants/aides and nine drug sellers in Luwero district, Uganda	In September and October 2003, four negotiation sessions were held and post-intervention follow-up conducted	• Improved recommendations of continued feeding (from 4% to 20%) and increased fluids or ORS (from 11% to 45%) • Poor compliance with registration regulations (80% of healthcare providers did not recommend continued feeding, 55% of healthcare providers did not advise on increased fluids intake or ORS) • 49% (out of 74) of private clinics stock ORS • 58% (out of 321) of drug shops stock ORS

3.3. Guidelines and policies

The third and last section of the analysis looks at existing guidelines and policies supporting the use of ORT in children with acute diarrhoea in terms of the accessibility and availability of affordable ORS and zinc in Bangladesh and Uganda. Table 8 give details about studies examining guidelines and policies supporting the use of ORT in Bangladesh and Uganda.

Example from Bangladesh

Guidelines and policies supporting the use of ORT

In the early stage of independence, the Government of the People's Republic of Bangladesh created several policies to regulate its healthcare system. In 1972, for example, shortly after independence, Bangladeshi leaders included a legal right to healthcare in the country's new constitution; this allows voluntary and donor-led initiatives to complement state programmes (Balabanova et al., 2013). The Ministry of Health and Family Welfare created a separate directorate that was responsible for the sustained investment in and creation of innovative community-based interventions (Sundewall et al., 2006). For example, in 1980, the National Oral Rehydration Project was established by the government to provide ORS to healthcare centres in sub-districts of the countries (Chowdhury, 1996).

In 1982, on the basis of a drug policy, the Bangladesh government compiled a list of essential drugs, consisting mainly of generic medicines, as well as establishing an indigenous drug company, both of which ensured the production and distribution of affordable medicine for the public sector (Chowdhury, 1996; Balabanova et al., 2013). Today, 97% of key commodities (such as ORS, zinc, and antibiotics) are manufactured domestically by a successful pharmaceutical industry (Gill et al., 2013). Bangladesh invested substantially in programmes to alleviate severe malnutrition and to improve water and sanitation (Gill et al., 2013).

Yet another policy, this one pertaining to of human resources, initially regulated the primarily recruitment of male fieldworkers. Later it was extended to include female healthcare assistants and family welfare assistants, all three of which are engaged in out-reach programmes, such as those providing immunisation, healthcare education including family planning and the distribution of essential medicines and contraceptives (Balabanova et al., 2013). Furthermore, the healthcare system benefitted from a broader set of policies for education, female empowerment, strengthening the transport infrastructure, and access to electronic media. For example, an emergency response system and a better

infrastructure have been developed in response to past experiences with seasonal floods and cyclones (Balabanova et al., 2013). In addition, Bangladesh's early and constant focus on local research and development, found, for example, in the world-renowned International Centre for Diarrhoeal Disease Research in Dhaka, Bangladesh (ICDDR,B), ensured that medical innovations, such as ORS and zinc as well as novel service delivery models, such as IMCI have been widely promoted (Wilson et al., 2013). However, all policies, no matter how sound, need to be effectively implemented to work (Balabanova et al., 2013). To this end, a district management committee is in charge of implementation of government programmes as well as to coordinate those from private providers and NGOs, such as the Bangladesh Rehabilitation Assistance Committee, formerly known as Bangladesh Rural Advancement Committee (BRAC), which has contributed greatly to the prevention of diarrhoeal deaths in children and provides healthcare services to marginalised populations (Balabanova et al., 2013). Between 1980 and 1990, for example, 12 million women (half of all women living in Bangladesh) received training in the use of sugar-salt solutions from BRAC staff (Wilson et al., 2013). In 1998, Bangladesh's sector-wide approach as based on a synergy between 120 separate health programmes all of which acting together to reduce fragmentation (Balabanova et al., 2013). Therefore, reviewed evidence indicates that appropriate policies and regulations have been put into place in Bangladesh to ensure the functioning not only of healthcare providers and drug manufacturers, but also of the healthcare system as a whole.

In Bangladesh, community healthcare workers (CHWs) augmented their usual services in terms of additionally offering primary care and referrals during home visits. Others became village doctors or unlicensed providers in rural areas after working in programmes for smallpox eradication or as health and family welfare assistants (Balabanova et al., 2013). They then introduced and delivered low-cost therapeutic innovations, such as ORS and zinc to treat diarrhoea (Balabanova et al., 2013). One can, therefore, conclude that CHWs may contribute to the reduction of childhood mortality by improving access to basic medical services and low-cost drugs (Mahmood et al., 2010).

In 1995, after several years of recommending sugar and salt solutions to treat diarrhoea, the Bangladeshi government started to widely promote brands of ORS, for example brands produced by the Bangladesh Social Marketing Company (SMC) which delivered ORS to 220,000 retail outlets, such as pharmacies, stores, and kiosks throughout the county (Social Marketing Co, 2010; Wilson et al., 2013). Since this initiative, essential medicine, such as ORS has become available free of charge in the public sector, or at very low cost (US$ 0.06) in the private sector (Balabanova et al., 2013; Wilson et al., 2013). Therefore, affordable and effective

medicine to treat childhood diarrhoea appears to be available throughout Bangladesh.

The IMCI strategy was based on *'Guidelines for the Management of sick Children at first-level Facilities'*, all of which aimed to guide the assessment and classification of a child's health (Arifeen et al., 2005). Additionally, specific operational guidelines were developed to assist nutrition workers to hold educational meetings for groups of women within the community. These efforts were supported by BRAC (Arifeen et al., 2004).

Example from Uganda

Guidelines and policies supporting the use of ORT

In the late 1990s and early 2000s, the Ugandan Ministry of Health (MOH) implemented several policies to promote health throughout the country. For example, in 1999, the MOH initiated a policy for reproductive health, which recommended exclusive breastfeeding for four months (Mbonye, 2003). Current *'Policy Guidelines on Infant and Young Child Feeding'* are now in accordance with the WHO guidelines, recommending, for example, exclusive breastfeeding for six months (MOH, 2009). In addition, in 2001, user fees were abolished which may explain why more caregivers seek treatment from healthcare providers for their children with diarrhoea (Meessen et al., 2006).

Nanyonjo et al. (2012) studied the acceptability and adoption of integrated community case management (ICCM) in eight districts in Midwestern Uganda using seven focus group discussions and 20 interviews with either female and male caregivers who look after children under five with diarrhoea and CHWs to gather data. The researchers found that, in two villages, a referral policy were established requesting that caregivers first consult CHWs before attending the local healthcare facility. As a consequence, caregivers were more likely to use the community service as well as to trust CHWs.

In 2002, the Ugandan MOH tried to regulate the referral of children with severe illnesses or severe malnutrition to healthcare facilities by publishing *'Guidelines for Referral Facility Quality of Care Improvement'* (Mbonye, 2003). In 2010, it published another brochure, the '*Implementation Guidelines on Integrated Community Case Management of Childhood Malaria, Pneumonia, and Diarrhoea'*, aimed at guiding healthcare providers in assessing, classifying, and treating a sick child who might, for example, be suffering from diarrhoea. These guidelines were in accordance with both IMCI case-management guidelines and WHO recommendations (WHO, 2008; MOH, 2010a).

Löfgren et al. (2012) reported that, at the time of their study, zinc was not included in Uganda's clinical guidelines. As a consequence, zinc was not provided in healthcare centres and nor was it recommended or prescribed by healthcare providers. However, since 2010, the national treatment guidelines, known as '*Uganda Clinical Guidelines*' (UCG) recommend ORT for children suffering from diarrhoea including medicine, such as low osmolarity ORS and zinc, which are in accordance with the WHO treatment guidelines for healthcare workers (WHO, 2005a; MOH, 2010b).
According to Nanyonjo et al. (2012), some caregivers reported that several CHWs left the impression of being insufficiently trained to treat

children adequately. Caregivers expected CHWs to examine a child before prescribing a drug as well as offering advice on how to administer it correctly (Nanyonjo et al., 2012). Conversely, CHWs reported being treated aggressively by caregivers if they were unable to dispense medicine in general because children were older than five years of age or if they did not meet caregivers' demands for more medicine than was usually needed. However, in communities where an ICCM programme was well-functioning, caregivers mentioned receiving quick and accessible service, since CHWs demonstrating how to mix the drugs with boiled water and administered the first dose to the sick child. This, in turn, successfully educated caregivers on how to administer prescribed drugs in the home (Nanyonjo et al., 2012).

Nanyonjo et al. (2012) reported that, due to a lack of drugs, CHWs referred sick children to healthcare centres, which disappointed community members, who had been expecting to receive a minimum of equipment, training, and experience from CHWs. The study also revealed that the expectations of community members were equally unfulfilled at healthcare facilities because, in addition to long waiting times, prescribed drugs were often out of stock and had to be bought at drug shops or private clinics. As a consequence, caregivers may choose to seek help from a drug shop or private clinic directly during the next bout of diarrhoea. However, Löfgren et al. (2012) reported that, at 77% of the healthcare centres they examined, ORS was in stock compared to 63% of the drug shops. The stock shortages were ascribed to the fact that central medicine depots were late in delivering the drug to healthcare centres or that the owners of the drug shops had not ordered it.

Therefore, frequent shortages of drugs and diagnostic tools, inadequate healthcare performance due to poor recruitment of healthcare workers or insufficient supervision and training, amongst other factors, limit the community's acceptance of healthcare services at both community and healthcare facility levels in Uganda (Nanyonjo et al., 2012).

In 2000, according to Karamagi et al. (2004), most children did not receive treatment at a healthcare facility before referral. Gouws et al. (2004) reported, for example, that 21% of sick children younger than five years of age received their first dose of antibiotics at the healthcare facility if this was prescribed by an IMCI-trained healthcare provider; only three per cent children received their first dose of antibiotics from a healthcare provider who was not IMCI-trained. However, Pariyo et al. (2005) presented data from the year 2000 recording the availability of oral medicine in 80% of cases at healthcare facilities and Löfgren et al. (2010) reported that after reviewing health centres' records that 78% of 523 cases of childhood diarrhoea were treated with ORS (Pariyo et al., 2005). Therefore, Ugandan caregivers may have a reasonable chance of receiving appropriate medicine.

In both Bangladesh and Uganda, few caregivers received the first dose of treatment from healthcare facilities, and some learnt how to administer a prescribed drug after counselling from a provider (Gouws et al., 2004; Karamagi et al., 2004; Pariyo et al., 2005; Arifeen et al., 2009). In the broader context, a functioning healthcare system would support the successful management of acute diarrhoea in children younger than five of age by providing appropriate policies and regulations, appropriate standards and guidelines, and trained healthcare workers, who know how to prevent and to treat childhood diarrhoea (Ross-Degnan et al., 2008). As seen in the reviewed literature, the Bangladesh government committed to child health and accepted responsibility for producing and delivering such services and medicines as ORS and zinc (Balabanova et al., 2013). Balabanova et al. (2013) identified four attributes of a well-functioning healthcare system: good governance and political commitment; effective bureaucracies and institutions; innovate service delivery, and the resilience of the healthcare system. All four of these can be found in the success story of Bangladesh: for example, there seems to be strong ownership of the country's health concerns. This was evidenced when some Bangladesh political leaders reversed a decision to unify the MOH and Family Welfare Department due to internal resistance, which had resulted in disagreement between the development partners and the government of Bangladesh (Sundewall et al., 2006). In the case of Uganda, the attributes of a well-functioning healthcare system are less obvious, particularly since ORS appears not to be widely available free of charge in either the public or the private sector. The same applies for zinc, which, although it was included in the '*Ugandan Clinical Guidelines'* in 2010 does not yet appear to have been used as a treatment intervention.

Table 8: Studies examining guidelines and policies supporting the use of oral rehydration therapy in Bangladesh and Uganda

Author	Year	Sample	Study Design	Relevant Study Results
Arifeen et al.	2004	N=20 first-level outpatient facilities in Matlab sub-district, Bangladesh	Household and healthcare facility surveys, IMCI-trained (intervention) facilities vs. non-IMCI-trained (comparison) facilities	• IMCI guidelines adapted to local context • 94% of healthcare workers were IMCI-trained at intervention facilities • Healthcare system support available • Mean index for correct treatment 54 at IMCI facilities vs. 9 at comparison facilities (range 0-100) • 19% of sick children taken to IMCI vs. 9% to non-IMCI-facilities • Use of IMCI facilities increased from 0.6 to 1.9 visits per child per year
Arifeen et al.	2005	N=19 healthcare facilities in Bangladesh	Multi-country evaluation using facility survey tools, observation, exit interviews, inventories, and interviews with facility healthcare workers	• IMCI guidelines adapted to local context • Few children fully accessed or correctly treated at healthcare facilities • Lower-level healthcare workers classified children correctly compared to higher-level healthcare workers
Balabanova et al.	2013	Bangladesh, Ethiopia, Kyrgyztan, Thailand, and Indian state of Tamil Nadu	Literature review using a conceptual framework intended to answer the question of why some countries achieve better healthcare and social outcomes compared than others	Attributes of success: • Good governance, political commitment (e.g. policies) • Effective bureaucracy (e.g. essential drug list) • Innovative healthcare workforce strategies (e.g. NGOs provided healthcare services) • Service delivery (e.g. local manufacturers)
Gill et al.	2013	Academic, public health, governmental and private sector stakeholders	Identify key barriers to progress by multi-country consultations and workshops, focused on deaths in children with pneumonia and diarrhoea	Bottlenecks included: • Antiquated supply management system • Insufficient funding for drugs • Inadequate knowledge about interventions • Healthcare worker shortages and poor support for training and retention • Difficulty translating national policies into action plans

Continuing Table 8: Studies examining guidelines and policies supporting the use of oral rehydration therapy in Bangladesh and Uganda

Author	Year	Sample	Study Design	Relevant Study Results
Mahmood et al.	2010	N=1,000 households from eight regions of Chakaria, Upazila, Bangladesh	February 2007, household survey randomly selecting one household member who felt sick during the past 14 days	• 44% of the villagers felt sick (in 4.8% of the cases due to diarrhoea) • 47% of the villagers sought treatment • 67% of the villagers consulted a village doctor first • 14% of the villagers consulted a qualified practitioner • Shortage of qualified physicians
Meessen et al.	2006	Uganda and Cambodia	Literature review compared both countries	Key conclusions: • Inequities in the healthcare system are evitable since funds become available • Context matters (e.g. local needs, constraints, and opportunities) • Reform process either gradual or radical • Healthcare financing solutions based on institutional arrangements • Strong policies often mean successful implementation • National political resoluteness is key for a successful healthcare system
Nanyonjo et al.	2012	Community members, CHWs, supervisors in eight districts in Midwestern Uganda	July 2011, qualitative study to identify factors that influence use of ICCM based on focus group discussions and interviews	Adoption of ICCM were hindered by: • Stringency, quality and cost of access to healthcare, such as irregular drug supply, lack of financial support, lack of adequate referrals
Sundewall et al.	2006	Government of Bangladesh	February/March 2003, governmental decision-making process examined via data collection through participant observation, interview, and document review	• Main actors (government and development partners) interpret ownership and coordination differently
Wilson et al.	2013	Bangladesh compared to India, among other countries	Qualitative, pair-wise (or three-country) comparison of similar countries to establish differences in ORS coverage	Identified factors for success: • Involvement of a broader range of key players • Addressing supply and demand • Private and public partnership

Chapter 4: Discussion

This thesis has analysed the use of ORT in children younger than five years of age with acute diarrhoea in Bangladesh and Uganda. Table 9 details factors identified factors for the successful use of ORT in children younger than five years of age with acute diarrhoea and issues hindering its use. In the following section, this thesis discusses the main findings, firstly, by presenting the main limitations of the research, secondly, by highlighting similarities in both countries, and thirdly, by pointing out the main differences in the use of ORT in Bangladesh and Uganda.

The literature review has been limited due to no or insufficient data on several aspects of the framework worth taking into consideration, for example, whether caregivers obtain appropriate and correctly labelled medicine at healthcare facilities and whether they administer those medicines correctly in the home. Sometimes available literature is out-dated. Very limited data were available on caregivers' ability to recognise signs of dehydration as a symptom of diarrhoea. It was not worth comparing some available studies as there was inconsistent use of descriptions of signs of dehydration, for example. Moreover, the great variety of healthcare providers operating in the public and private sector and the inconsistent use of several terms, such as licensed and not-licensed; registered and not-registered; formal and informal, has hindered the data analysis at some points. Studies aiming to evaluate the IMCI strategy have mainly published aggregated data on healthcare providers' ability to assess and to treat various diseases. This allows, to some extent, speculation about how they would perform when dealing with childhood diarrhoea.

The literature review has revealed that in most of the diarrhoeal cases caregivers in Bangladesh and Uganda decided that a child needed treatment and sought healthcare from a healthcare provider at some point in time. However, some studies, such as the DHS, which utilised caregivers' memories of diarrhoeal episodes over a defined period of time in the past, excluded caregivers whose children died due to diarrhoea since only caregivers of children currently living in the household were interviewed. The studies mentioned above do not reveal if an untreated or inappropriately treated diarrhoeal episode has been the reason for a child's death. In order to identify children at high risk of dying due to diarrhoea, it would be meaningful to assess the ability of those caregivers whose children died to recognise symptoms of diarrhoea and to decide on a child's treatment. There is a probability that they will have another child, or look after other children as a secondary caregiver. Furthermore, since Bangladeshi caregivers appear to recognise diarrhoea as watery and loose stools, other caregivers who may have failed to observe other symptoms of diarrhoea, such as invisible blood in stools or signs of dehydration may have been excluded from the studies.

Table 9: Success and hindering factors identified for the use of ORT in children younger than five years of age with diarrhoea

Framework: Using medicines appropriately for childhood illness	Bangladesh	Uganda
3.1. Caregivers' use of oral rehydration therapy		
A. Caregivers recognise symptoms of diarrhoea, such as unusually loose or watery stools in a 24-hour period, bloody stools, or signs of dehydration (including sunken, eyes, skin pinch, not able to drink or drink poorly, eagerly, or thirstily, restlessness or irritability, and lethargy or unconsciousness) and caregivers decide a child needs treatment	**Success factors:** • Caregivers appear to recognise watery and loose stools as a symptoms of diarrhoea • Caregivers appear to decide on a diarrhoeal treatment intervention **Hindering issues:** • Caregivers may not recognise signs of dehydration as a symptom of diarrhoea	**Success factor:** • Caregivers appear to decide on a diarrhoeal treatment intervention
B. Caregivers seek healthcare from an appropriate healthcare provider, such as licensed or registered and trained healthcare provider either in the public (governmental healthcare facilities) or private sector (drug shops, private clinics, pharmacies)	**Success factor:** • Caregivers seek private healthcare for ORS **Hindering issues:** • Caregivers may consult an inappropriate private healthcare provider • Caregivers do not seek public healthcare • Caregivers may not seek any healthcare	**Success factor:** • Caregivers seek healthcare **Hindering issues:** • Caregivers may consult an inappropriate private healthcare provider • Caregivers do not seek public healthcare • Caregivers may not seek any healthcare
C. Caregivers select an appropriate medicine, such as oral rehydration therapy consisting of more fluids, including oral rehydration therapy, continued feeding, and zinc; antibiotics (in bloody diarrhoea)	**Success factor:** • Caregiver selects appropriate medicine, such as oral rehydration salt **Hindering issues:** • Caregiver may not administer zinc • Caregiver may not increase fluids • Caregiver may not continue feeding • Caregiver may select some inappropriate medicine, such as antibiotics, traditional medicine • Caregivers may not select any intervention	**Success factor:** • Caregivers select appropriate medicine, such as ORS **Hindering issues:** • Caregivers may not administer zinc • Caregiver may use less oral rehydration therapy • Caregivers may not increase fluid • Caregivers may not continue feeding • Caregivers may select inappropriate medicine, such as antibiotics, traditional medicine • Caregivers may not select any intervention
D. Caregivers administer appropriate medicine correctly	• Literature review did not reveal any data about childhood diarrhoea in Bangladesh to elaborate on this point	• Literature review did not reveal any data of childhood diarrhoea in Uganda to elaborate on this point
E. Caregivers reassess symptoms correctly		

Framework: Using medicines appropriately for childhood illness	Bangladesh	Uganda
3.2. Healthcare providers' prescribing and recommendation practices		
F.1. Healthcare providers assess symptoms of diarrhoea, such as unusually loose or watery stools in a 24-hour period, bloody stools, or signs of dehydration (including sunken, eyes, skin pinch, not able to drink or drink poorly, eagerly, or thirstily, restlessness or irritability, and lethargy or unconsciousness)	**Success factors:** • IMCI-trained public healthcare providers may check for the three danger signs (inability to drink or breastfeed, vomiting, convulsions) • IMCI-trained public healthcare providers may check for presence of cough, diarrhoea, or fever **Hindering issues:** • Non-IMCI-trained public healthcare facilities may perform poorly	**Success factors:** • Public and private healthcare providers may assess loose and frequent stools as symptoms of diarrhoea • Public healthcare providers may assess signs of dehydration as a symptom of diarrhoea **Hindering issues:** • Private healthcare providers may not assess signs of dehydration as a symptom of diarrhoea
F.2. Healthcare providers prescribe and recommend appropriate medicine, such as oral rehydration therapy consisting of more fluids, including oral rehydration therapy, continued feeding, and zinc; antibiotics (in bloody diarrhoea)	**Success factor:** • IMCI-trained public healthcare providers may correctly prescribe antibiotics **Hindering issues:** • IMCI-trained public healthcare providers may not sufficiently prescribe oral rehydration salt • Non-IMCI-trained public healthcare providers may perform poorly	**Success factor:** • Public and private healthcare providers may know about oral rehydration salt and zinc **Hindering issues:** • Private and public healthcare providers (both non- IMCI-trained) may prescribe antibiotics inappropriately • Private healthcare providers may recommend inappropriate medicine, such as antimotility drugs
F.3. Healthcare providers give advice and information, such as advice on more fluids, continued feeding, how to administer a prescribed drug	**Success factors:** • IMCI-trained public healthcare providers may give instructions on how to administer medicine, such as oral rehydration salt, antibiotics • IMCI-trained public healthcare providers may give advice on increased fluid intake • IMCI-trained public healthcare providers may advise on continued feeding **Hindering issues:** • Non-IMCI-trained public healthcare providers may perform poorly	**Success factors:** • IMCI-trained healthcare give instructions on how to administer an medicine, such as antibiotics and oral rehydration salt • IMCI-trained healthcare providers give advice on increased fluid intake • IMCI-trained healthcare providers give advice on continued feeding **Hindering issues:** • Caregiver may not able to reiterate treatment instructions received from non-IMCI-trained healthcare providers
F.4. Healthcare providers give advice on signs of treatment failure and/or need for referral	• Literature review did not reveal any data about childhood diarrhoea in Bangladesh to elaborate on this point	• Literature review did not reveal any data about childhood diarrhoea in Uganda to elaborate on this point
G. Caregivers obtain appropriate, correctly labelled medicine		

Framework: Using medicines appropriately for child illness	Bangladesh	Uganda
3.3. Guidelines and policies supporting the use of ORT		
I.1. Appropriate standards and guidelines exist	**Success factors:** • Standards and guidelines exist • IMCI guidelines adapted to local context	**Success factors:** • Standards and guidelines exist • IMCI guidelines adapted to local context • Referral guidelines **Hindering issues:** • Clinical guidelines are not available at healthcare facilities
I.2. Appropriate policies and regulatory structure in place	**Success factors:** • Policies and regulations in place • Policies created (legal right to healthcare, population policy, drug policy, human resources) • Ministry of Health, Family Welfare and District Management Group in place • National Oral Rehydration project established • Recommendation of branded ORS **Hindering issues:** • Drug shop offers services not authorised to provide	**Success factors:** • Policies and regulations in place • Policies created (national and reproductive healthcare policies, breastfeeding up to six months) • In 2001, abolition of user fees at government healthcare facilities **Hindering issues:** • Provider is not registered at the district health authorities • Drug shop offers services not authorised to provide • Clinic sells drugs to clients
I.3. Supply system functions efficiently	**Success factors:** • In 1982, essential drug list compiled • Local manufacturers established • Affordable medicine supplied • NGOs provide healthcare service	**Hindering issues:** • No local production or distribution of ORS and zinc • Provider does not stock ORS

(Modified from Ross-Degnan et al., 2008, p.20)

Recognition of signs of dehydration has not been currently investigated in Uganda and has been investigated inconsistently in Bangladesh. The examples reviewed suggest that caregivers may less able to recognise the signs of dehydration and therefore they may less able to decide on an appropriate treatment for children. In consequence, less diarrhoeal episodes may had been reported in surveys and better outcomes had been reached by including only those caregiver's able to recognise symptoms and, therefore, decide for a child's treatment. On the other hand, interviewing only one caregiver, primarily the mother, leaves out other family members, such as relatives, siblings, or the father who may also look after a child. Since they may have observed a diarrhoeal episode in the requested period of time, it would be worth to include them in studies. Therefore, study findings received should be treated with caution since they may not reflect reality to the full extent.

The available evidence reviewed suggests that Bangladeshi and Ugandan caregivers, in practice, seem to follow a common pattern for accessing healthcare. While some caregivers may wait until the child has developed more obvious severe symptoms of diarrhoea, few caregivers give a child more fluid or continue feeding. Others may buy ORS in the private sector close to their homes. This seems to be logical, since in both countries the private sector dominates the healthcare system in comparison to the public sector which appears to be less utilised in the first instance. However, the literature review did not reveal which type of private healthcare provider, formal or informal or both, was preferred by caregivers when seeking help for a sick child with diarrhoea. It would have been useful to know whether particular types of provider have an influence on caregivers' treatment decisions. It could be argued that as long as caregivers know what kind of treatment they should administer in to a child with diarrhoea, the source of healthcare is probably less important. However, in both countries caregivers may receive inappropriate treatment, such as antibiotics and antimotility drugs to a treat a child with diarrhoea. Therefore, the influence and performance of healthcare providers appears to be important to know.

The evidence reviewed allows very limited conclusions about public and private healthcare providers' prescription and recommendation practices with regard to ORT in Bangladesh and Uganda. Available data on the performance of different healthcare providers does consistently specify the type of private healthcare provider or does not specifically focus on childhood diarrhoea. However, if one extrapolates from the study population in both countries in Bangladesh (non-IMCI-trained public healthcare providers) and in Uganda (both, IMCI and non-IMCI-trained public healthcare providers), and it would appear that those less well-performing healthcare providers represent the norm for healthcare at all public healthcare facilities. Presuming this is true the quality of healthcare delivered to sick children younger than five years of age suffering from

diarrhoea at first-level governmental healthcare facilities would be generally insufficient. This may explain why caregivers tend not to seek healthcare from public healthcare facilities before a child exhibits life-threatening or obviously severe symptoms. However, healthcare delivered at healthcare facilities may differ between different public healthcare providers as well as between the formal and informal private sector. Therefore, further research on the performance of both public and private healthcare would be useful.

One of the main differences between Bangladesh and Uganda is that in Uganda individual IMCI training has impacted less successfully on the quality of care delivered to sick children by public healthcare providers as than in Bangladesh. Therefore, training alone does not appear to be enough. Bangladesh established entire IMCI healthcare facilities receiving all interventions, such as IMCI training courses, supervision, and adapted guidelines, while Uganda chose to train individual staff at public healthcare facilities. Furthermore, Bangladesh's government intended to implement all three components of the IMCI strategy, which, apart from improving the case management skills of healthcare staff, consists of an improved healthcare system as well as improved family and community practice. It is worth mentioning that an overall improvement in the performance of Bangladeshi healthcare providers at non-IMCI-trained facilities has been reported, probably due to healthcare interventions that were implemented at the same time, independent of the IMCI strategy.

Another point of difference between the two countries is that Bangladeshi caregivers appear to use ORS, which may indicate that this treatment is not only accepted by caregivers as a useful medicine for their children with diarrhoea but is also accessible, available, and affordable. In Bangladesh, governmental leaders have successfully implemented, over the past three decades, a variety of guidelines and policies to support the use of ORT. However, some issues may need to be addressed, for example, the prescription and recommendation practices of healthcare providers for some medicine such as ORS and antibiotics. In Uganda, governmental leaders should further support the use of ORS since Ugandan caregivers appear to know about ORS and partly use it. However, the accessibility, availability, and affordability of ORS appear to be inconsistently guaranteed throughout the country.

Chapter 6: Conclusions and recommendations

In the last section, this thesis presents some conclusions based on the main findings and suggests areas of investment to further reduce child mortality due to diarrhoea.

- Bangladeshi caregivers appear to be able to recognise loose or watery stools, bloody stools, and some signs of dehydration as symptoms of acute diarrhoea in children younger than five years of age.

- Due to a lack of data, no conclusions can be drawn on the ability of Ugandan caregivers to recognise loose or watery stools, bloody stools, and signs of dehydration as symptoms of acute diarrhoea in children younger than five years of age.

- It is likely that more than one caregiver is looking after a child younger than five years of age in Bangladesh and Uganda.

- Bangladeshi and Ugandan caregivers appear to be able to decide on diarrhoeal treatment and may seek private healthcare for children younger than five years of age with acute diarrhoea.

- Bangladeshi caregivers appear to administer ORS and zinc to children younger than five years of age with acute diarrhoea.

- Ugandan caregivers appear to administer ORS and no zinc to children younger than five years of age with acute diarrhoea.

- Public and private healthcare providers' prescription and recommendation practices with regard to ORS and zinc are needed.

- All components of the IMCI strategy may have to be implemented in order to reduce child mortality.

- ORS appears to be available, accessible, and affordable throughout Bangladesh and it is accepted by caregivers.

- Specific guidelines and policies supporting ORT need to be in place and successfully implemented.

- Due to a lack of data, no conclusion can be drawn about following important points: whether Bangladeshi and Ugandan caregivers obtain appropriate and correctly labelled medicine and whether they administer those medicines correctly in the home.

Further research is needed on Bangladeshi and Ugandan caregivers ability to recognise symptoms of diarrhoea (loose or watery stools, bloody stools, signs of dehydration) in relation to their ability to timely decide for a diarrhoeal treatment, both of which in children younger than five years of age. Understanding caregiver's practices of childhood diarrhoea, specifically, in-depth diarrhoea-related research of caregiver's perspectives is needed, for example, on illness perception of diarrhoea and severity, on decision-making for diarrhoea treatment, and on healthcare-seeking behaviour for diarrhoea. Mixed research design using quantitative and qualitative methods, such as structured questionnaires, focus group discussions and in-depth interviews, appear to shed light on caregiver's use of ORT in the above mentioned aspects

Since childhood diarrhoea usually starts in the home, all caregivers should be targeted at an early stage. That would include mothers, relatives, siblings, and particularly fathers and husbands, who all should be actively included in research and interventions since they may play an important role in preventing childhood deaths due to diarrhoea.

The three elements of oral rehydration therapy (increased fluid (oral rehydration salt), (exclusive breast) feeding, and zinc) should be promoted to caregivers as well as to healthcare providers since early administration in case of a diarrhoeal episode is needed.

References

Ahmed, S., Farzana, F.D., Ferdous, F., Chisti, M.J., Malek, M.A., Faruque, A.S.G. and Das, S.K., 2013. Urban-rural differentials in using antimicrobials at home among under-5 children with diarrhea. *Science Journal of Clinical Medicine*, 2(3), pp.81-86.

Arifeen, S.E., Blum, L.S., Hoque, D.M.E., Chowdhury, E.K., Khan, R., Black, R.E., Victora, C.G. and Bryce, J., 2004. Integrated management of childhood illness (IMCI) in Bangladesh: early findings from a cluster-randomised study. *Lancet*, 364, pp.1595-1602.

Arifeen, S.E., Bryce, J., Gouws, E., Baqui, A.H., Black, R.E., Hoque, D.M.E., Chowdhury, E.K., Yunus, M., Begum, N., Akter, T. and Siddlique, A., 2005. Quality of care for under-fives in first-level health facilities in one district of Bangladesh. *Bulletin of the World Health Organisation*, 83, pp.260-270.

Arifeen, S.E., Hoque, D.M.E., Akter, T., Rahman, M., Hoque, M.E., Begum, K., Chowdhury, E.K., Khan, R., Blum, L.S., Ahmed, S., Hossain, M.A., Siddik, A., Begum, N., Rahman, Q.S., Haque, T.M., Billah, S.M., Islam, M., Rumi, R.A.R., Law, E., Al-Helal, Z.A.M., Baqui, A.H., Schellenberg, J., Adam, T., Moulton, L.H., Habicht, J.-P., Scherpbier, R.W., Victora, C.G., Bryce, J. and Black, R.E., 2009. Effect of integrated management of childhood illness strategy on childhood mortality and nutrition in a rural area in Bangladesh: a cluster-randomised trial. *Lancet*, 374, pp.393-403.

Ferdous and Roy, 2011. Perception of caregivers on pathology of childhood diarrhoea. *Abstract in: 13th Annual Scientific Conference of ICDDR,B. Science to accelerate universal health coverage.* Dhaka, Bangladesh. 14-17 March 2011. Dhaka: ICDDR,B. [online] Available at: http://www.icddrb.org/what-we-do/publications/cat_view/52-publications [Accessed 23 July 2013].

Awor, P., Wamani, H., Bwire, G., Jagoe, G. and Peterson, S., 2012. Private sector drug shops in integrated community case management of malaria, pneumonia, and diarrhea in children in Uganda. *American Journal of Tropical Medicine and Hygiene*, 87(5), pp.92-96.

Balabanova, D., Mills, A., Conteh, L., Akkazieva, B., Banteyerga, H., Dash, U., Gilson, L., Harmer, A., Ibraimova, A., Islam, Z., Kidanu, A., Koehlmoos, T.P., Limwattananon, S., Muraleedharan, V.R., Murzalieva, G., Palafox, B., Panichkriangkrai, W., Patcharanarumol, W., Penn-Kekana, L., Powell-Jackson, T., Tangcharoensathien, V. and McKee, M., 2013. Good health at low cost 25 years on: lessons for the future of health systems strengthening. *Lancet*, 381 April, pp.2118-2233.

BDHS, 2001. *Bangladesh Demographic and Health Survey 1999/2000.* Dhaka, Bangladesh and Calverton, Maryland, USA: National Institute of Population Research and Training (NI-PORT), Mitra and Associates, and ORC Marco. [online] Available at: http://www.measuredhs.com/pubs/pdf/FR119/FR119.pdf [Accessed 18 July 2013].

BDHS, 2005. *Bangladesh Demographic and Health Survey 2004.* Dhaka, Bangladesh and Calverton, Maryland, USA: National Institute of Population Research and Training (NI-PORT), Mitra and Associates, and ORC Marco. [online] Available at: http://www.measuredhs.com/pubs/pdf/FR165/FR-BD04%5BFR165%5D.pdf [Accessed 18 July 2013].

BDHS, 2009. *Bangladesh Demographic and Health Survey 2007.* Dhaka, Bangladesh and Calverton, Maryland, USA: National Institute of Population Research and Training (NI-PORT), Mitra and Associates, and Marco International. [online] Available at: http://www.measuredhs.com/pubs/pdf/FR207/FR207%5BApril-10-2009%5D.pdf [Accessed 18 July 2013].

BDHS, 2013. *Bangladesh Demographic and Health Survey 2011.* Dhaka, Bangladesh and Calverton, Maryland, USA: National Institute of Population Research and Training (NI-PORT), Mitra and Associates, and ICF International. [online] Available at: http://www.measuredhs.com/pubs/pdf/FR265/FR265.pdf [Accessed 18 July 2013].

Bhutta, Z.A., Das, J.K., Walker, N., Rizvi, A., Campbell, H., Rudan, I. and Black, R.E., 2013. Interventions to address deaths from childhood pneumonia and diarrhoea equitably: what works and at what cost? *Lancet*, 381 April, pp.1417-1429.

Black, R.E., Lopez de Romana, G., Brown, K.H., Bravo, N., Bazalar, O.G. and Kanashiro, H.C., 1989. Incidence and etiology of infantile diarrhea and major routes of transmission in Huascar, Peru. *American Journal of Epidemiology*, 129, pp.785-799.

Black, R.E., Morris, S.S. and Bryce, J., 2003. Where and why are 10 million children dying every year? *Lancet*, 361 June, pp.2226-2234.

Bryce, J., Victora, C.G., Habicht, J.-P., Vaughan, P. and Black, R.E., 2004. The multi-country evaluation of the integrated management of childhood illness strategy. *American Journal of Public Health*, 94, pp.406-415.

Bryce, J., Victora, C.G. and the MCE-IMCI technical advisors., 2005a. Ten methodological lessons from the multi-country evaluation of integrated

management of childhood illness. *Health Policy and Planning.* 20(1), pp.i94-i105.

Bryce, J., Victora, C.G., Habicht, J.-P., Black, R.E. and Scherpbier, R.W. on behalf of the MCE-IMCI technical advisors, 2005b. Programmatic pathways to child survival: results of a multi-country evaluation of integrated management of childhood illness. *Health Policy and Planning.* 20 (1), pp.i5-i17.

Cairncross, S., Hunt, C., Boisson, S., Bostoen, K., Curtis, V., Fung, I.C .H. and Schmidt, W.P., 2010. Water, sanitation and hygiene for the prevention of diarrhoea*. International Journal of Epidermiology*, 39, pp.i193-205.

Caulfield, L.E., de Onis, M., Blössner, M. and Black, R.E., 2004. Undernutrition as an underlying cause of child deaths associated with diarrhea, pneumonia, malaria, and measles. *American Journal of Clinical Nutrition*, 80, pp.193-198.

Countdown to 2015., 2013. Accountability *for maternal, newborn and child survival.* [online] Available at: http://countdown2015mnch.org/documents/2013Report/Countdown_2013-Update_withprofiles.pdf [Accessed 14 June 2013].

Chopra, M., Mason, E., Borrazzo, J., Campbell, H., Rudan, I., Liu, L., Black, R.E. and Bhutta, Z.A., 2013. Ending of preventable deaths from pneumonia and diarrhoea: an achievable goal. *Lancet*, 381 April, pp.1499-1506.

Chowdhury, Z., 1996. *The politics of essential drugs: the making of a successful health strategy: lessons from Bangladesh.* Dhaka: University Press.

Divon, S.A. and Bergstrøm, C.E., 2012. Unintended consequences of development interventions: a case of diarrhoeal diseases, Ruhiira, Uganda. *Development in Practice*, 22 (1), pp.71-90.

Das, S.K., Nasrin, D., Ahmed, S., Wu, Y., Ferdous, F., Farzana, F.D., Khan, S.H., Malek, M.A., Arifeen, S.E., Levine, M.M., Kotloff, K.L. and Faruque, A.S.G., 2013. Health care-seeking behaviour for childhood diarrhea in Mirzapur, rural Bangladesh, *American Journal of Tropical Medicine and Hygiene*, [online] Available at: http://www.ajtmh.org.pva.uib.no/content/89/1_Suppl/62.full.pdf [Accessed 18 July 2013].

Edgeworth, R. and Collins, A.E., 2006. Self-care as a response to diarrhoea in rural Bangladesh: Empowered choice or enforced adoption? *Social Science and Medicine*, 63, pp.2686-2697.

Ferdous, F., Das, S.K., Ahmed, S., Farzana, F.D., Kaur, G., Chisti, M.J. and Faruque, A.S.G., 2013. The impact of socio-economic conditions and clinical characteristics on improving childhood care-seeking behaviors for families living far from the health facility. *Science Journal of Public Health.* 1(2), pp.69-76.

Fischer Walker, C.L., Rudan, I., Liu, L., Nair, H., Theodoratou, E., Bhutta, Z.A., O'Brien, K.L., Campbell, H. and Black, R.E., 2013. Global burden of childhood pneumonia and diarrhoea. *Lancet*, 381 April, pp.1405-1416.

Gill, C.J., Young, M., Schroder, K., Carvajal-Velez, L., McNabb, M., Aboubaker, S., Qazi, S. and Bhutta, Z.A., 2013. Bottlenecks, barriers, and solutions: results from multicountry consultations focused on reduction of childhood pneumonia and diarrhoea deaths. *Lancet*, 381 April, pp.1487-1498.

Gouws, E., Bryce, J., Habicht, J.-P., Amaral, J., Pariyo, G., Schellenberg, J.A. and Fontaine, O., 2004. Improving antimicrobial use among health workers in first-level facilities: results from the multi-country evaluation of the integrated management of childhood illness strategy. *Bulletin of the World Health Organisation,* 82, pp.509-515.

Gouws, E., Bryce, J., Pariyo, G., Schellenberg, J.A., Amaral, J. and Habicht, J.-P., 2005. Measuring the quality of child health care at first-level facilities. *Social Science and Medicine*, 61, pp.613-625.

Okello, D.O., Konde-Lule, J.K., Lubanga, R.N., Arube-Wani, J. and Lwanga, J., 1998. A review of regulatory framework for the emerging private health sector in Uganda. *Journal of Clinical Epidemiology*, 51(1), p.S41.

Paredes, P., De la Pena, M., Flores-Guerra, E., Diaz, J. and Trostle. J., 1996. Factors influencing physicians' prescribing behaviour in the treatment of childhood diarrhoea: knowledge may not be the clue. *Social Science and Medicine*, 42 (8), pp.1141-1153.

Pariyo, G.W., Gouws, E., Bryce, J., Burnham, G. and the Uganda IMCI impact study team, 2005. Improving facility-based care for sick children in Uganda: training is not enough. *Health Policy and Planning*, 20 (1), pp.i58-i68.

Pathak, D., Pathak, A., Marrone, G., Diwan, V. and Lundborg, C.S., 2011. Adherence to treatment guidelines for acute diarrhoea in children up to 12

years in Ujjain, India – a cross-sectional prescription analysis. *BMC Infectious Diseases*, 11 (32).

Isanaka, S., Elder, G., Schaefer, M., Vasset, B., Baron, E. and Grais, R.F., 2012. Bridging the gap from knowledge to delivery in the control of childhood diarrhoea. *Bulletin of the World Health Organisation*, 90, pp.635-635A.

Jones, G., Steketee, R.W., Black, R.E., Bhutta, Z.A., Morris, S.S. and the Bellagio Child Survival Group, 2003. How many child deaths can we prevent this year? *Lancet*, 362 July, pp.65-71.

Karamagi, C.A.S., Lubanga, R.G.N., Kiguli, S., Ekwaru, P.J. and Heggenhougen, K., 2004. Health provider's counselling of caregivers in the integrated management of childhood illness (IMCI) programme in Uganda. *African Health Sciences*, 4 (1), pp.31-39.

Konde-Lule, J.K., Okello, D.O., Lubanga, R.N. and Arube-Wani, J., 1998. Legislatory framework for private medical practice in Uganda. *East African Medical Journal*, 75(9), pp.544-548.

Konde-Lule, J., Gitta, S.N., Lindfors, A., Okuonzi, S., Onama, V.O. and Forsberg, B.C., 2010. Private and public health care in rural areas of Uganda. *BMC International Health and Human Rights*, 10(29), [online] Available at: http://www.biomedcentral.com/content/pdf/1472-698X-10-29.pdf [Accessed 21 July 2013].

Kotloff, K., Nataro, J.P., Blackwelder, W.C., Nasrin, D., Farag, T.H., Panchalingam, S., Wu, Y., Sow, S.O., Sur, D., Breiman, R.F., Faruque, A.S.G., Zaidi, A.K.M., Saha, D., Alonso, P.L., Tamboura, B., Sanogo, D., Onwuchekwa, U., Manna, B., Ramamurthy, T., Kanungo, S., Ochieng, J.B., Omore, R., Oundo, J.O., Hossain, A., Das, S.K., Amhmed, S., Qureshi, S., Quadri, F., Adegbola, R.A., Antonio, M., Hossain, M.J., Akinsola, A., Mandomando, I., Nhampossa, T., Acácio, S., Biswas, K., O'Reilly, C.O., Mintz, E.D., Berkeley, L.Y., Muhsen, K., Sommerfelt, H., Robins-Browne, R.M. and Levine, M.M., 2013. Burden and aetiology of diarrhoeal disease in infants and young children in developing countries (the Global Enteric Multicenter Study, GEMS): a prospective, case-control study. *Lancet*, 382 July, pp.209-222.

Larson, C.P., Saha, U.R., Islam, R. and Roy, N., 2006. Childhood diarrhoea management practices in Bangladesh: private sector dominance and continued inequities in care. *International Journal of Epidemiology,* 35, pp.1430-1439.

Löfgren, J., Tao, W., Larsson, E., Kyakulaga, F. And Forsberg, B.C., 2012. Treatment patterns of childhood diarrhoea in rural Uganda: a cross-

sectional survey. *BMC International Health and Human Rights*, 12(19), [online] Available at: http://www.biomedcentral.com/content/pdf/1472-698X-12-19.pdf [Accessed 19 July 2013].

Liu, L., Johnson, H.L., Cousens, S., Perin, J., Scott, S., Lawn, J.E., Rudan, I., Campbell, H., Cibulskis, R., Li, M., Mathers, C. and 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 June, pp.2151-2161.

Mahmood, S.S., Iqbal, M., Hannifi, S.M.A., Wahed, T. and Bhuiya, A., 2010. Are "village doctors" in Bangladesh a blessing or a curse? *BMC International Health and Human Rights*, 10(18), [online] Available at: http://www.biomedcentral.com/content/pdf/1472-698X-10-18.pdf [Accessed 28 July 2013].

Mbonye, A.K., 2003. Prevalence of childhood illnesses and care-seeking practices in rural Uganda. *The Scientific World Journal*, 3, pp.721-730.

Meessen, B., Damme, W.V., Tashobya, C.K. and Tibouti, A., 2006. Poverty and user fees for public health care in low-income countries: lessons from Uganda and Cambodia. *Lancet,* 368, pp.2253-2257.

MOH, 2009. *Policy guidelines on infant and young child feeding.* Kampala, Uganda: Ministry of Health [online] Available at: http://www.health.go.ug/nutrition/docs/IYCF_Guidelines.pdf [Accessed 18 July 2013].

MOH, 2010a. *Integrated community case management of childhood malaria, pneumonia and diarrhoea.* Kampala, Uganda: Ministry of Health [online] Available at: http://www.malariaconsortium.org/inscale/downloads/uganda/ICCM-implementation-guidelines.pdf [Accessed 18 July 2013].

MOH, 2010b. Uganda clinical guidelines. *National guidelines on common conditions.* Kampala, Uganda: Ministry of Health [online] Available at: http://www.kampala.cooperazione.esteri.it/utlkampala/Download/Clinical%20Guidelines%202010.pdf [Accessed 18 July 2013].

MOH, 2010c. Health sector strategic and investment plan. *Promoting people's health to enhance socio-economic development.* Kampala, Uganda: Ministry of Health [online] Available at: http://hingx.org:8080/svn/main/eHealth%20Regulation/HEALTH%20SECTOR%20STRATEGIC%20%26%20INVESTMENT%20PLAN.pdf [Accessed 18 July 2013].

Munos, M.K., Fischer Walker, C. and Black, R.E., 2010. The effect of oral rehydration solution and recommended home fluids on diarrhoea mortality. *International Journal of Epidemiology*, 39, pp.i75-i87.

Nanyonjo, A., Nakirunda, M., Makumbi, F., Tomson, G., Källander, K. and the inSCALE Study Group, 2012. Community acceptability and adoption of integrated community case management in Uganda. *American Journal of Tropical Medicine and Hygiene*, 87 (5), pp.97-104.

Quereshi, U.A., Bhat, J.B., Ali, S.W., Mir, A.A., Kambay, A.H. and Bhat, I.N., 2010. Acute salt poisoning due to different oral rehydration solution (ORS) packet sizes. *Indian Journal of Pediatrics,* 77 (6), pp.679-680 [online] Available at: http://imsear.hellis.org/bitstream/123456789/142605/1/ijp2010v77n6p679.pdf [Accessed 31 July 2013].

Rice, A.L., Sacco, L., Hyder, A. and Black, R.E., 2000. Malnutrition as an underlying cause of childhood deaths associated with infectious diseases in developing countries. *Bulletin of the World Health Organisation*, 78 (10), pp.1207-1221.

Ross-Degnan, D., Backes-Kozhimannil, K., Payson, A., Aupont, O., LeCates, R., Briggs, J. and Chalker, J., 2008. *Improving community use of medicines in the management of child illness: a guide to developing interventions.* Submitted to the U.S. Agency for International Development by the Rational Pharmaceutical Management Plus Program. Arlington, VA: Management Science for Health

Sack, D.A., 1991. Use of oral rehydration therapy in acute watery diarrhoea: a practical guide. *Drugs,* 41 April, pp.566-573.

Schedl, H.P. and Clifton, J.A., 1963. Solute and water absorption by the human small intestine. *Nature*, 199, pp.1264-1267.

Schultz, S.G. and Zalusky, R., 1964. Ion transport in isolated rabbit ileum. II. The interaction between active sodium and active sugar transport. *The Journal of General Physiology*, 47, pp.1043-1059.

Social Marketing Company, 2010. *Sales Network.* Dhaka: Bangladesh. [online] Available at: http://www.smc-bd.org/sales.html [Accessed 18 July 2013].

Sundewall, J., Forsberg, B.C. and Tomson, G., 2006. Theory and practice: a case study of coordination and ownership in the Bangladesh health SWAp. *Health Research Policy and Systems*, (4), pp.1-8.

Tawfik, Y., Nsungwa-Sabitii, J., Greer, G., Owor, J., Kesande, R. and Prysor-Jones, S., 2006. Negotiating improved case management of

childhood illness with formal and informal private practitioners in Uganda. *Tropical Medicine and International Health*, 11 (6), pp.967-973.

Thapar, N. and Sanderson, I.R., 2004. Diarrhoea in children: an interface between developing and developed countries. *Lancet*, 363 February, pp.641-653.

Tulloch, J., 1999. Integrated approach to child health in developing countries. *Lancet*, 354 (2), pp.SII16-20.

UDHS, 1989. *Uganda demographic and health survey 1988/1989.* Columbia, Maryland, USA: Macro Systems Inc. [online] Available at: http://www.measuredhs.com/pubs/pdf/FR41/FR41.pdf [Accessed 7 July 2013].

UDHS, 1996. *Uganda demographic and health survey 1995.* Calverton, Maryland, USA: Uganda Bureau of Statistics (UBOS) and Macro International Inc. [online] Available at: http://www.measuredhs.com/pubs/pdf/FR69/FR69.pdf [Accessed 7 July 2013].

UDHS, 2001. *Uganda demographic and health survey 2000/2001.* Calverton, Maryland, USA: Uganda Bureau of Statistics (UBOS) and ORC Macro. [online] Available at: http://www.measuredhs.com/pubs/pdf/FR128/FR128.pdf [Accessed 7 July 2013].

UDHS, 2007. *Uganda demographic and health survey 2006*. Calverton, Maryland, USA: Uganda Bureau of Statistics (UBOS) and Macro International Inc. [online] Available at: http://www.measuredhs.com/pubs/pdf/FR194/FR194.pdf [Accessed 7 July 2013].

UDHS, 2012. *Uganda demographic and health survey 2011*. Uganda Bureau of Statistics (UBOS), Kampala. Uganda: UBOS and Calverton, Maryland: ICF International Inc. [online] Available at: http://www.measuredhs.com/pubs/pdf/FR264/FR264.pdf [Accessed 7 July 2013].

UNICEF, 2012a. *Levels and trends in child mortality, estimates developed by the United Nations (UN) Inter-agency Group for Child Mortality Estimation.* New York: UNICEF. [online] Available at: http://www.childinfo.org/files/Child_Mortality_Report_2012.pdf [Accessed 12 March 2013].

UNICEF, 2012b. *Pneumonia and diarrhoea: tackling the deadliest diseases for the world's poorest children*. [online] Available at:

http://www.unicef.org/media/files/UNICEF_P_D_complete_0604.pdf [Accessed 28 March 2013].

UNICEF, 2012c. *Committing to child survival: A promise renewed*. New York: UNICEF. [online] Available at: http://www.unicef.org/videoaudio/PDFs/APR_Progress_Report_2012_final.pdf [Accessed 14 June 2013].

UNICEF, 2013. *The state of the world's children. About the state of the world's children. Statistics. Under-five mortality rankings.* [online] Available at: http://www.unicef.org/sowc2013/files/Stat_Tables_SOWC_2013_Under-five_mortality_rankings_EN.pdf [Accessed 7 August 2013].

Victora, C.G., Bryce, J., Fontaine, O. and Monasch, R., 2000. Reducing deaths from diarrhoea through oral rehydration therapy. *Bulletin of the World Health Organisation,* 78(10), pp.1246-1255.

Vashishtha, V.M., 2001. Oral Rehydration Salts (ORS) solution use in India: Why are doctors not still convinced? *BMJ Rapid Response.* July 17 [online] Available at: http://www.bmj.com/rapid-response/2011/10/28/%E2%80%98oral-rehydration-salts-ors-solution-use-india-why-are-doctors-not-still-c [Accessed 31 July 2013].

Wahed, T., Kaukab, S.S.T., Saha, N.C., Khan, I.A., Khanam, F., Chowdhury, F., Saha, A., Khan, A.I., Siddik, A.U., Cravioto, A., Qadri, F. and Uddin, J., 2013. Knowledge of, attitudes toward, and preventive practices relating to cholera and oral cholera vaccine among urban high-risk groups: findings of a cross-sectional study in Dhaka, Bangladesh. *BMC Public Health*, 13, pp.242.

WHO, 1999. *IMCI planning guide. Gaining experience with the IMCI strategy in a country.* Geneva: WHO. [online] Available at: http://whqlibdoc.who.int/hq/1999/WHO_CHS_CAH_99.1_eng.pdf [Accessed 25 July 2013].

WHO, 2005a. *The treatment of diarrhoea. A manual for physicians and other senior health workers.* Geneva: WHO. [online] Available at: http://whqlibdoc.who.int/publications/2005/9241593180.pdf [Accessed 31 May 2013].

WHO, 2005b. *Diarrhoea Treatment Guidelines for Clinic-Based Healthcare Workers.* Geneva: WHO. [online] Available at: http://whqlibdoc.who.int/publications/2005/a85500.pdf [Accessed 25 March 2013].

WHO, 2008. *Integrated Management of Childhood Illness*. Geneva: WHO. [online] Available at: http://whqlibdoc.who.int/publications/2008/9789241597289_eng.pdf [Accessed 21 July 2013].

WHO, 2013a. *WHO Model List of Essential Medicines for children*. 4th list. Geneva: WHO. [online] Available at: http://www.who.int/medicines/publications/essentialmedicines/4th_EMLc_FINAL_web_8Jul13.pdf [Accessed 21 July 2013].

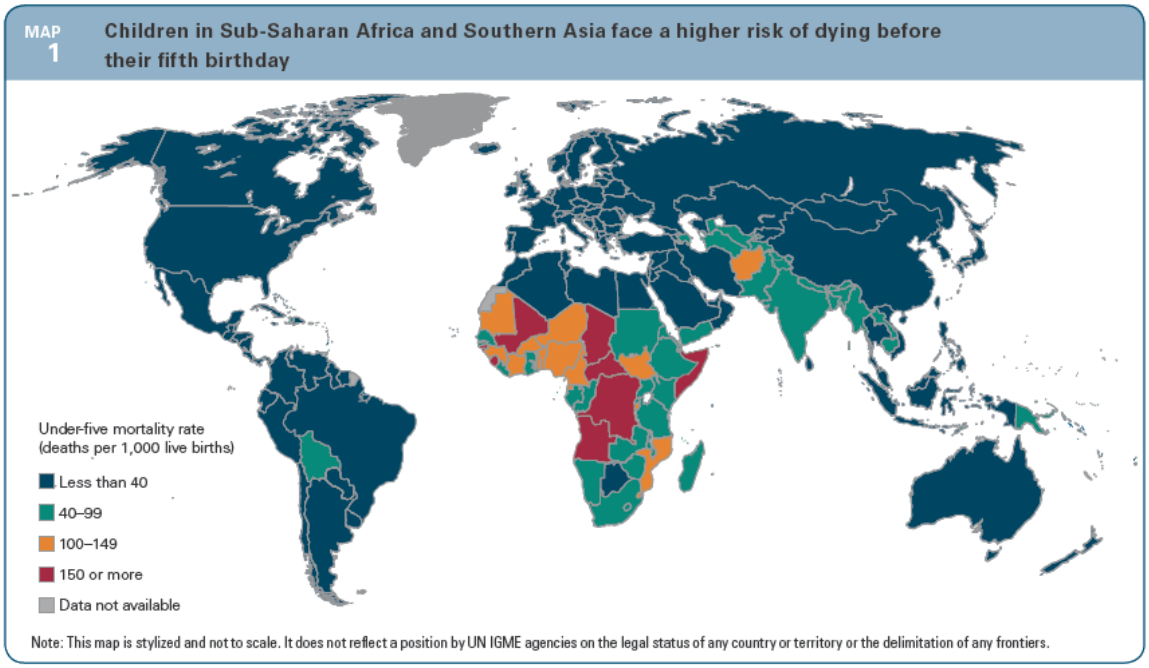
WHO, 2013b. *Health expenditure series.* Geneva: WHO. [online] Available at: http://apps.who.int/nha/database/DataExplorerRegime.aspx [Accessed 9 August 2013].

Wilson, S.E., Morris, S.S., Gilbert, S.S., Mosites, E., Hackleman, R., Weum, K.L.M., Pintye, J., Manhart, L.E. and Hawes, S.E., 2013. Scaling up access to oral rehydration solution for diarrhea: Learning from historical experience in low- and high-performing countries. *Journal of Global Health*, 3(1), June, [online] Available at: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3700030/pdf/jogh-03-010404.pdf [Accessed 18 July 2013].

Worldbank, 2013. *Data. GDP growth (annual %).* [online] Available at: http://data.worldbank.org/indicator/NY.GDP.MKTP.KD.ZG [Accessed 10 August 2013].

Appendices

Appendix 1: Children in Sub-Saharan Africa and Southern Asia face a higher risk of dying before their fifth birthday



(UNICEF, 2012a, p.11)

Appendix 2: Oral rehydration solution (ORS)

For more than 25 years WHO and UNICEF have recommended a single formulation of glucose-based ORS to prevent or treat dehydration from diarrhoea irrespective of the cause or age group affected. This product has contributed substantially to the dramatic global reduction in mortality from diarrhoeal disease during this period. Despite this success, research to develop an "improved" ORS has continued. This would be an ORS that would be at least as safe and effective as standard ORS for preventing or treating dehydration from all types of diarrhoea, but would, in addition, reduce stool output or have other important clinical benefits. One approach has been to reduce the osmolarity of ORS solution to avoid possible adverse effects of hypertonicity on net fluid absorption. This was done by reducing the solution's glucose and salt (NaCl) concentrations .

The studies[13] that evaluated this approach showed that the efficacy of ORS solution for treatment of children with acute non-cholera diarrhoea was improved by reducing the sodium concentration to 75 mEq/l, the glucose concentration to 75 mmol/l, and the total osmolarity to 245 mOsm/l. The need for unscheduled supplemental IV therapy in children given this solution was reduced by 33% when compared with standard ORS (311 mOsm/l). In a combined analysis of this study and studies with other reduced osmolarity ORS solutions (osmolarity 210-268 mOsm/l, sodium 50-75 mEq/l) stool output was also reduced by about 20% and the incidence of vomiting by about 30%. The 245 mOsm/l solution also appeared to be as safe and at least as effective as standard ORS for use in children with cholera.

Based on the greater efficacy of reduced osmolarity ORS solution, especially for children with acute, non-cholera diarrhoea, WHO and UNICEF now recommend that countries use and manufacture the following formulation in place of the previously recommended standard ORS solution.

Table A: Composition by weight and molar concentrations of reduced (low) osmolarity ORS solution.

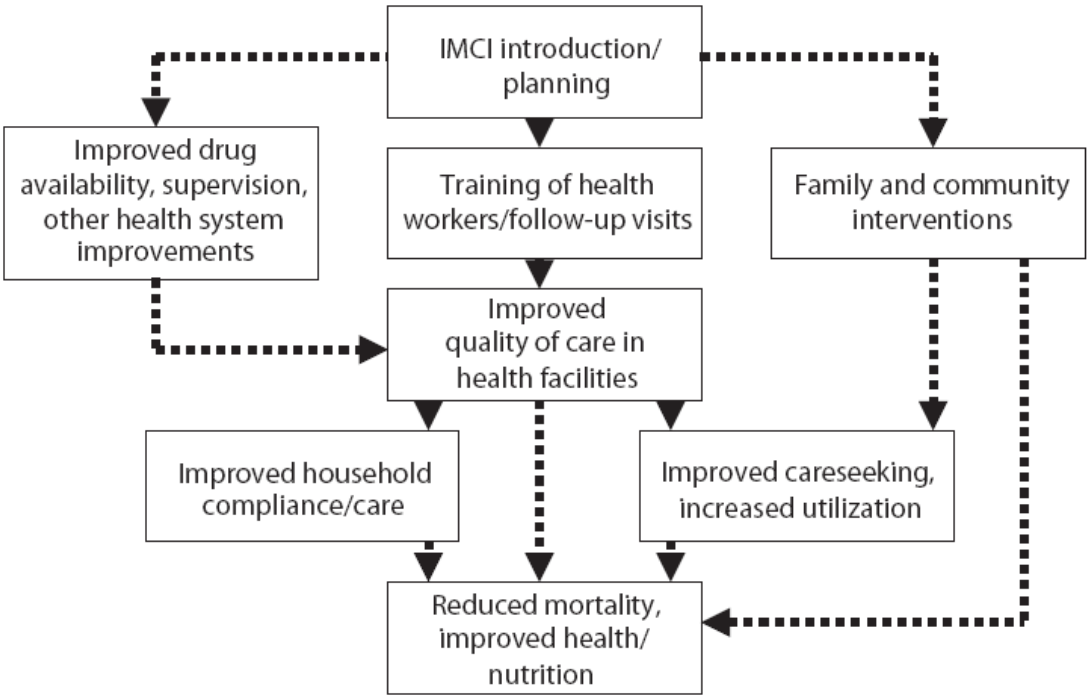
Reduced osmolarity ORS	grams/litre	Reduced osmolarity ORS	mmol/litre
Sodium chloride	**2.6**	**Sodium**	**75**
Glucose, anhydrous	**13.5**	**Chloride**	**65**
Potassium chloride	**1.5**	**Glucose, anhydrous**	**75**
Trisodium citrate, dihydrate	**2.9**	**Potassium**	**20**
		Citrate	**10**
		Total Osmolarity	**245**

When prepared and given correctly, ORS solution provides sufficient water and electrolytes to correct the deficits associated with acute diarrhoea. Potassium is provided to replace the large potassium losses associated with acute diarrhoea, especially in infants, thus preventing serious hypokalaemia. Citrate is provided to prevent or correct base deficit acidosis. Glucose is essential because, when it is absorbed, it promotes the absorption of sodium and water in the small intestine. This is true irrespective of the cause of the diarrhoea. Without glucose, ORS solution would be ineffective.

[13] Reduced osmolarity oral rehydration salt formulation – A report from a meeting of experts jointly organised by UNICEF and WHO-UNICEF House, New York, USA, 18 July 2001 (WHO/FCH/CAH/01.22).

(WHO, 2005a, p.33)

Appendix 3: Outline of the Integrated Management of Childhood Illness impact model



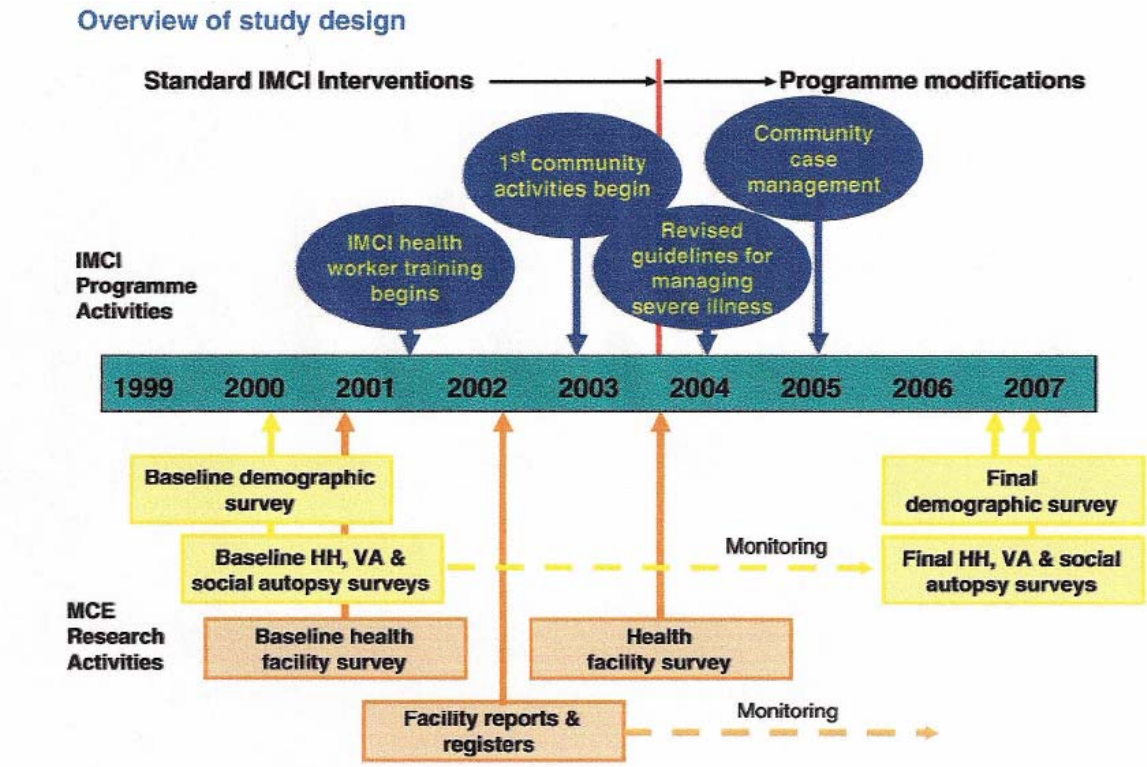
(Bryce et al., 2004, p.407)

Appendix 4: Components of the IMCI strategy

Component of the IMCI strategy	Possible activities in early implementation phase
Improving case management skills of health staff	● Adaptation of generic guidelines and training materials on integrated management of childhood illness at the first-level health facility ● IMCI training courses for first-level facility health workers ● Follow-up visits after training to reinforce skills of health workers ● Guidelines and training to improve skills at referral-level facilities
Improving the health system	● Ensuring availability of drugs needed for IMCI through improving supply and management ● Improving referral pathways and services ● Improving organization of work at health facilities ● Improving supervision of health services ● Linking IMCI classifications and the health information system
Improving family and community practices	● Providing health education and counselling to mothers about feeding children and care of a sick child, with improved counselling skills of health workers ● Ensuring that consistent messages about child health are given to families ● Implementing community-based interventions to promote child health and development

(WHO, 1999, n.p.)

Appendix 5: Time frame for implementing of the multi-country evaluation (MCE) of IMCI in Bangladesh



(Bryce et al., 2005a, p.i99)