EXTERNALITIES PRODUCED BY INTERPLAY BETWEEN DEVELOPMENT INTERVENTIONS: IMPACT ON HEALTH IN THE MILLENNIUM VILLAGES PROJECT, RUHIIRA, UGANDA.

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For Hege, Daniel and Naomi,
my beacons in the dark

Declaration

I, Shai A. Divon, declare that this thesis is a result of my research investigations and findings. Sources of information other than my own have been acknowledged and a reference list has been appended. This work has not been previously submitted to any other university for award of any type of academic degree.

Signature……..
Date……

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Abstract

Achieving multiple development goals by means of several interventions produces a number of synergies and trade-offs (externalities) affecting the desired impact. The aim of this study is to develop and test a conceptual framework which will enable the identification of externalities produced by Millennium Village Project (MVP) interventions towards a specific health issue: diarrheal diseases. This issue was chosen since it incorporates challenges within health, environment and development. A basic conceptual approach was used as a sensitizing concept to identify the relevant components of MVP interventions in Ruhiira, Uganda. Data was gathered through a number of qualitative methods including: transect walks, semi-structured interviews, non-participant observation, focus group discussions and collection of secondary data. A number of sectors for data collection were identified including education, health and infrastructure. In the education sector the school feeding program coupled with current infrastructure and water challenges, may result in the creation of reservoirs for diarrheal pathogens. In the health sector, practices associated with infrastructure challenges may result in cross infections. In the infrastructure sector, failure of some communities to meet their maintenance obligations results in contamination of protected water sources. Poor or inadequate infrastructure and knowledge application deficiencies result in increased risk of acquiring diarrheal pathogens in markets, schools, HCs' and households. The results indicate that a number of externalities produced by certain project interventions create challenges that reduce the efficiency and effectiveness of impacts of other interventions, thus impairing the ability to achieve the Millennium Development Goals (MDGs). This indicates that the suggested framework can be used to evaluate MVP interventions, and to correct unwanted externalities, improving project efficiency and effectiveness, thus contributing to the long term sustainability of the project.

Acronyms

ACTS	Africa Community Technical Service; Canadian NGO at work in Uganda
CDC	Center for Diseases Control and Prevention: U.S. Department of Health and Human Services.
CHW	Community Health Worker
CPR	Common Pool Resource; A resource to which the regulation of access is difficult, and using the resource subtracts from the total amount available to other users.
DALY	Disability-Adjusted Life Year
DHS	Demographic and Health Survey
EAEC	Enteroaggregative E. coli
EcoSan	Ecological Sanitation – A type of latrine based on the principles of separation and recycling of waste in ways which are safe and promote sanitation, hygiene and health.
EI	Earth Institute at Columbia University
EIEC	Enteroinvasive E. coli
EPA	Environmental Protection Agency (U.S.)
EPEC	Enteropathogenic E. coli
ETEC	Enterotoxigenic E. coli
FGD	Focus Group Discussion
HC	Health Center
HH	Household
HUS	Hemolytic-uremic Syndrome
HQ	Headquarters
IPD	Inpatient Department

IRB	Institutional Review Board – an ethical committee which reviews research procedure relevant for human subjects in order to determine if they are consistent with international guidelines and ethics. An IRB approval is needed before a researcher is allowed to proceed with a research.
IV	*intra-venous*
LC	Local Council – a title of local community leaders, usually attributed with a number between 1and 5. 1 designates the lowest level of community leader; 5 designate the highest level of community leader.
MD	Medical Doctor
MDG	Millennium Development Goals
MVP	Millennium Villages Project
OCV	Oral Cholera Vaccine
OPD	Outpatient Department
ORS	Oral Rehydration Solution
ORT	Oral Rehydration Treatment
STEC	Shiga toxin producing E. coli
TB	Tuberculosis
UNDP	United Nations Development Program
WHO	World Health Organization

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1. Introduction

> *"A world that is complex, often ambiguous, evincing constant change as well as periods of permanence; where action itself, although routine today may be problematic tomorrow; where answers become questionable and questions produce ultimately questioned answers"* – A. Strauss on the nature of the universe (1993: 19).

1.1 Background

During a lecture on "*health and development"*, we were presented with an example[1] of a development project implemented in a remote village, targeting access to water for achieving multiple Millennium Development Goals relating to sanitation, hygiene and consequently health. The creation of a new water source in the village changed the patterns of use. Before the project introduced a readily accessible water source, people had to travel long distances to reach water. This had implications on the way and frequency with which water was used (e.g. bathing, washing dishes, and washing clothes). Once a water source was readily available, the patterns and locations of water use changed. Water was now accessible in the village and was used indoors, which led to the dumping of grey and black water in the streets, resulting in new environmental and health hazards around homes.

This example demonstrates how good intentions can result in unintended consequences that create new development challenges. The underlying reason for this relates to the quote above: The world is a complex system, integrating several natural processes with constructions created by humans in order to shape their lives. Since the system is integrated, changing elements in one process can lead to changes in others, resulting in unpredicted outcomes and unintended consequences.

This basic concept is the main pillar upon which this study rests. The assumption that development initiatives incorporate manipulation of processes of a complex integrated system, leads to the preliminary hypothesis that unintended consequences (also referred to in this study as externalities), will manifest through this manipulation. Externalities, which can be positive or negative, can affect the efficiency and effectiveness of interventions.

This study aims at identifying both the current and potential future negative externalities produced by a development project. The main focal point chosen is a health issue: diarrheal diseases. As such, this study will attempt to uncover externalities produced directly by

[1] The example is taken from Nawab & Nyborg (Forthcoming).

development interventions, as well as externalities caused by the interplay between interventions, affecting elements that can contribute to the contraction of diarrheal diseases.

Diarrheal diseases were chosen for a number of reasons: Firstly, diarrheal diseases are easily manageable. Nevertheless, they are a central cause of morbidity and mortality, especially in developing countries (see Chapter 3). Secondly, diarrheal diseases relate mostly to poor sanitary and hygiene conditions. These conditions are targeted by several different development interventions, and therefore can affect diarrheal diseases. Thirdly, the environment plays a major role when it comes to diarrheal diseases, since the pathogens are mostly water-borne and/or foodborne and can find their way into these mediums by a number of routes (see Chapter 3). These three elements relate health, environment and development to each other, reflecting the complexity of integrating systems.

The Millennium Villages Project (MVP) is a development project that applies a holistic package of interventions in a chosen location in order to meet the UN Millennium Development Goals (MDG) by 2015[2]. The application of several interventions, affecting a number of sectors and creating new infrastructure and new behavioral patterns amongst the population in order to improve their life, can result in multiple unanticipated externalities, and therefore provide an ideal site for the conduction of this study.

1.2 Objectives

This study explores externalities produced by development interventions, and focuses on the elements that help create these externalities. It examines the interplay of elements within an intervention, and the interplay of these elements between interventions (see Chapter 2).

The main objective of this study is to create a basic conceptual framework, tested and amended based on analysis of data collected in the field. The purpose of the fieldwork is to facilitate the identification of externalities produced both directly and in the interplay between development project interventions towards a chosen issue.

In order to reach this objective, a number of targeted objectives were formulated to direct data collection:

- To identify possible externalities produced by the current solutions relevant for diarrhea mitigation in the village.

[2] See Chapter 5 for detailed background on the MDGs and MVP.

- To assess the long term synergies and tradeoffs that the current practices are producing in relation to environmental sustainability.
- To identify how the local population and decision makers understand the interventions, and assess how they perceive the future benefits (and costs) of a given solution.

As mentioned above the chosen issue which is the focus of this study is diarrheal diseases. The identification of externalities, assessment of synergies and trade-off produced towards sustainability, and the current and future perception of benefits by the local population and decision makers, will be studied through their impact on diarrheal diseases.

1.3 Significance

According to Jeffrey Sachs (2008), one of the leading thinkers behind the MVP, from the many challenges that the twenty-first century will present to the inhabitants of this planet, sustainable development will take centre-stage. Ending extreme poverty and environmental protection are interconnected goals, and need to be achieved in integration. It is therefore necessary to consider how actions introduced to end extreme poverty may affect the future sustainability of the environment. Reaching a development goal, while unintentionally creating conditions that may negatively affect other issues, such as health, will result in more challenges for development.

Designing interventions to reach development goals must take into consideration local culture, knowledge, institutions, political stand-points, personal rationalities and goals of involved people, as well as physical and environmental dynamics. These elements often reflect different expertise and scientific disciplines. Bringing all the elements together can contribute to successful and sustainable development interventions. This study aims at providing a contribution to the interdisciplinary integration that is needed to design, monitor and evaluate development interventions. The approach used here will help create a basic framework that will facilitate the exposure of unintended externalities, thus contributing to future design considerations for development interventions and monitoring.

At the local level, this study has uncovered externalities in a MVP village that result in increased risk for contraction of diarrheal diseases. These externalities are often manageable by introducing small, immediate changes that eliminate them directly. This can result in immediate benefits to the local people. It will further help the local project in planning future

interventions and help the MVP to monitor, evaluate and introduce long-term changes to capture, identify and rectify future externalities both within this project and at other sites.

1.4 Outline

The thesis is divided into two main parts:

Part 1 is the background for the study, and comprises three chapters (1-3). Chapter 1 is the general introduction, presenting the idea of this study, its objectives and significance. Chapter 2 presents the conceptual framework which forms the scientific background for this study. This chapter outlines the basic ontological and epistemological assumptions guiding the design and strategy of the study. Chapter 3 presents a literature review relating to diarrheal diseases, sanitation and hygiene. The information in this chapter was used as preparation before field-work began in order to identify and plan the initial areas of field investigation.

Part 2 is the research part of this study, and comprises six chapters (4-9). Chapter 4 provides the specific background for the study including a general presentation of the MVP and the study area. Chapter 5 presents the methodology used for data collection and analysis, criteria for evaluation and ethical considerations. Chapter 6 outlines the data collected in the field work and analysis. Chapter 7 is a discussion of the data and the analysis. Chapter 8 provides concrete recommendations to the MVP and Chapter 9 concludes the study.

2. Conceptual Framework

This chapter clarifies the approach to this study. It is divided into four sections, beginning with a description of the ontological and epistemological assumptions which inform the choice of methodology used during the study. The second section is devoted to conceptual frameworks and their importance to an inquiry. The third section presents the basic conceptual framework used as a sensitizing concept during this study. A modification of the basic conceptual framework based on the dialectical process in the field, with the aim of creating a more suitable framework for the MVP will be addressed in the discussion chapter of this study.

2.1 Ontology and Epistemology

One of the most difficult tasks for a researcher is to define his position in relation to the different philosophical views of the nature and form of reality, and the nature of knowledge. Terminological confusion is one of the major obstacles in the process of defining ones epistemological and ontological assumptions (Barkin 2003: 326). Not only that these questions are highly complex, the answers to these questions usually refer to terms which may have different meanings in different disciplines or fields of research (Toma 1996: 3ff; Barkin 2003: 329-332). This is particularly so in inter-disciplinary work.

Paradigms are frameworks which encompass a set of basic beliefs, the pattern of thought (Merriam-Webster 1999) through which we understand and interpret our world and the way its different elements interact (Guba & Lincoln 1994: 107). A paradigm is constructed from our ontological, epistemological and methodological assumptions. Our ontology informs our epistemology and the entailed methodology. Paradigms play an important role when it comes to decisions adopted regarding the approaches and methods of an inquiry. The way the form and nature of reality and the nature of knowledge is viewed affect the way we approach and interpret it (Guba & Lincoln 1994:107-108). Paradigms can be defined by the answers they give to ontological, epistemological and methodological questions, and are constructed in such a way that an answer to one question shapes the answer to the other questions (ibid.)

There is an inherit problem in choosing between paradigms for research. Paradigms encompass a set of beliefs framed through the ontological and epistemological assumptions embedded into them. These specific formulations can create challenges when an interdisciplinary effort is undertaken. Different disciplines tend to subscribe to a certain ontological and epistemological position, and again, different researchers within the different disciplines may have different positions. As remarked by Guba & Lincoln (1994: 107), no consensus exists on which of the existing paradigms reflect best the form and nature of reality, the nature of knowledge and the ways they should be explored. This is an ongoing debate in the philosophy of science, and will most likely never be resolved.

Endorsing paradigms as the absolute way of defining the ontological and epistemological position may not reflect accurately the approach of this study. I will therefore begin by describing the basic assumptions of this study, and try to correlate it with different perspectives in the philosophy of science.

The basic view adopted here is of the Earth as an integrated system. This view is a relatively new notion, which began to receive serious attention in the 1970s with the publication of the Gaia hypothesis (Lovelock 1979). This position regards the physical, chemical and biological processes of the earth as interlinked in complex dynamics. These dynamics include living organisms as active participants in complex systems of forcing and feedbacks. The social constructions set up by human beings are viewed as an integral part of the Earth System and not as a foreign element in a natural system (Steffen et al 2005: 7). Social systems are constructed and organized by humans, often around a set of conditions dictated by the natural environment (Vatn 2005: 14-19). Since the beginning of time the natural environment has played a major role in shaping the cognitive notions of humans, influencing beliefs, values, practices, rules and choices. In the modern era, social systems are a significant factor further affecting other processes of the Earth System. The role of humans is a dominant one, simply because we are the only species which developed capabilities to alter elements of the Earth System by will (both consciously and unconsciously). We are also the only species that has developed the capability to understand the effects of our actions on the Earth System. Currently, many people are involved in actively trying to alter our choices in order to limit, halt or reverse what we perceive as negative, often unintended, effects on the other elements of the Earth System (for example climate change, loss of biodiversity and desertification).

Both the physical and social components of each process of the Earth System vary in space and throughout time. This creates different contexts; different realities for different stakeholders in different locations on the Earth at different times (both historically and presently). These realities are in constant state of change[3] because of the interaction between the different elements of the System, of which, the human constructed social systems play a major role (Strauss 1993: 19). When a researcher sets to study certain phenomena in a specific location, the object of investigation comprises unique traits, true to the location and time of investigation. In addition, the interpretations of these traits are constrained by the social construction affecting the investigator. In order to offset these biases as much as possible, the researcher must interact with his objects of study in order to understand the complexity of the structure, and consistently adapt the interpretation to the actual circumstances (Guba & Lincoln 1994: 111).

The Earth System comprises the physical, chemical, biological and social processes which have traditionally been studied by different scientific disciplines, each approaching their respective field of study with fundamentally different ontologies, epistemologies and methodologies (Cupchik 2001). Some disciplines (mostly related to exact sciences) tend to adopt a *positivistic* paradigm[4] (Boghossian 2006: 7), viewing the world as constructed by a set of laws which can be studied objectively by a researcher through mostly quantifiable means (Guba & Lincoln 1994; Bryman 2004). Other disciplines, chiefly among them the Social Sciences, tend to adopt a *postmodern* philosophy, subscribing to other *inquiry* paradigms such as *Critical Theory* or *Constructivism* (Ibid.). The challenge in this study is to adopt a stance that incorporates ontological and epistemological assumptions that reflect the complexity of the Earth System as a whole which is greater than the sum of the disciplinary approaches (Savory 1999: 17-27). In other words, an approach is needed which not only reflects the assumptions of the different disciplines that study the different processes of Earth System, but also integrates them into a whole to reflect the complex dynamics of that system.

The scope and scale of this study does not allow an in-depth analysis and reflection on the different philosophical positions on ontology and epistemology. It seems clear though, that in

[3] It can be argued that there are periods of stability, where change is not present. I would argue against, emphasizing that change is constant; it is our perception of time that results in the interpretation of stability. In reality, change as a result of interactions between physical, chemical, biological and social processes occurs constantly.

[4] It is important to emphasize that many scientists from these disciplines do not subscribe to *Positivism*; Other paradigms are used in all sorts of sciences, and the reference here is only meant do describe the most common approach accepted by *natural sciences* (Cupchik 2001).

order to conduct an interdisciplinary study that encompasses the complex dynamics of the Earth System, bridges need to be built between different ontologies and epistemologies (Cupchik 2001; Proctor 1998). This is necessary in order to adopt methods of inquiry and interpretation that will reflect most accurately the effects of the integration of processes of the Earth System. It will not be possible to reconcile different philosophical approaches in this study, but different approaches will be used and the reason for choosing one approach or another will be given. To a philosopher, these choices may reflect incommensurable ontological and epistemological assumptions. Nevertheless, I will try to explain the reasons behind adopting certain approaches, and refer to literature where such a combination of approaches is suggested.

The basic ontological stance adopted here will be consistent with the idea of *Social Constructivism* described by Berger & Luckmann (1967: 151), according to which existing social structures are the objective reality into which individuals are born. This reality and the embedded norms, values and rules of the pre-existing social structures, as well as the dominant individuals who mediate the structure, play a crucial role in shaping the individual (Vatn 2005: 29). I will emphasize the importance of this ontology in later chapters, referring to social structures which are introduced into a new setting, say through a development initiative, and the effects of the interplay between the "new" and "old" social structures.

According to this ontology, the reality presented by a researcher is not an objective description, but a description of social reality, constructed through the mediation of previous knowledge, social context and the objective of the inquiry; knowledge is therefore viewed as intermediate (Bryman 2004: 17). This assertion entails a *Relativistic* outlook, where different elements, including the interpretation of these elements, are subjected to a number of components, such as location, time, culture, institutions, circumstances and previous knowledge. These elements form a mental construction which reflects a subjective level of knowledge or sophistication, but are not "more or less true in the absolute sense" (Guba & Lincoln 1994: 110-111) and therefore knowledge is said to be intermediate (Bryman 2004: 17). But as pointed out by some, *Social Constructivism* does not necessarily entail *Relativism* (Vatn 2005: 55; Proctor 1998). There is a need to distinguish between what is referred to as *Radical Relativism*[5] and other, milder versions of *Relativism* (Corbin & Strauss: 2008: 4; Proctor, 1998: 359). According to Proctor (ibid.) "*Radical Relativism* states that all truth and

[5] Proctor (1998: 359) referring to Stout (1988) uses the term *Radical Relativism* in the positive sense, stating that in the negative sense it is referred to as *Nihilism.*

related claims are equally correct", and therefore renders context as immaterial. This is the main criticism of *Relativism* by many who reject it completely (Wright 2008: 379; Boghossian 2006: 82-84). Certainly not all social constructivists subscribe to *Radical Relativism* (e.g. Corbin & Strauss: 2008: 4; Vatn 2005: 55; Proctor 1998: 360). As a matter of fact, Ladd (1982: 161) indicates that the ascription of *Radical Relativism* to *Social Constructivism* is done chiefly by anti-constructivists, while most social constructivists distance themselves from this definition[6]. Milder forms of *Relativism* are preferred by social constructivists. These forms of *Relativism* are unavoidably embedded into other philosophical positions, such as *Critical Realism* and *Pragmatism*, of which the former is widely acknowledged by Social Constructivists (Vatn 2005: 55; Proctor 1998: 352). Milder forms of *relativism* float between *absolutism*[7] on one side where "truth is one", and *Radical Relativism* on the other, where "anything goes" (Proctor 1998: 359-360).

Realism, sometimes called *Naïve* or *Empirical Realism*, is the assertion that an external reality exists objectively and is apprehensible to us by the use of appropriate methods (Bryman 2004: 12; Deutch 1997: 96; Guba & Lincoln 1994: 109). This epistemic position is difficult to consolidate with the ontology of *Constructivism* according to which the realities presented by researchers are constructions bounded by the social context, previous knowledge and the internalized views of reality that forms the individual, and therefore represents a specific version of reality and not the objective external one (Bryman 2004: 17). The assumptions of *Critical Realism* deviate from *Empirical Realism*, by recognizing that there is a socially constructed reality, in addition to a natural world that is separate from it. This means that there is a world out there which is separate from our perception of it, but our ability to understand this world is limited due to our predisposed biases, resulting in our socially constructed reality. Knowledge is therefore acquired through an interaction between subject and object, and results in "partial truths" (Proctor 1998: 361), in contrast to the "anything goes" notion of *Radical Relativism* (see also Vatn 2005: 55). To illustrate this point, Proctor (ibid.) refers to Sayers (1985: 176) analogy taken from optics, where reality is viewed through lenses. Lenses can either focus or obscure reality, but remains our means by which to view it. The only way we can assess the version of reality we are viewing is through experience and practice. The reality we see is restricted to the way we view it (Bryman 2004: 12). Therefore

[6] Ladd actually uses the term *ethical relativism* which he describes as the same thing that Proctor (1998) calls *Radical Relativism*.

[7] *Absolutism* is regarded as the opposite of *Relativism* and is "The view that truth (value, reality) is objectively real, final and eternal" (Angeles 1992:1 quoted in Proctor 1998: 359).

an effort to identify the social structures that generate our understanding of the natural world is key to change and achievable through "practical and theoretical work of social sciences" (Bhaksar 1989: 2).

Defining myself as a critical realist-social constructivist, I view reality as a set of constructions formed on the basis of the interaction between the social world and natural world. These constructions are dynamic and in a constant state of change. Social structures shape individuals, which in turn may shape and reshape social structures[8]. Vatn (2005: 54) coins the term *Methodological Institutionalism* referring to the dialectic process between institutions and individuals. This process affects the perception of reality, and in turn the interpretation given to it. This does not mean that a concrete physical reality does not exist outside our perception of it, only that our interpretation of this reality is affected by our social constructions, and therefore cannot be separated from it.

2.2 Conceptual Frameworks and their Importance for Inquiry

A conceptual framework can be viewed as a map; a guide which allows one to navigate through research in a manner which is consistent with one's basic assumptions, values and definitions (Dewy 1938: 401-404). A map is a relative representation of reality. It allows users to navigate accurately if a number of basic assumptions, values and definitions are observed (such as scale, projection and direction). Still a map is not an accurate representation of reality, but a tool that provides approximation, allowing a user to interpret certain information and transfer it to surroundings.

Similarly, conceptual frameworks serve as means allowing researchers to navigate their study according to their basic ontology and epistemology, and at the same time, clarify the concepts used to others who wish to understand what guided the thought and methodology of the researcher (Kaplan, 1964: 269).

Conceptual frameworks should be flexible and subject to constant revision. Knowledge acquired through research and experience will result in development and adaption of a conceptual framework to serve as an evolving guiding tool that allows a better understanding of reality and that could be used for future research.

[8] This statement does not imply that social structures preceded individuals or vice versa. Here I revert to Vatn (2005: 53) who refers to this as the "chicken and egg" problem.

2.3 The Basic Conceptual Framework of this Study

2.3.1 Background

As stipulated by Sanchez *et al.* (2007: 16775), the MVP recognizes that achieving the MDGs requires a multifaceted approach. This is because the underlying factors that cause poverty, hunger, diseases, inequality, environmental degradation and access to resources are embedded in the Earth System as it is described above. It is the interface between the different elements of the Earth System that results in conditions that causes the problems addressed by the MDGs.

The approach adopted by the MVP recognizes that in order to achieve the MDGs a number of tailored interventions should be applied at a selected site (Konecky & Palm, 2008: 1-2). The MVP implements specific solutions, based on identified needs and challenges of the locations where the project is undertaken. To achieve the MDGs, social and environmental changes are introduced, and will therefore cause multiple, sometimes unintended, transformations to the system (immediate and/or in the future).

The MVP applies a multiple interventions strategy at a selected location in order to demonstrate how the MDGs can be achieved in a sustainable manner within the time set by the UN (by year 2015; Sachs 2008: 238). Because the Earth System is complex and involves multiple interlinked processes, the basic hypothesis of this study asserts that the application of one intervention to achieve one or a set of MDGs, may cause unintended effects, referred to here as *externalities*, that will inevitably affect the efficiency and effectiveness to reach other MDGs targeted by other project interventions. The main objective is to develop an approach, grounded in the data accumulated from the field, that will help assess how to recognize and then reduce or eliminate these externalities[9] either before applying an intervention, or during the monitoring phase of the project.

Since this study is both limited in scale and scope, specific MDGs are chosen as the target of investigation towards which the externalities are produced. The project interventions are then analyzed in order to identify the elements in them that interfere[10] with the achievements of these MDGs.

[9] The emphasis here in on negative externalities; It is possible that positive externalities are produced, and in this case, the aim would be to replicate and reproduce the externalities.

[10] Or assist if the externality is positive.

2.3.2 Interventions as Institutions

An *intervention* in the context of the MVP is an action which is aimed at reaching a target that will contribute towards reaching the objective, i.e. achieving the specified MDGs. The MVPs interventions take place in a chosen location, where conditions dictate that a change is needed in order to reach the MDGs. The local communities are involved in a participatory manner in order to identify the priorities for development within four strategic sectors[11] chosen by the MVP in order to reach the MDGs (Konecky & Palm 2008: 4-5).

The MVP's approach aims at demonstrating how results on a local level can be achieved based on international goals. The recommendations of the MVP are designed to "enhance the capacity of communities to plan, act, participate in, monitor and effectively manage the development process" (Konecky & Palm 2008: 4). As mentioned above, the MVP implements multiple interventions at a chosen location.

Institutions are structures designed and used by humans in order to systematize interactions (Ostrom 2005: 3). Scott (1995: 33) defines institutions as "…cognitive, normative and regulative structures and activities that provide stability and meaning to social behavior". This definition is consistent with the MVP's own description of principles and guidelines[12], as published in Chapter 2 of the Millennium Villages Handbook (see Konecky & Palm 2008: 4ff). In order to facilitate the data collection and analysis, an intervention can be defined as an institution, and therefore some concepts from the study of institutional interactions may be used.

2.3.3 Conceptual Framework for the Study of Institutional Interactions

The basic concept used in this study derives from the assessment of *International Regimes* (Underdal 2002). An *International Regime* is a set of "principles, norms, rules, operating procedures and institutions, usually centered around one or more international agreements, governing particular issues in world politics" (Chasek, Brown & Downie 2006: 337).

In order to evaluate the effectiveness of a regime, Underdal (2002: 5-7) distinguishes between three objects of assessment (Figure 2.1): In the formation phase of the regime: (1) **Output** of decision making, i.e. norms, principles and rules that form the regime; in the implementation

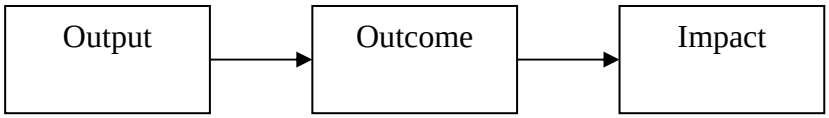
[11] Agriculture, health, education and infrastructure.

[12] Such as: institutionalize participation; strengthen the communities' capacity for collective action; develop community bases information systems; build up a cadre of change agents and develop their capacity, participation and gender relation expertise; enhance an enabling policy environment that supports community development (Konecky & Palm 2008: 5).

phase of the regime: (2) the **Outcome** – referring to the change in the human behavior; and (3) the **Impact** – the change inflicted on the target parameters of the regime.

This concept is applied in this research towards the MVP interventions. An intervention can be disaggregated into the three components described above. Each object affects the next in a causal pathway:

Figure 2.1: Objects of assessment (adapted from Underdal 2002: 7)

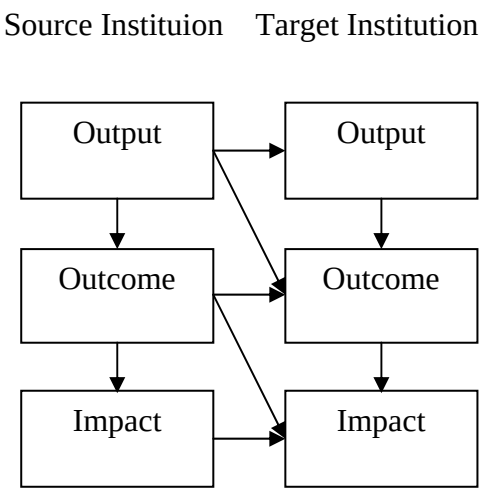


The intention in this research is to use this framework to study how interactions between interventions create *externalities* that ultimately reduce the ability to achieve a specific goal, in this case specific MDGs. Oberthür and Gehring (2006: 19-51) take Underdal's concepts a step forward intending to create a basic conceptual framework that will facilitate the study of institutional interactions (ibid: 19). Their idea is based on disaggregating institutions into the three components describe above, and then analyzing the interaction between these institutions at each level:

- Output level interaction – between rules and decision-making process
- Outcome level interaction – between the behavior of relevant actor groups
- Impact level interaction – between the target variable of the agreements involved

As stated above, the output of an institution leads to outcomes which eventually affect the impacts. An institution is designed mainly for a vertical flow (Oberthür and Gehring 2006: 42ff) i.e. work as an independent unit. But each level may also have an effect on other institutions, for instance, rules of one institution may affect the rules or behavior of actor groups targeted by another institution. This may in turn, reduce the overall effectiveness of that institution to reach its objectives and may introduce new elements that have not previously been taken into account. Figure 2.2 shows the causal mechanism of institutional interactions.

Figure 2.2: Causal mechanism of institutional interaction (adapted from Oberthür and Gehring 2006: 43)



It is important to emphasize here that the framework described above was originally designed for studying interactions between macro-level institutions, such as between global regimes on climate change, e.g. the potential effects of the adoption of The Kyoto Protocol on the effectiveness of Convention on Biological Diversity (Oberthür and Gehring 2006: 33). In this study, some of the ideas and concepts are transferred in order to study interactions between MVP interventions at a specific location. The causal mechanisms described in Figure 2.2 are slightly different from those described by Oberthür and Gehring (2006: 42-44). Oberthür and Gehring (ibid.) believe that cross level interaction are theoretically impossible or empirically highly improbable[13]. I believe that on the level of MVP interventions, cross level interaction is possible and occurring in the field, simply because the actors targeted by each intervention are the same. This point will be demonstrated in the data, analysis and discussion chapters of this study.

A second important point is that the above described framework was used as a sensitizing concept in this study, an initial guide to direct the observation and data collection. It is my belief that this framework reflects interaction in a general manner. It is anticipated that a more

[13] Oberthür and Gehring remarks are directed at causal mechanisms relevant for the study of macro-level institutional interactions, and actors in international arenas. This assumption is not addressed in this study, since the concept is adapted for a different use .The object of study in this research has different properties. Here, we deal with a number of institutions in a specific location, all designed to affect the same actor groups at the same time; this may explain the reason for cross level interaction in this case.

detailed framework will emerge from the experience in the field. An attempt to construct a framework which reflects how interactions between MVP interventions create externalities that reduce their overall effectiveness when it comes to achieving the MDGs is presented in the discussion chapter of this study.

3. Literature Review

3.1 Defining Diarrhea

Diarrhea is a term describing a symptom complex characterized by the frequent passage of watery stools, usually indicating gastrointestinal infection (Clasen *et al.* 2008). The WHO (2008a) defines diarrhea as the passage of three or more watery stools per twenty-four hour period. There are over twenty enteropathogens responsible for acute diarrhoea, including bacteria, viruses and parasites (O'Ryan *et al.* 2005). Diarrhea causes a rapid loss of fluids, nutrients and electrolytes that can lead to severe dehydration and death if left untreated (Clasen *et al.* 2008; O'Ryan *et al.* 2005).

3.1.1 Morbidity and Mortality

Approximately 10.6 million children aged less than five years die each year from various health hazards and diseases (Bryce *et al.* 2005). Diarrheal diseases account for approximately 18% of the deaths of children aged five or less (ibid.), making it the second most important cause of death after acute respiratory infections (WHO 2005a). The WHO (2005) estimates approximately 1.8 million yearly deaths of children aged five or less due to diarrheal diseases. Children in developing countries bear approximately 68% of the global burden of diarrheal diseases (Bartram 2003).

3.1.2 Causes

Acquisition of diarrheal pathogens by humans occurs mainly through fecal-oral contact. This transmission usually occurs through direct contact between people (person-to-person) or with contaminated water, food, or feces (Ejmot *et al.* 2008; Wilson 2005).

There are several underlying conditions that lead to the exposure of humans to diarrheal pathogens, most are results of poverty conditions[14] that lead to difficult or no access to clean water, poor sanitary conditions, lack of personal hygiene, lack of education and difficult access to medical care (O'Ryan *et al.* 2005). Poverty conditions leading to malnutrition increase vulnerability to diarrheal pathogens by increasing immunodeficiency (Trevett & Carter 2008).

[14] One clear indication for this assertion is that deaths of children aged five or less due to diarrheal diseases is almost eradicated in developed countries while it is still a leading cause of death in developing countries (WHO 2002).

3.1.2.1 Pathogens and Water Related Transmission Routes

There are currently more than twenty identified pathogens associated with acute diarrhea in children including viruses, bacteria and enteropathogenic parasites (O'Ryan *et al.* 2005; See Table 3.1 below for an overview of the most common diarrhea causing pathogens). These pathogens have water-related transmission routes[15] and can be classified as water-borne and water-washed[16] (Cairncross & Feachem 1993: 4-10). Different pathogens can be transmitted through more than one water-related route. Water-borne transmission of a pathogen occurs when an individual drinks infected water, while water-washed transmission refers to the acquisition of a pathogen that could otherwise be avoided by the use of a volume of water for hygienic purposes (ibid: 4-7).

Some of the pathogens are endemic in some areas and epidemic in others (Lopez *et al.* 2008; Wilson 2005; Naidoo & Patric 2002; Svenungsson *et al.* 2000; Guerrant *et al.* 1990). Even though most pathogens are present worldwide, people in poor countries more frequently develop the severe infections associated with them (O'Ryan *et al.* 2005; Guerrant *et al.* 1990). As mentioned above, young children in developing countries aged less than five years are more susceptible to these pathogens for reason which will be described below.

3.1.2.2 Food Related Transmission Routes

While most transmission routes of diarrheal pathogens are predominantly water related, some are also foodborne (Southwick 2004: 190). The term *foodborne disease* refers to diseases that are acquired through the ingestion of food (WHO 2007c). Foodborne diseases are often referred to as emerging diseases since they have become a major public health concern in recent years (WHO 2007c; WHO 2002a).

[15] But they may also be foodborne – see below.

[16] There is a logic-problem related to the definitions of water-related transmission routes: *Water-borne* is a pathogen that is acquired through drinking, *water-based* is a pathogen that spends a part of its cycle in the water and *water-related vector borne* is a pathogen whose life cycle depends on water related vector. These three concepts stand in contrast to the term *water-washed*. *Water-washed* relates to pathogens that can be avoided by using a large volume of water for hygienic purposes. While the first three categories are connected to water related acquisition, the fourth is connected to water scarcity.

Table 3.1: Common Pathogens causing acute diarrhea and their transmission routes (adapted from Cairncross & Feachem 1993 and O'Ryan et al. 2005).

Pathogen		Water-Related Route	Transmission
Viruses	*Rotavirus*	Water-borne/water-washed	Fecal-oral, person-person
	Norovirus	Water-borne/water-washed	Fecal-oral, person-person
	Sapovirus	Water-borne/water-washed	Fecal-oral, person-person
	Astrovirus	Water-borne/water-washed	Fecal-oral, person-person
	Enteric adenovirus	Water-borne/water-washed	Fecal-oral, person-person
Bacteria	*Diarrheagenic E. coli*	Water-borne/water-washed	Fecal-oral, person-person, animal-person
	Shigella spp.	Water-borne/water-washed	Fecal-oral, person-person
	Salmonella enteritidis	Water-borne/water-washed	Fecal-oral, person-person, animal-person
	Campylobacter spp.	Water-borne/water-washed	Fecal-oral, person-person, animal-person
	Vibrio cholerae	Water-borne/water-washed	Fecal-oral, person-person
Parasites	*Giardia lamblia*	Water-borne/water-washed	Fecal-oral, person-person
	Entamoeba histolytica	Water-borne/water-washed	Fecal-oral, person-person
	Cryptosporidium parvum	Water-borne/water-washed	Fecal-oral, person-person, animal-person
	Cyclospora cayetanensis	Water-borne/water-washed	Fecal-oral, person-person
	Isospora belli	Water-borne/water-washed	Fecal-oral, person-person, animal-person

According to the WHO (2007c), the major foodborne pathogens responsible for diarrheal diseases are: *Salmonella, Campylobacter, Vibrio cholerae and E. coli* (Southwick 2004: 192). The acquisition of these pathogens can occur through the ingestion of the following (ibid.):

- Raw milk
- Chocolate
- Eggs
- Poultry and other meats (raw or undercooked)
- Rice
- Vegetables
- Millet
- Various type of sea food

Foodborne illnesses related to the above pathogens can be relatively easily prevented, provided certain guidelines are followed. The most predominate ways to avoid foodborne diseases are to keep the food clean, thoroughly cook it and practice personal hygiene. Raw food should be avoided and not mixed with cooked food (WHO 2007d).

3.1.2.3 Pathogens and diseases

The lengthy list of pathogens and associated diseases does not allow for full presentation in this study. This section will therefore contain a description of the pathogens that are predominantly responsible for the high burden of diarrheal diseases in developing countries (WHO 2008a).

A. Vibrio Cholerae

Cholera is a disease caused by two predominant strains of bacterium *Vibrio cholerae* (*V.cholerae O1* and *V.cholerae O139*). The bacteria colonize the intestinal lining, and produce a toxin called choleragen. The toxin causes an influx of fluids into the intestines, resulting in an acute onset of diarrhea (Moore 2007: 352). The massive loss of liquids and nutrients caused by cholera can lead to complications including severe dehydration, hypotensive shock, kidney failure and death (Moore 2007; Naidoo & Patric 2002).

Cholera is one of the main causes of epidemics in Africa (Naidoo & Patric 2002). It is characterized by sudden severe outbreaks that affect both children and adults. It can cause death, even in healthy adults, in a very short period of time (WHO 2007a). The disease is particularly severe for pregnant women, and may cause miscarriage (Lopez *et al.* 2008; Naidoo & Patric 2002). In endemic areas, cholera affects all age groups, but seems to mostly affect young children under five years of age (Lopez *et al.* 2008).

The disease occurs when humans ingest the pathogen either through contaminated drinking water, food or through unsanitary contact with other infected humans (Naidoo & Patric 2002). The disease is most prevalent in least developed countries; outbreaks in developed countries are usually associated with travelers who ingested contaminated water or food while visiting a developing country (Moore 2007; WHO 2007a).

Poor sanitary conditions (e.g. lack of latrines) that lead to the contamination of water sources with fecal matter are the primary cause of infections, as well as poor hygienic habits (e.g. not washing hands) leading to the contamination of stored water, food and other humans (Lopez *et al.* 2008; Moore 2007; Naidoo & Patric 2002). These conditions are mostly prevalent in

poor socio-economic area. They are aggravated by a range of circumstances, including natural disasters, war, displacement and crowded living conditions[17] (Lopez *et al.* 2008; Naidoo & Patric 2002).

B. Diarrheagenic Escherichia coli

Escherichia coli (*E. coli*) is a bacterium which is a facultative anaerobic flora that inhabits the human intestines as well as the systems of other-warm blooded animals (Nataro & Kaper 1998). *E. coli* is predominately symbiotic with the human host, but has developed strains which are responsible for the most common gastrointestinal diseases (Moore 2007; Nataro & Kaper 1998).

There are a number of groups of diarheagenic *E. coli*: Shiga toxin producing *E. coli* (formerly referred to as enterohemorrhagic EHEC: Janda and Abbot 2006: 24); enteropathogenic (EPEC); enterotoxigenic (ETEC); enteroaggregative (EAEC) and enteroinvasive (EIEC) (O'Ryan *et al.* 2005). These are responsible for a number of clinical syndromes in humans (Table 3.2). They are the most common cause of diarrheal diseases in children, accounting for 30-40% of all reported episodes in developing countries (Nataro & Kaper 1998).

Diarrheagenic *E. coli* diseases occur through the ingestion of pathogens resulting in their colonization and infection of the intestines and/or colon (Janda & Abbott 2006: 47). There are a number of transmission routes associated with each particular category and respective strains (Nataro & Kaper 1998). In general, the diseases occur when the pathogen is ingested through contaminated drinking water (either by human or animal excreta), food contaminated by polluted water, food originating from a contaminated animal source such as milk or raw meat and unsanitary contact with infected humans (Moore 2007; O'Ryan *et al.* 2005; WHO 2005b; Cairncross & Feachem 1993).

[17] A recent example is the cholera outbreak in Zimbabwe which is a direct cause of a political crisis and general failure of the country's governance system. Among other things, the political crisis led to a severe shortage of drugs and unpaid salaries to medical personnel, which resulted in empty clinics and hospitals. Coupled with the collapse of other governance systems which led to the contamination of water sources, the culmination has resulted in what is described as the worlds' largest cholera outbreak, leading at the time of writing to over 4000 deaths (CDC 2009).

Table 3.2: Diarrheagenic E. coli groups and the respective clinical syndrome (adapted from O'Ryan et al. 2005, Nataro and Kaper 1998 & Janda and Abbot 2006).

Diarrheagenic E. coli	Associated clinical syndrome	Nature of diarrhea
Shiga toxin producing (STEC)	Hemorrhagic colitis and hemolytic-uremic syndrome (HUS) caused by the E. coli serotype 0157:H7	Watery (early), bloody (later)
Enteropathogenic (EPEC)	Watery diarrhea in infants	Watery
Enterotoxigenic (ETEC)	Travelers' diarrhea	Watery
Enteroaggregative (EAEC)	Acute and chronic diarrhea	Watery
Enteroinvasive (EIEC)	Bloody diarrhea and fever (indistinctive from Shigella infections)	Watery (early), bloody (later)

C. Salmonella

Salmonella is a bacterium which is a facultative anaerobic flora of the human and animal intestines. There are many serotypes of the *Salmonella* organism; some of these cause Salmonellosis, which has three predominant syndromes: Typhoid fever (caused by *Salmonella typhi*), enteric fever (caused by *Salmonella paratyphi*) and gastroenteritis (caused by more than 2300 serotypes of *Salmonella*). Gastroenteritis is the most predominant syndrome of Salmonellosis (Moore 2007).

Salmonellosis causes a variety of symptoms including fever, chills, vomiting and diarrhea. These symptoms may lead to dehydration, and can be dangerous in elderly and very young humans. In some cases, Salmonellosis can cause bloodstream infection (WHO 2005c; CDC 2003).

Salmonellosis is predominately a foodborne disease contracted through the ingestion of food of animal origin, such as milk, eggs, poultry and beef infected with *Salmonella* bacteria (O'Ryan *et al.* 2005). Other sources of infection are contaminated drinking water, food which comes in contact with contaminated drinking water (CDC 2003) and food which comes in contact with contaminated animal manure or human excreta, such as green vegetables (Moore 2007; WHO 2005c). Human-to-human contamination may occur where poor hygienic and sanitary conditions prevail (Cairncross & Feachem 1993).

D. Shigella

Shigella is a gram-negative bacterium which can spread efficiently from cell to cell (Southwick 2004:193). The bacteria produces shiga toxin, which results in an inflammation caused by ulcers in the bowl mucosa (ibid.). Because of its resistance to acid, Shigella can survive for prolonged periods in the gastric juices, which allows for a relatively small numbers of bacteria (200 individual) to cause a disease (ibid.).

There are four predominant serologic groups of Shigella:

- Serotype A – Shigella *dysenteriae*
- Serotype B – Shigella *flexeneri*
- Serotype C – Shigella *boydii*
- Serotype D – Shigella *sonnei*

Shigella spreads typically from person-to-person through the fecal-oral route. The pathogen is usually acquired from unsanitary and unhygienic conditions (contaminated objects such as toilet seats), but also through water and food contaminated through contact with feces (Southwick 2004: 193). The transmission of the pathogens is also attributed to flies, and epidemics have been correlated to fly infestations (ibid.).

E. Rotavirus

Rotavirus is a wheel-shaped virus, a member of the *reovirus* family, which causes diarrhea by affecting the absorption capabilities of epithelial cells (Southwick 2004: 205). As a viral disease, diarrhea caused by *Rotavirus* is self-limited (Southwick 2004: 204).

Rotavirus primarily affects infants younger than three; it is believed that by the age of three most children have acquired antibodies against the pathogen (Southwick 2004: 205).

Rotavirus is a resistant organism, and can endure hand-washing and most kinds of disinfectants, but can be inactivated with chlorine. Its ability to survive on most kinds of surfaces and in water for prolonged periods of time renders it highly infectious. It is one of the most common pathogen responsible for diarrheal diseases in young infants, especially in developing countries (Southwick 2004: 204-205).

Since it is self-limited, viral diarrhea treatment is mostly supportive, aimed at preventing dehydration by restoring nutrient loss through rehydration therapy and care (Southwick 2004: 204).

3.2 Mitigation and Prevention of Diarrheal Diseases

3.2.1 General

Diarrheal diseases are caused by pathogens that are common in nature. They exist within humans, within domesticated animals present around humans and in the physical environment. There are many conditions that lead to circumstances where humans come into contact with diarrhea-causing pathogens. There are also many ways to prevent the contraction of disease from these pathogens, ways to avoid the contraction of the pathogen, as well as many ways to treat a disease - or symptoms of a disease - that has infected a human. But there are also circumstances which render prevention and treatment difficult, as well as circumstances that enhance the severity of a disease in humans. Almost all obstacles for prevention and mitigation stem from poor socio-economical conditions (Clasen *et al* 2008; Ejemot *et al.* 2008; Clasen *et al.* 2006; Harting *et al.* 2006). Poor socio-economical conditions affect peoples' ability to acquire necessary knowledge relevant for both prevention and mitigation. Even if knowledge is not an obstacle, poor socio-economical conditions affect peoples' ability to apply their knowledge and seek solutions. Poor socio-economical conditions also lead to poor physical conditions, which render the natural immune system of the body more vulnerable to the acquisition of pathogens and recovery from a disease. In the following sections, I describe prevention and mitigation methods for diarrheal diseases as well as the complexity of the system which renders these methods difficult to apply and monitor. This complexity originates from the integration of the physical environment (location, resources, climate, and infrastructure), social environment (rules, norms, culture, knowledge and governance) and economical constraints (poverty, access to knowledge, access to food, access to medicine, poor health). These elements have clear implications for the solutions chosen, their application, and efficacy their efficiency.

This section begins with an attempt to define *sanitation and hygiene*. Once the definitions used for the purpose of this study have been clarified, an overview on the current solutions used for mitigating and preventing diarrheal diseases will be reviewed. The review will be divided into three main parts: medical solutions, sanitary solutions and solutions relating to hygiene.

3.2.2 Defining *Sanitation* and *Hygiene*

There is confusion, both in the literature and in the field, as to the differences between sanitation and hygiene. In the field, professionals who deal with issues related to sanitation

and hygiene, often do not consider the exact definition, and find it challenging when asked to distinguish between them (Clasen *et al*. 2008: 1-2). Since these terms are often used in this study, it is important to review some definitions, and try to draw a clear line between the two.

In the literature one can find several definitions for *sanitation* and *hygiene*[18]:

- The WHO (2008b) defines *sanitation* as "the provision of facilities and services for safe disposal of human urine and feces...The word *sanitation* also refers to the maintenance of hygienic conditions, through services such as garbage collection and wastewater disposal."
- According to Wikipedia (2008), *sanitation* "is the hygienic means of preventing human contact from the hazards of wastes to promote health".
- Webster's dictionary (2003) defines *sanitation* as "the act of rendering sanitary; the science of sanitary conditions; the preservation of health; the use of sanitary measures; *hygiene*".
- The EPA (2008) states that sanitation is the "Control of physical factors in the human environment that could harm development, health, or survival".

The term *hygiene* is defined:

- The WHO (2008d) adopts Webster's definition for *hygiene* and terms it "the science dealing with the establishment and maintenance of health in the individual and the group. It includes the conditions and practices conducive to health".
- In Wikipedia (2009), "*Hygiene* refers to the set of practices associated with the preservation of health and healthy living…The scientific term *hygiene* refers to the maintenance of health and healthy living".

Careful reading of these definitions reveals that there are nuances that may create some confusion. It seems that *sanitation* is the infrastructure that facilitates *hygiene*. The WHO, EPA and Wikipedia's definitions of *sanitation* may be understood as infrastructure: "facilities and services" (WHO); "control of physical factors in the environment" (EPA); "hygienic means of preventing contact" (e.g. gloves - Wikipedia). According to these definitions, *sanitation* can be understood as, for example, sinks and soap, but not necessarily the act of washing hands or wearing gloves. This interpretation is induced by the reference in the

[18] I have chosen to present definitions of major organizations which influence the current agenda and widely quoted public sources such as dictionaries and online references.

definitions to “facilities”, “physical factors” and “means of preventing contact”. Webster’s definition of *sanitation*, however, includes behavior in the definition: “The act of rendering sanitary….; *hygiene*”. This is an example of the confusion that prevails around the interpretations of references to *sanitation* and *hygiene*, and therefore to clarifying the distinction between them.

When it comes to defining *hygiene*, the WHO adopts Webster's definition for *hygiene* focusing on what seems to be behavioral aspects, but also infrastructure: “…conditions and practices conductive to health” (WHO). This implies that *sanitation* is a term which can come under *hygiene*, since “conditions…conducive to health” can be interpreted as infrastructure. According to Wikipedia, “Hygiene refers to practices associated with ensuring good health”. Here it seems that *hygiene* refers to practices, i.e. behavior and not infrastructure.

The use of these terms is important in order to avoid misunderstanding and contribute to increased clarity in this field. It is not possible here to conduct an in-depth review of this terminology in the literature, which is a subject that merits separate attention. Based on my interpretation of the many sources consulted during this study as well as consultation with relevant scholars, I distinguish between these two terms in the following way: *Sanitation* is encompassed in the concept of *hygiene*. It refers to the infrastructure that contributes to the promotion of *hygiene.* The act of hand-washing, for example, is a behavior that can be practiced - and may be enhanced - with the help of a facility (infrastructure), but existence of the facility is not strictly necessary as one can wash hands without having a hand washing facility[19]. This may lead to the conclusion that the term *sanitation* has little meaning without *hygiene*, since one can have a hand-washing facility and soap, but still not use it. It is the behavior, the practice of *hygiene* that creates the desired effect of health promotion. *Sanitation* facilitates this goal.

Considering the EPAs’ definition, *sanitation* has an additional purpose which is to transfer waste to the environment in such a way that there will be no (or minimal) effects on environmental parameters (i.e. not pollute, not change ecosystems or contribute to any effects that may result in health hazards). According to this definition, *sanitation* means facilities to improve human *hygiene*, but also facilities that do this while ensuring environmental sustainability. This does not eliminate the behavioral factor embedded into the term *hygiene*,

[19] One can argue that water will be indispensable for hand-washing (unless artificial decontaminants are used). But water does not necessarily mean infrastructure since in theory any natural spring or stream may be used for this purpose.

since without appropriate surveillance, compliance and use of facilities by humans, the infrastructure has little meaning.

3.2.3 Solutions for Mitigating and Preventing Diarrhea

3.2.3.1 Medical Solutions for Diarrhea Mitigation and Prevention

Medicine[20] and medical solutions can be defined in various ways. In this paper medical solutions for diarrhea will be defined as the application of medical knowledge[21] in order to diagnose, cure, mitigate, treat and prevent diarrheal diseases. Under this definition, I include educational efforts aiming at facilitating self diagnosis of diarrheal episodes, and self administration of medicine, such as Oral Rehydration Solutions (ORS). This definition will be used in order to differentiate medical solutions for diarrhea from other solutions, such as sanitation and hygiene.

Medical interventions introduced to prevent and/or resolve diarrheal diseases can be divided into four categories:

1. Vaccination: to prevent the occurrence of a disease.
2. Diagnosis: for discovering the cause of the disease.
3. Administration of medicine: to resolve the cause and/or the symptoms of the diseases.
4. Education[22]: to facilitate self diagnosis where possible and to reach a decision to administrate medicine (mainly ORS) or seek medical help.

McMahan & Dupont (2007) review the history of infectious diarrhea management from early history to date. There are four main ways to manage acute diarrhea episodes medically (ibid: 726ff):

- Oral Rehydration Therapy (ORT) aimed at reintroducing lost fluids, minerals and electrolytes.

[20] The Science of *medicine* is defined here as "*the branch of health science and the sector of public life concerned with maintaining or restoring human health through the study, diagnosis and treatment of disease and injury"* (http://en.wikipedia.org/wiki/Portal:Medicine).

[21] By medical knowledge I mean Knowledge acquired through the science of *medicine.*

[22] The term education here refers only to efforts relating to *medical solutions for diarrhea mitigation and prevention*. Other educational efforts relating to solutions other that *medical intervention* will be described in their respective categories below.

- Administration of anti-motility agents in order to reduce the ability of the intestines to contract.
- Administration of anti-secretory agents in order to reduce or prevent secretion of the gastrointestinal tract.
- Antimicrobial agents aimed at reducing the ability of pathogens to cause the disease or to destroy the pathogens.

There are certain problems associated with use of anti-motility, anti-secretory and antimicrobial medication. The first two types of medication are relatively expensive and thus not affordable for poor people. These types of medication help prevent the massive loss of fluids and nutrients associated with a disease, but they do not address the pathogens. They are mostly used when there is a pressing need to stop the symptoms of diarrhea, i.e. when travelers need to have freedom of movement (McMahan & Dupont 2007). Anti-microbial drugs attack the pathogens, but have other use-related problems in addition to their expensive cost. In developed countries it is difficult to obtain antimicrobial drugs without a prescription from a medical doctor. This is because many of these drugs are effective against specific pathogens, and should be linked with them before use, which implies thorough investigation before administration. In addition, frequent use of anti-microbial agents can eventually result in the development of resistant strains of pathogens, and therefore they are not given unless there exists a certain degree of certainty that they are needed. In developing countries, poor people often do not have access to medical doctors; hence, they do not receive or know about anti-microbial agents even though it is possible for them to obtain these agents over the counter without a prescription. In many cases, even if a doctor prescribed an anti-microbial drug to a patient in a developing country, the cost of the agent would inhibit people from being able to purchase it. Actual availability of drugs can also be problematic.

ORT is very effective in preventing deaths related to the massive loss of fluids and nutrients associated with diarrheal diseases (McMahan & Dupont 2007). The ORTs are relatively inexpensive and easy to obtain either from clinics or over the counter in various stores. In order to use ORTs, people need to know that they are available and when/how to administer them. This implies a system that educates people on these matters. Ideally they should also know that ORTs do not cure diarrhea but only alleviate the symptoms of it.

There are a number of vaccinations that provide different degrees of protection against enteric diseases. Currently, vaccines against *Vibrio cholerae, Salmonella* (serotype *Typhi),* and

Rotavirus are available, and several other vaccinations for other pathogens are in development (Herrmann 2006).

There are a few types of vaccines against Cholera (Lopez *et al.* 2008; Moore 2007; McMahan & Dupont 2007; WHO 2005d), but only three oral cholera vaccines (OCV) are licensed for use (Lopez *et al.* 2008). The use of OCV is most practical for visitors to endemic area since their effectiveness ranges between 3-6 months: it is less useful as a prevention strategy for inhabitants of endemic areas (Moore 2007: 352). The WHO recommends mass vaccinations using these vaccines only in cases of complex emergencies (WHO 2007a). As mentioned above, vaccines against the serotype *Typhi* type of *Salmonella* and against Rotavirus are available, effective and recommended by the WHO (Anderson 2008; WHO 2007b; WHO 2005d).

In developing countries, diagnosis and education measures for the treatment and prevention of diarrheal diseases are effective, but depend on investment and resources. Diagnosis and treatment by health professionals imply the presence of health professionals and facilities such as clinics and labs to carry out work. Educating people for self diagnosis and administration of self treatment requires the initial presence of professionals; training and availability of resources, such as ORTs; teaching aids and actual purchase power in order to obtain drugs.

3.2.3.2 Mitigation and Prevention of Diarrheal Diseases through Sanitation

As defined above, *sanitation* is viewed as infrastructure installed to facilitate good health, and as such encompasses many different elements from soap to health centers. It is worth noting that there are numerous types of infrastructure using different technologies for achieving efficient and effective hygienic practices, and it will not be possible to review them, nor their intended impact in detail. This section will therefore focus on categories and not on specific technologies. There will be, however, reference to studies which review different technological solutions and their studied impact on diarrheal diseases. The purpose here is to familiarize the reader with the categories that were used to facilitate the field work.

The etiology and epidemiology of diarrheal diseases specified above is material to understanding the types of sanitary measures necessary to mitigate and prevent their occurrence. Knowing which pathogens cause diarrhea, understanding their modes of

transmission and the underlying causes that result in human exposure to them, are important steps in order to design interventions, and adjust infrastructure to current needs in specific locations.

Considering the fecal-oral route through which these pathogens are mostly acquired by humans, and the common mediums through which the pathogens come in contact with humans (water, food, persons, and animals), leads to number of possible basic *sanitary* interventions (Classen *et al.* 2008; Ejmot *et al.* 2007; Classen *et al.* 2006; Fewtrell *et al.* 2005):

- Excreta disposal
- Water Supply
- Water quality
- Hand sanitation

Health centers (HC), labs and the supply of medicine can also be viewed as infrastructure that among other things, contributes to diarrhea mitigation and treatment, and can come under the term *sanitation*.

The infrastructure that helps mitigate and prevent the contraction of diarrheal disease can be (and often is) viewed through a sectoral outlook, i.e. each type of infrastructure in its own category. In reality, however, these categories are interconnected, e.g. excreta disposal interventions need to consider contact of feces with water sources, which is relevant for water infrastructure interventions. Attention - or the lack of attention - to overlaps of infra-structural sectors is, therefore, also important when seeking to identify how and in what ways infrastructure contributes to the contraction (or prevention) of diarrhea.

Excreta disposal is aimed at reducing direct and indirect contact of humans with feces (Classen *et al.* 2008: 4). Even though most studies focus on interventions eliminating human contact with human feces (Fewtrell *et al.* 2005), it should be emphasized that human contact with animal feces is also a major reason for contracting diarrheal pathogens (see above). Most interventions focusing on human feces focus on the elimination of open defecation, and include many different types of latrines and elements associated with them, such as septic tanks and sewers (Classen *et al.* 2008; Fewtrell *et al.* 2005). There are many different types of latrines, ranging from a simple bucket to more complicated technologies that separate urine and excreta and provide measures for recycling (e.g. *Eco-San* latrines). Adapting a certain

type of solution for excreta disposal to a given location depends on many factors, including local practices, costs and desired impact (Frengstad & Banks 2002; Brandberg 1997; Pickford 1995; Roy 1984; Ryan 1983).

Water supply interventions, at both the public and household levels, aim at improving distribution and supply of water, especially where it is scarce or difficult to access (Fewtrell *et al.* 2005: 43). There are many types of water supply interventions, including bore-holes, isolation of spring eyes, wells, water collection tanks and piped schemes. Similarly to excreta disposal interventions, the choice of solution in a give location depends on many variables such as geographical location, water use patterns, costs and desired impact. (Bartram 2008; Fry *et al.* 2008; Water-Aid 2007; Pokhrel 2004; Bartram 2003; Sobsey 2002; Tumwine *et al.* 2002).

Interventions for the improvement of water quality are designed to remove biological and chemical contaminants in water (Fewtrell 2005: 43). These types of intervention can be applied at the water source or at the point of use. There are different types of techniques and technologies designed to improve water quality. The first consideration before applying such interventions is the quality of the existing water, meaning the chemical composition of the water and the microbiological organisms that are present or can potentially be present in the water. This depends on variables such as the type of source, environmental conditions, seasonality, human practices and animal presence. Interventions may include chemical removal filters and plants, water boiling, chemical treatment, solar disinfection and more advanced techniques that usually imply access to an electrical grid. The type of intervention depends on physical conditions, desired impact, costs, practicalities relating to location, local practices, and availability of resources such as firewood and electricity. (Sobsey *et al.* 2008; Trevett *et al.* 2008; Altherr 2008; Clasen *et al.* 2007a; Luby 2007; Clasen *et al.* 2006; Tumwine *et al.* 2002).

Hand sanitation refers to the infrastructure that facilitates and supports hand washing. The act of washing hands relates to hygiene as discussed above, and can take place in theory with or without infrastructure, resulting in different degrees of effectiveness. Hand sanitation relates strongly to water supply, but not exclusively since different antibacterial disinfectants can be used without water supply. There are different infrastructural interventions that contribute to hand hygiene, including hand washing facilities (e.g. sinks, tapped jerry-cans, casseroles),

provision of soap[23], gloves and artificial disinfectants. The type of sanitary intervention to encourage hand hygiene depends among other things on the location of the intervention, its purpose (e.g. home use vs. medical use), presence of other infrastructure (e.g. piped water scheme, electrical grid) and costs involved (Ejemot 2008; Aiello 2008; Halder 2008; Banda *et al.* 2007; Luby *et al*. 2004; Rotter 1999; Shahid 1996; Han 1989).

3.2.3.3 Mitigation and Prevention of Diarrheal disease through Hygiene Practices

Hygiene is defined here as a behavior undertaken to ensure and promote health (see above). As such, it involves not only individual practices such as hand washing, but also the educational activities to promote behavior conductive to good health.

The importance of infrastructure for promoting *hygiene* was discussed above. As mentioned above, infrastructure contributes to *hygiene* by facilitating behavior. In some locations one can find necessary infrastructure, but not the associated behavior (which can be observed on many levels, from not practicing hygienic behavior to practicing wrong behavior with or without the infrastructure[24]). *Hygiene* includes washing hands, wearing gloves and other conscious actions for avoiding contact with fecal material in general, and in association with specific tasks such as cooking, handling children, working, etc. (Ejemot 2008: 3).

The most important aspect of *hygiene* is awareness. This is especially true when it comes to developing countries, where development interventions are undertaken. Building pit latrines without proper guidance of how to place[25] use and maintain them, may not improve *hygiene*, and in many cases may cause the opposite effect[26]. There are many activities that may be undertaken to improve *hygiene* including (Ejemot 2008: 3):

- Sensitization activities (concentrated awareness days, seminars and discussions).
- Promotion through the education system.
- National campaigns (using multimedia, posters, signposts etc.)

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[23] Soap and gloves are considered as infrastructure since they are physical means that contribute to hand washing and greatly improve the effectiveness of the action, but are not the action.

[24] See data and discussion chapters for concrete examples observed during this study in Ruhiira, Uganda.

[25] For example see Nawab (2006) describing how wrong placement of latrines resulted in pollution of water sources.

[26] A concrete example is smearing walls of latrines with excreta due to lack of other means of cleaning hands (see below, Chapter 6).

- Local campaigns and projects (e.g. using local resources in the community to disseminate knowledge such churches, nurseries, schools while using audio visual means such as posters, signs, games, drama etc.).

Promotion of *hygiene* should not be limited to explaining the purpose of infrastructure and to the illustration of its correct use, but should also include detailed explanations of associated diseases, contraction pathways, prevention and supportive treatment[27]. It is important to convey information that clarifies the connection between series of activities that can lead to the acquisition and cross infection of diseases. This is a crucial step in *hygiene* promotion since series of actions that can lead to cross infections are not always obvious to people[28] (Stenberg *et al.* 2008; Ejemot 2008; Osumanu 2007; Torres & Skillicorn 2004).

[27] Namely Oral Rehydration Solutions and their importance during diarrheal episodes.

[28] Children in Ruhiira, for example, were well aware of how they can acquire a diarrheal pathogen, but they were not aware that they could transfer pathogens to others. They were aware that not washing hands after latrine use may result in the contraction of a disease, but it did not occur to them that contaminated hands could also infect others, such as their younger siblings.

4. Background

The purpose of this chapter is to offer the reader a general background to the Millennium Villages Project (MVP), and a description of the study area of this research. The aim is to provide the context for the thesis, and to facilitate the reading of subsequent chapters.

4.1 The Millennium Villages Project

In September 2000, world leaders gathered at the United Nations headquarters in New-York for the Millennium Summit. The summit ended with a resolution adopted by the General Assembly, known as the United Nations Millennium Declaration (UN 2000). The Millennium Declaration gave birth to eight concrete, time bounded goals, known as the Millennium Development Goals (MDGs – see Appendix C). Each goal consists of a number of targets to be achieved within a specific time frame, generally by 2015.

In 2002, the UN Secretary General Kofi Annan, commissioned the Millennium Project in order to establish a concrete action plan to achieve the MDGs (UN 2006). The synthesis of the Millennium Project was presented in 2005, and included recommendations for the achievements of the MDGs (UN 2005). According to the UN Millennium Project, the road out of the poverty trap can be paved with the help of targeted public-sector investments (Sanchez *et al* 2007).

As a follow up to the UN Millennium Project recommendations, a joint partnership between the UNDP, the Earth Institute at Columbia University and the Millennium Promise Foundation, established the Millennium Villages initiative. The aim of the initiative is to demonstrate the feasibility of adopting an integrated strategy based on community-led development to achieve the MDGs in rural Africa. The objective is to use this model in partnership with local governments in order to scale it up to the national, and the long run, global level (MV 2007).

The Millennium Villages initiative selected twelve sites in ten African countries. Each site comprises a number of villages (approximately 5000 inhabitants in each village) which are provided with experts[29] whose role is to facilitate the community-led development strategy. In

[29] Both international and national experts are included. The national experts usually become the local MVP team that is responsible for the project, while the international experts provide continuous advice and input.

line with the recommendations of the UN Millennium Project, The Millennium Villages Project (MVP) offers public sector investment, focusing on agricultural productivity, public health, education and infrastructure (Sanchez *et al* 2007: 16776). The four strategically chosen sectors are interconnected, for example: increased food production can positively affect health, which in turn can increase studying capacity and positively contribute to education by keeping children in school instead of working on farms (ibid.). Each selected MVP site offers different challenges, and has been chosen to represent a different agro-ecological zone, as well as for the particular challenges associated with its distinct location (MV 2007). Consequently different strategies for reaching the MDGs need to be adopted in the particular context of the different villages.

4.2 Description of the Study Area

This study was conducted in one MVP cluster of villages: Ruhiira. The Ruhiira cluster is located in the Isingoro district in the southern part of Uganda, bordering Tanzania and Rwanda to the south (Figure 4.1). The cluster is divided into six sub-districts (Figure 4.2), and is composed of eight Millennium Villages spread over a few hundred square kilometers, at an approximate elevation of between 1350-1850 meters above sea level, and with an approximate total population of 40,000 (Brown *et al* 2007: 8; see Figure 4.3). The poor, and sometimes, non-existent road system between the villages and the nearest commercial center, is a serious hamper for development. The poor infrastructure distances the villagers from education, health centers, commercial centers, communication and local governments. (MV 2007).

Approximately 90% of the population in Ruhiira is engaged in agriculture (Figure 4.2). The Ruhiira villages suffer from difficult access to drinking water, low level of education, gender inequities and isolation. Approximately 40% of the population lives in extreme poverty, 30% are infected with malaria, about 10% suffer from HIV/AIDS. One third of the children are under-weight and the region suffers from one of the highest-rates of tuberculosis in southwestern Uganda (MV 2007). Given the context of the area and the fact that diarrheal disease account for over 2 million yearly deaths globally, predominantly among children

(Landon 2006: 144-146), it is to be expected that diarrhea is also an important problem in Ruhiira[30].

Figure 4.1: Location of the Ruhiira MVP cluster in Uganda

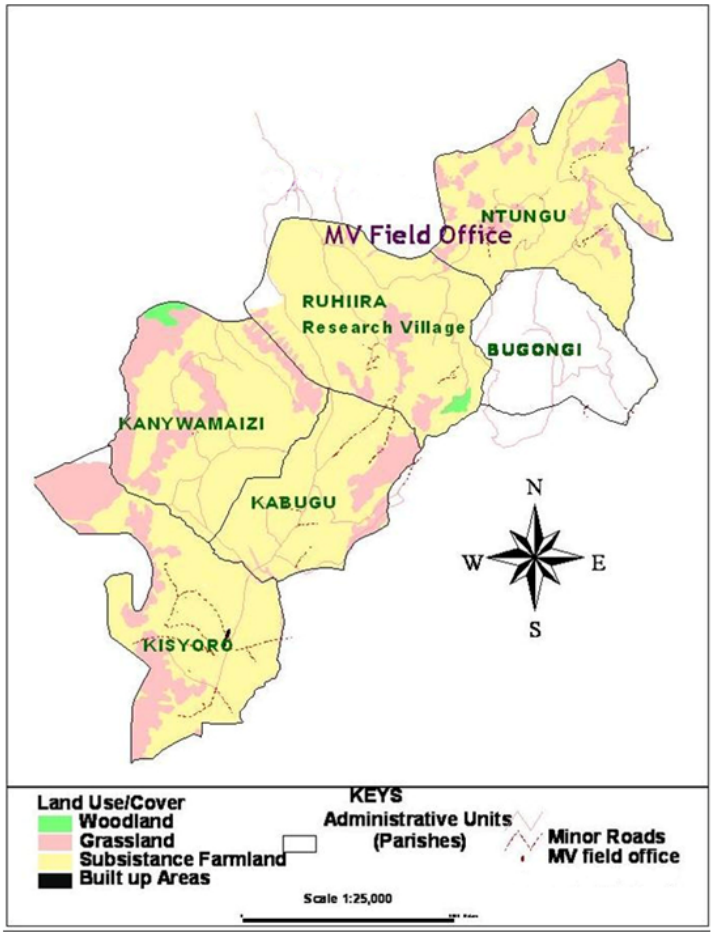
The site was selected as an MVP project in 2006, and interventions have focused on increasing crop yields to decrease hunger, community development (banking, education, health etc.), and business development (creation of cooperative groups, business management training, and banking). Many of the MVP applications are installed and running in Ruhiira, and this location is considered as one of the *flag* projects of the MVP[31]. The underlying reason for choosing the Ruhiira cluster as the location for the Master thesis is the link between growth and environmental degradation (Costantini & Monni

[30] The existing medical records on this issue make it impossible to provide a general statistic on it (see Chapter 6).

[31] This assertion was expressed to me as a personal communication from the MVP management at Columbia University.

2008). Since growth is a major component of the MVP in Rhuiira, and since the project is relatively well established in this location, we would expect to find here externalities associated with the adoption of certain solutions and approaches for development. Therefore, Ruhiira was found to be a suitable site for the application of this study.

Figure 4.2: Ruhiira cluster, Uganda – sub-districts and land use/cover[32]



[32] Map generated and received from science-coordinator, MVP Ruhiira, Uganda

Figure 4.3: A view of the landscape in Ruhiira MVP Cluster, Uganda

5. Methodology

The purpose of the following chapter is to describe the theory behind the process undertaken during this study from its design to its conclusions. In order to explain the process of data collection and analysis, and to clarify the analytical procedures used, this chapter will include an overview of the research design, strategy of inquiry, the subsequent methods used for data collection and analysis, and the criteria for evaluation. The last sections of this chapter will outline ethical considerations applied during the collection and presentation of data.

5.1 Research Design

5.1.1 General

The purpose of the research design is to create a coherent structure that connects the basic ontology with the purpose of the study through a strategy of inquiry and subsequent methodology (Denzin & Lincoln 2000: 21-22). It is a "flexible set of guidelines" (ibid.) that links the location and object of research to the basic ontology and epistemology of the researcher (Janesick 200: 384). At the same time, it addresses questions relating to representation and legitimation (Denzin & Lincoln 2000: 22).

Recalling the basic stance adopted in the study which views the world as a complex system involving composite dynamics between physical, chemical, biological and social constructs, the research design should reflect the need to combine methods of data collection and analysis, which will reveal these dynamics and inform conclusions that reflect this complexity. Accordingly, the design of this research relates a basic critical realist-social constructivist ontological stance as described in Chapter 2, to the purpose of this study, which is to develop a basic conceptual framework that will facilitate the identification of unintended externalities produced by project interventions towards a defined target issue (diarrheal diseases).

As demonstrated by the literature review, the purpose of this study demands a thorough investigation into introduced project solutions that produce effects on environmental issues and social systems. These solutions have been introduced in a cross-sectoral approach to development, as a part of a project that emphasizes integrated solutions to achieve MDGs. The basic assumption of this research is that the manipulation of complex systems in order to

create a desired outcome, may also result in unintended outcomes. Constructing a framework that facilitates the identification of these unintended outcomes is important in order to contribute to the potential to achieve long term sustainability.

5.1.2 Choice of Site

Ruhiira, as the chosen location for this research, can be described as an *exemplifying case* (Bryman 2004: 51), which provides a context to achieve the purpose of the study. The MVP is a concept which is currently applied at fifteen sites in thirteen countries, involving more than five hundred thousand people. Ruhiira is a location where the MVP is relatively well established, and where many basic applications of the MVP are already installed and operating (MVP 2008; 2008a; 2008b). It is therefore a suitable location to conduct a study which has a purpose of creating a framework which will facilitate the identification of unintended problems created through the MVP approach. Even though the research was conducted in a specific location, it represents the application of a framework, which has the aim of introducing a broad approach to assessing integrated development interventions. The MVP approach is based on achieving the UN Millennium Development Goals, which themselves stand for a cross-sectoral approach to development. It is therefore possible that the case of Ruhiira can be used as a generalization not only for the MVP, but also to other sites and projects that use the MDGs as their basic guidelines for development strategies.

5.1.3 Combining Basic Views with Purpose and Location

The strategy of inquiry is the tool used by the researcher in order to move from his basic views to his collection of materials (Denzin & Lincoln 2000: 371). The choice of location may imply that this study assumes a *case-study* methodology, but as stipulated by Stake (2000: 435), case-studies are not a "methodological choice, but a choice of what is to be studied". This means that different methodologies can be applied to case-studies depending on the purpose of the study and the questions being asked.

The basic view of integrated complex systems, combined with the purpose of this study, requires a methodology that will allow for the collection of data and analysis, and which results in a framework that can be used to explain the data collected. This description is consistent with *Constructivist Grounded Theory* as described by Charmaz (2000: 509; 2006 180-181). The use of *Constructivist Grounded Theory* methodology implies assuming certain procedures and use of qualitative data collection methods, following a rationale which

evolved over the years by a number of prominent researchers who founded and developed this approach (Corbin & Strauss 2008; Charmaz 2006; Charmaz 2000).

5.2 Grounded Theory

Founded by Glaser & Strauss (1967), *grounded theory* is an inductive methodology which aims at constructing theory deriving from data. *Grounded theory* was described as a pioneering methodology, challenging the focus of the scientific community on quantification, and establishing guidelines for successful qualitative research and the development of theory (Corbin & Strauss 2008: 1; Charmaz 2006: 4-5; Chramaz 2000: 511-512).

The founders of *grounded theory* combined two traditions in sociology: Columbia University positivism and Chicago school pragmatism and field research (Charmaz 2006: 6-7). These different traditions led eventually to a division between the founders, creating two different versions of *grounded theory* (Mils *et al.* 2006: 3; Charmaz 2000: 523-525):

- *Objectivist Grounded Theory* following Glasers' adherence to the "positivistic canons of traditional science" (Charmaz 2000: 524), often referred to as *traditional grounded theory* (Mils 2006:3).
- *Constructivist Grounded Theory* often referred to as *evolved grounded theory* (Mils 2006: 3), following Strauss & Corbins' version of the method, which recognizes that the presented realities are a result of interaction between the researcher and objects of the research, thus representing an account of reality which incorporates the viewer and the viewed, affecting what will be "defined, measured and analyzed", and therefore can always be refined (Charmaz 2000: 524). Most importantly, *constructivist grounded theory* "seeks to define conditional statements that interpret how subjects construct their realities" (ibid.).

Consistent with the ontological and epistemological assumption presented in Chapter 2, and combined with the objectives of this research, the *evolved* version of *grounded theory* (*constructivist*) is a suitable methodological choice for data collection and analysis. This methodology allows more flexibility regarding tools that can be used in preparation for research and requires the use of some procedures for data analysis (see below).

In contrast to the *traditional* version of *grounded theory*, the *evolved version* recognizes the importance of a literature review and the use of theoretical frameworks in the planning phase

of the research (Corbin & Strauss 2008: 35-42; Mils 2006: 4-5; Charmaz 2006: 165-172). Literature review in the *evolved* version of *grounded theory* enables the researcher to clarify ideas, make comparisons, facilitate the theoretical discussion for the readers, place the research in the broader context (Charmaz 2006: 167), help formulate initial questions for the application of data gathering methods such as observations and interviews and contribute to the analysis process (Corbin & Strauss 2008: 37). Theoretical frameworks in the *evolved* version of *grounded theory* can be used as a sensitizing concept to serve as a starting point to help conceptualize and arrange key ideas, as well as convey logic (Corbin & Strauss 2008: 39-40; Charmaz 2006: 169). In addition, the use of sensitizing concepts recognizes prior work and places the current emerging theory in relation to these works, consequently helping to demonstrate its significance (ibid.)

Charmaz (2006: 11) draws a general outline of the *grounded theory* process, beginning with the sensitizing concepts and general disciplinary perspectives and ending with the write up. This process outlines a number of unique methodological techniques for data analysis designed to facilitate the emergence of theory such as *coding*, *memos* and *theoretical sampling* which were applied during this study.

The *coding* process in *grounded theory* aims at developing *categories* from the data (Corbin & Strauss 2008: 65). The *categories* are aggregation of relevant groups of *codes*, and are used to develop *concepts* in theory (Charmaz 2006: 186).

Memo writing takes place during the research, and serves as an intermediate step between data collection and write up (Charmaz 2006: 188). *Memos* are theoretical ideas arising in the field through data collection. Corbin & Strauss (2008: 123-124) distinguish between field notes and *memos*. For them field notes are "data that may contain conceptualization and analytic remarks", while *memos* are more complex and analytic, and serve as an initial analysis that helps develop *codes* into *categories* later in the process (Charmaz 2006: 188).

Theoretical sampling is a method in *grounded theory* which aims at developing emerging *categories* and theory by seeking specific information or events that can help clarify and bound *categories* (Charmaz 2006: 189). It is a method to gather data relevant to emerging *concepts* from *categories* relevant to the story line (Corbin & Strauss 2008: 195).

5.3 Research Methods

5.3.1 Qualitative Advantage

This study focuses on qualitative methods for data collection as a function of the basic ontological and epistemological views adopted here, and the subsequent strategy of inquiry undertaken to achieve the purpose of the research. A limited amount of quantitative data was used, but gathered through review of secondary data and was not collected directly through the use of quantitative methods.

As emphasized by Bryman (2004: 20), qualitative methods are useful when conducting an inductive inquiry which emphasizes generation of theories. As this research is focused on interventions established upon social-construction-based interpretations of reality (MDGs), and assuming solutions that modify elements in a system affecting directly and indirectly social constructions, qualitative methods are best suited for conducting the inquiry. This is because qualitative methods are flexible and allow for readjustments and pursuance of different leads based on emerging knowledge *in-vivo* conditions (Charmaz 2006: 14). Qualitative methods aim at capturing the perspectives of respondents in their own settings, focusing on the creation of social meaning and interpretation of experience (Denzin & Lincoln 2000: 8), and are consistent with the view that social realities are dynamic and varied when viewed from an individuals' perspective (Bryman 2004: 266).

5.3.2 Methods used for Qualitative Data Collection

The sensitizing conceptual framework and opening research questions used to guide the conduct of the study in order to achieve its purpose, where also useful in choosing the methods for initial data collection. A number of qualitative research methods where used throughout the study. The following section describes the methods used and the reasons for choosing them.

5.3.2.1 Transect Walks

A transect walk is a method used for general and particular familiarization with an area (Mikkelsen 2005: 90). The research in Ruhiira focused on a few chosen locations as described below (see Chapter 6). Each location functions as an independent unit, using a set of resources available to it within its boundaries (household, school compound, market place, health center, etc). In addition to these resources, each unit may access other public resources and

services which are not available to them in their immediate boundaries (water sources, latrines, health center etc.).

Upon arrival to a chosen location for the conduction of this research, the first step undertaken in order to become familiar with the available resources was a transect walk. The focus of the transect walks was to locate and understand the use of resources relevant to contraction, prevention and mitigation of diarrheal diseases in each visited location.

Since this method is limited to current observed situations which usually result in a map including only what the researcher observes himself (IAPD 2008), the transect walks were carried out with a local research assistant/translator who is familiar with the area. The research assistant helped to overcome the limitations of the method by indicating locations of resources that can easily be overlooked by a non-local observer. In addition, community members and officials met at random during visits at the different locations, were interviewed (see section below: semi-structured and unstructured interviews) in order to help locate resources, understand patterns of use, acquire specific knowledge on a situation of interest and create trust to facilitate future access points to local people.

5.3.2.2 Non-Participant Observations

Non-participant observations is a term encompassing a few types of observation research where the principal attribute is that the observer does not participate in the social setting observed (Bryman 2004: 167).

Non-participant observations can take the form of *structured observation* (also called *systematic observation*), *unstructured observation* and *simple observation*. All these types of observations were used in the current research. *Structured observations* are observations following pre-determined rules established by the researcher in order to inform the length of the observation, type of behavior to be observed and recording method (ibid.). *Unstructured observations* do not follow a set of pre-determined rules, but are observations aiming at recording as much detail as possible on an observed situation in order to recount it in a narrative form (ibid.). *Simple observations* refer to observations where the observer is totally separated from the observed situation and cannot influence it in any way, implying that the subject of the observation is not aware of being observed (ibid.).

All observations conducted in Ruhiira were *non-participant observations* which took the form of either *structured, unstructured, simple-structured and simple-unstructured observations.* In

schools for instance, hand washing practices of students after their use of latrines were observed. In each school, two types of observation where used: *structured* and *simple-structured*. Both observations followed the same rules: they were conducted in schools during a defined length of time, observing hand washing habits of boys and girls and recording practices in a pre-defined way (use of water, use of water with soap etc.). During the *structured non-participant observation*, a suspicion arose that the students' usual behavior is modified by their knowledge that they are being observed. As a result, a second, *simple-structured non-participant observation* took place, during which the students were not aware that they were being observed. As suspected, this yielded different results from the former type of observation (see below, Data chapter).

Non-participant observations were conducted continuously, in conjunction with other methods and taking all forms described above, during the entire length of the study. In general, *simple-observations* when they are possible to undertake, represent reality in a more accurate manner, since people tend to change certain behavior when they know they are being observed, especially if they have a notion of what behavior is expected from them, as is the case for many people in the Ruhiira cluster (see Data sections for details).

5.3.2.3 Semi-Structured and Unstructured Interviews

Interviews are a common method for data collection in social sciences (Kvale 1996). Interviews are used to acquire all sorts of information, and can take many forms[33]. Bryman (2004: 109) notes that interviews can be used to: understand behavior of respondents, understand the way that behavior of others is perceived by respondents, understand social situations and, institutions, and acquire opinions and wishes of respondents. The most common type of *qualitative interview* used during this research was *semi-structured interviews.*

Semi-structured interviews are characterized by the use of a questioner guide comprised of a set of general, open and flexible questions which can be supplemented *ad-hoc* during the interview process according to need (Mikkelsen 2005: 89; Bryman 2004: 113). This type of interview is contrasted with *structured interviews*, where a rigid questionnaire is prepared and coded beforehand. *Structured interviews* offer less flexibility and are aimed at asking different respondents identical questions in order to aggregate the answers into a standardized result (Bryman 2004: 109). *Semi-structured interviews* were better suited to the type of qualitative

[33] From *structured* to *unstructured* interviews.

research undertaken in Ruhiira, and proved useful to capture the gap between respondents' knowledge and their application of that knowledge through the flexibility the method offers in the interview process. *Semi-structured interviews* were conducted in a number of occasions during this research with different categories of local people, including medical personnel in HCs, school personnel (teachers, headmasters and cooks), community officials (mostly in markets) and family members during household visits.

In addition to *semi-structured interviews*, a number of random *unstructured interviews* took place in the course of this study. *Unstructured interviews* are often opportunistic, usually informal (Bryman 2004: 113), and relate to an observed situation or a topic of interest manifesting randomly during the study. *Unstructured interviews* were conducted daily, and included many different community members in different situations, e.g. during transect walks, in markets, HCs, schools, MVP office in Mbarara, around water sources etc.

5.3.2.4 Focus Group Discussions

Focus Group Discussions (FGD) is a form of group interview where a specific theme is explored through a discussion within a group of respondents (Bryman 2004: 346). Emphasized in FGD, are group dynamics and the ways meaning is jointly constructed (ibid.).

As indicated by Merton (1956, cited in Bryman 2004: 346), FGDs are in effect a combination of *group interviews* and *focused interviews*. *Group interviews* are composed of several people discussing a number of topics, while *focused interviews* are composed of selected individuals who have knowledge or have participated in a situation of interest.

A number of FGDs took place during this research, and included children in schools, mothers of children aged 5 or less, community health workers, traditional healers and local community leaders. The explicit goals of each FGD are specified in Appendix D, and the content elaborated in the Data section.

The FGDs proved to be a useful tool to understand how different groups of people view the MVP and the applied interventions, as well as to capture priorities of individuals, how these priorities are discussed and possible future externalities of MVP interventions as a result of these views. The FGDs were also helpful in capturing actual knowledge of different individuals within groups, and knowledge of groups, which proved useful during observations in order to notice the gap between the actual knowledge possessed by community members

and the application of the knowledge, including possible reasons for this phenomenon in Ruhiira.

5.3.2.5 Review of Secondary Data

The scope and scale of this research limits the amount and variety of data that can be collected. Secondary data, referring to data collected by other researchers, can help bridge the tradeoffs between the data gathering limitations of this research and the wanted results.

The MVP in Ruhiira began in 2006. Since that time much data has been collected for different purposes, and a number of reports and papers published. These data include statistics from the baseline survey in the village, other statistical information such as weather data, some data regarding burden of diseases, morbidity and mortality, annual reports, development plans, water sample analysis, etc. In addition, some secondary data was available from the Uganda Bureau of Statistics in Kampala, namely surveys such as the Demographic and Health Survey for Uganda from 2006, and other relevant data such as recent data from weather stations.

The aim was to use the secondary data, if possible, as triangulation to some of the qualitative data gathered during the study. In addition, annual reports, future development plans and project policy papers can help focus some questions and answers of this study and can constitute a meaningful contribution by helping to fortify the results of this study.

Secondary data represents the only quantitative data in this study. The secondary quantitative data will be reviewed critically since it was gathered by other researches for other purpose and might not be fully compatible with the needs or basic assumptions of this research.

5.4 Criteria for Evaluation

5.4.1 Choosing Criteria for Evaluation for Qualitative Research

The literature indicates that there are a number of schools of thought when criteria for evaluation of qualitative research are concerned (Corbin & Strauss 2008 297-312; Bryman 2004: 272-276; Smith & Deemer 2000, 877-896). The first division revolves around the application of standard quantitative research criteria for evaluation, namely *reliability* and *validity* for qualitative studies. Researchers adopting different ontological and epistemological positions than the *positivist* paradigm have claimed that these criteria stem from the view of researchers assuming an objectivist stance, which does not settle with the degrees of *relativism* implied by other standpoints towards reality and knowledge (Denzin & Lincoln

2000: 871-872). There are secondary divisions within qualitative research (ibid.), but there is no intention here to enter the debate around the three main positions on evaluative criteria[34] simply because the scale and scope of this thesis does not permit that. I will therefore state the position for criteria of evaluation assumed for this study, the reasons for adopting these criteria and application during the research.

Stemming from the basic ontological position assumed herein, the criteria for evaluation of a study should be consistent with the *nonfoundationalist* position stating that "the criteria for evaluating qualitative work are also moral and fitted to the pragmatic, ethical and political contingencies of the concrete situations" (Denzin & Lincoln 2000: 873). This position is reflected in the work of Corbin & Strauss (2008: 297-312) and Charmaz (2006: 181-183). Both offer a set of criteria to serve as guidelines for evaluation, but emphasize that not necessarily all can or should be used in every research and should be adjusted to fit the circumstances of the study (Corbin & Strauss 2008: 309; Charmaz 2006: 182).

Because I subscribe to the notion that criteria for evaluation should be relevant directly to the type of study and basic assumptions used, I offer a tentative list of criteria for evaluation which guided the process undertaken during this research. The list is composed from criteria suggested mainly by Charmaz (2006: 182-183), but also inspired by Corbin & Strauss' notes on the evaluation of *constructivist grounded theory* (2008: 302-309).

Corbin & Strauss (2008: 302) believe that the nature of qualitative research does not allow a composition of a checklist of evaluation criteria to be used across studies; each research should be judged according to its own set of criteria. The main focus, according to Corbin & Strauss (ibid.) should be on *quality*. They proceed by offering a set of guidelines for constructing, judging and evaluating qualitative research (Corbin & Strauss 2008: 302-309); but the scale and scope of each study should also serve as a guideline to help choose the criteria according to which it should be evaluated (Corbin & Strauss 2008: 311). The focus on *quality* allows adopting the set of criteria offered by Charmaz (2006: 182-183). As remarked by Corbin & Strauss (2008: 299-300), Charmaz's list of criteria "Addresses both the creative and scientific aspects of doing qualitative research". In addition, these set of criteria require

[34] Referring to the *foundational*, *quasi-foundational* and *non-foundational* stances. For elaboration see Denzin & Lincoln 2000: 872-873 and their references to literature.

that the researcher engages in self evaluation during and after the research process[35] (Corbin & Strauss 2008: 300), and therefore I find these criteria most suitable for this research.

5.4.2 Suitable Criteria for Evaluating Grounded Theory Studies

Recognizing that expectations from *grounded theory* studies vary according to type of study and who performs it, Charmaz suggests four criteria for evaluation (2006: 182-183):

- Credibility
- Originality
- Resonance
- Usefulness

Credibility is considered by Corbin & Strauss (2008: 301-302) as a term indicating that findings provide a "plausible" interpretation of the data to which the researcher, participants and readers can adhere, and as such, they are "trustworthy" and "believable". Charmaz (2006: 182) uses a set of questions to be asked by the researcher in order to determine if the research is *credible.* To her, very much like it is for Corbin & Strauss, *credibility* indicates that the researcher is well versed in the settings and topic of the research; the claims are well founded in the presented data; emerging categories are well anchored in observations; the logical links between data, arguments and analysis are strong; and the reader can independently assess and consent with the claims of the researcher.

Originality indicates that the research offer new insights and that the data can be interpreted in a way that will offer a new framework. The research should have some sort of social and theoretical significance and "refine current ideas concepts and practices" (Charmaz 2006: 182).

Resonance is the degree to which the findings of the study fit the experience of professionals and participants in the sense that they can identify with them (Corbin & Strauss 2008: 305). The findings should point to links between "institutions and individuals" when the data indicates it (Charmaz 2006: 183), and reveal "both luminal and taken-for granted meanings" (Charmaz 2006: 182).

[35] Corbin (2008: 300) actually views the self evaluation aspect of Charmaz's *Criteria for Evaluation* as a weakness, since it is complicated for researchers to self evaluate their own work. Nevertheless, as one of my professors used to stress, a researcher should always assume the role of the *Advocatus diaboli* towards his own work in order to improve the quality before publication.

Usefulness indicates that the interpretations of the analysis can be used by people in their respective worlds; further research is a potential outcome of the study even in other substantive areas, and the study contributes to knowledge and improvement (Charmaz 2006: 183).

These four criteria are interconnected and help improve each other. But as Charmaz indicates (ibid.), other criteria for evaluating research should apply, such as aesthetics of the writing and others as fitted to the specific attributes of each study.

5.4.3 Applications in this Study

A number of measures were taken both during the field work and in the subsequent analysis and conclusion process in order to ensure the quality of this study.

During the data gathering phase, a number of measures in order to triangulate answers and their interpretations were taken. These measures are indicated in the relevant data sections and include parallel observations of a local research assistant, returning to sites for re-validating observations, asking each respondent some questions a number of times in different manners and verifying interpretations with local people during interviews. As suggested by the strategy of inquiry, the data gathering process was dynamic; it evolved and followed leads during the field study. In addition, information from data gathering, initial interpretation, advice, emerging structures, problems etc, were discussed with local MVP staff, some with academic expertise and in-depth knowledge of the community and history of the region. These discussions took place both in the field and the MVP office in Mbarara. These measures were taken in an attempt to achieve *credibility, originality, resonance and usefulness* of the final product.

In addition, an initial description of the study and indications of possible directions towards which the conclusions were heading was presented to the local MVP team in Ruhiira at the end of the field work. This presentation was accompanied by a long discussion during which positive comments portraying to the four evaluation criteria were received.

Finally, the gathered data, analysis and conclusions of this study were presented to the MVP health team and representatives of the project management, including the science-coordinator from Ruhiira, at the Earth Institute at Columbia University a few months prior to the conclusion of this study (April 2009). This presentation served as an indicator of the degree to which the evaluation criteria were achieved.

5.5 Ethics

Ethical considerations are of the outmost importance to any study, but particularly significant to social studies since they incorporate an intense involvement of human subjects in various settings. It is therefore imperative to establish and follow ethical principles that are not only explicit when it comes to interactions with respondents, but also contain a dimension which clarifies special problems and revelation processes (Guba & Lincoln 1994: 115).

The basic ethical principle to which I subscribe is the *virtue ethics* position. This position emphasizes the internalization of moral values by the researcher (Kvale 1996: 122) through skill, experience, interaction and intuition, together a result of professional insight obtained gradually through a learning process. This position is consistent with the basic assumptions of constructivism, and incorporates both the researchers' and respondents' sense of meaning through the central concepts of virtue ethics: *virtue, practical wisdom* and *eudaimonia*[36] (Hursthouse 2007).

Also embedded into constructivism, is the notion that a researcher does not exist in a vacuum, in the sense that when a subject of study is approached some dictated rules and conditions exist, and often are presented as pre-conditions to beginning a research project. Some of these pre-conditions are formulated codes of ethics set by institutions which require compliance with these formulations. This is not meant as a criticism; set codes of ethics are a part of social constructions and therefore fully appreciated and respected.

Relevant for this study are a number of ethical requirements set by the Norwegian University of Life Sciences and The Earth Institute of Columbia University which needed to be consented to and followed, as pre-conditions before entering the field. These guidelines include a number of requirements, including not taking actions that will result in any harm to people, the elimination of identifiers, passing a Columbia University course for the "treatment of human subjects" and following IRB guidelines. The full list of ethical requirements is attached in Appendix G.

During field work, careful attention to comply with all the ethical requirements was applied. In unclear cases, advice was sought from the Science and Health Coordinators in Ruhiira

[36] A key term in Greek moral philosophy that can be translated as "flourishing", "happiness" and sometimes "well-being"; each translation carries advantages and disadvantages (Hursthouse 2007).

MVP, as well as from the supervisor of this thesis, in order to devise a course of action consistent with all guidelines.

In general, all respondents were informed of the purpose of this study; all participants were informed that under no circumstances any identifying information will be disclosed; all the people involved in this study consented to their participation and to the use of information acquired through their participation.

6. Data and Analysis

6.1 Background

This chapter presents an outline of the data gathered during the study. As mentioned above (Chapter 5), using *grounded theory* methodology implies a process of analysis that begins in the field. For this reason this chapter contains stages of the analysis that can be recognized in the form of categories in which the data is arranged, as well as interpretations emerging from the narrative form of the presentation.

The sensitizing framework (Chapter 2) guided the initial data collection with the aim of achieving the targeted objectives that informs the main objective of this study (Chapter 1). This chapter is divided into a two main sections. The first section focuses on qualitative data and indicates the relevant project interventions for this study and the data collected on each intervention. This section includes an outline of the data collected through FGDs, household visits, semi-structured interviews, transect walks and observations conducted in conjunction to these methods. The second section presents the Secondary data collected and problems relating to it.

6.2 Mapping of Relevant Project Intervention

Each intervention introduced by the MVP in Ruhiira embeds a number of elements which are aimed at producing an impact, contributing to the achievement of more than one MDG in parallel. Not all the interventions of the MVP in Ruhiira are relevant for this study. The project in Ruhiira lists nine prioritized objectives for achieving the MDGs in the villages (MVP 2008: 9):

1. Eliminate hunger and malnutrition
2. Improve livelihood of women and men
3. Assure full primary school attendance
4. Improve access to medical services
5. Decrease rate of infection of HIV/AIDS, malaria and tuberculosis
6. Integrate the principles of sustainable development
7. Increase access to clean water and sanitation
8. Make available communications technologies

9. Increase community capacity

Some interventions aim at achieving a number of objectives at the same time (see below), and subsequently contribute to reaching of a number of MDGs. The section below describes the relevant project interventions for this study. The description includes an outline of the intended design of the intervention correlated with observations in the field.

6.2.1 Education Sector: School Feeding Program

The school feeding program is multipurpose and directly contributes to the elimination of hunger and malnutrition, improved livelihoods, and increased school attendance. There are also indirect contributions associated with this program, such as reduction of infectious diseases rate and improved awareness of hygiene, mainly by increasing knowledge through education[37]. Reducing hunger and reduced malnutrition will result in better health, and thus increase peoples' ability to physically cope with illnesses. By strengthening education, the community's capacity will improve, and this will, in return, contribute to sustainable development.

The MVP built kitchens in schools within the project area. The kitchens are fitted with a large energy efficient stove for cooking meals for all students and staff. The project together with the community also provides utensils and foodstuff and hires kitchen personnel for cooking the food. The school provides two meals a day: maize porridge at 10 AM, and lunch at 12 PM (maize bread, beans and leafy vegetables). The foodstuff is bought from the community by the project, thus contributing directly to improved livelihood. Since to a large extent cooking depends, on water, the project installed rain water collection tanks[38] to improve access to water in schools (see Infrastructure Development in Schools section below).

Since meals are now provided in schools, the attendance rate has increased. In addition, a proper meal supplies the necessary energy for the pupils to improve their concentration and their ability to study, and helps to reduce dropout rates (MVP 2008: 19). Parents are encouraged to participate by contributing food (mainly leafy vegetables), firewood and labour

[37] Increased effectiveness of education achieved by the direct contributions of the schools feeding program results in benefits to many other MDGs.

[38] The rain water collection tanks were not installed solely for enabling the school feeding program. They also serve other purposes, see below: Infrastructure Development section.

(ibid). The rain collection tanks facilitate the accessibility to water[39], and reduce the time spend by children on fetching water for the school.

During the period of this study, observations and interviews were conducted at five schools[40]: Sinai, Ruhiira, Kanywamaizi, Nyampikye and Kabugu. Each of the observations was conducted during one full day. Subsequent random visits to each school were made a number of times during the research period in order to corroborate findings.

In practice, during the time of observations, meals were served at three of the five schools. One school served only lunch, and skipped breakfast. In subsequent visits during the month of November, all five schools failed to serve meals to pupils. The reason given for this was lack of supplies. When supplies were low, the cooks prepared meals only for school staff. Leafy vegetables were never served to pupils during the time of the observations. This does not necessarily reflect the state of the school feeding program, but may simply reflect the situation during the time of the observations, which was during the month of November, at the end of the school year, when supplies ran low. According to cooking staff, during most of the year, meals are served regularly to children in these schools.

The school feeding program is relevant for this study, since it introduces a number of factors that can contribute to the contraction of diarrheal diseases if not handled properly. Among these factors are food, and sanitation and hygiene considerations. If the two latter factors are lacking in infrastructure or execution, eating in schools introduces a fecal-oral route. Food, if not handled correctly by cooks, or if cooks do not practice safe hygienic procedures, or lack infrastructure for safe practices, may result in contamination of the food consumed by the pupils (see below).

6.2.2 Infrastructure Development in Schools

During the planning phase of the MVP, the community in Ruhiira indicated a number of infrastructural problems in schools (MVP 2008: 19). In order to improve educational services, facilitate the school feeding program, improve sanitation and thus improve overall conditions and increase attendance, the project installed a number of constructions in schools. The MVP annual report for 2007 (ibid.) indicates a number of infrastructure constructions in schools, including:

[39] In the rainy season.
[40] According to figures received from MVP Ruhiira, there are nineteen schools in the project area. The five schools visited were chosen randomly for the purpose of this study.

- Installation of rain water collection tanks
- New classroom block construction
- Refurbishment of existing classroom blocks
- Construction of school kitchens
- Construction of pit latrines

The observations conducted in each school were guided by a checklist[41] (Appendix A: I), and were carried out by my and a translator/research assistant allocated by the MVP. The assistant received detailed instructions and conducted the observations at the same time as I did, but independently. A discussion of the observations followed each visit. This process was undertaken in order to triangulate the results and enhance overall *credibility* (Charmaz 2006: 182-183; see also Chapter 5 above).

The school visits included semi-structured and unstructured interviews, and a focus group discussion with pupils. All research activities in schools were coordinated and consented to by the school headmasters beforehand.

6.2.2.1 School visits

A. General

The following section is a synthesis of the data gathered in the five schools. The schools in Ruhiira MVP area located both in the highlands (Siani, Ruhiira) and lowlands (Kabugu, Kanywamaizi, Nymapikye). The infrastructure in all schools visited consists of classroom blocks (both modern constructions and mud constructions), staff room and administration office, food storage room, latrines, kitchen and rain water collection tanks. Some schools have staff housing on school premises (Kanywamaizi). A church is usually located on the school premises or adjacent to the school compound. Sometimes the church infrastructure is used by the school (latrines, space for classes, water tanks). Each school visit began with a transect walk to map the resources of the school. The transect walk included water resources outside the school compound which are regularly used for water collection. Table 6.1 shows the total number of pupils, teachers and cooks in each visited school in 2008 (Data received from MVP Ruhiira).

[41] The use of a checklist does not imply that *Structured Observations* were undertaken. The checklist serves as a guide as well as means to achieve *credibility* (see above, Chapter 5).

Table 6.1: Total attendance by school for Ruhiira 2008 (Source: MVP 2008)

Name of School	Pupils	Teachers	Cooks
Ruhiira	420	9	4
Kabugu	325	8	3
Kanywamaizi	697	17	7
Nyampikye	420	10	3
Sinai	376	9	3

B. Pit Latrines

Most visited schools have brick constructed pit latrines. Some schools have mud constructed pit latrines in addition. The number of latrines and their size vary from school to school. Table 6.2 summarizes the information on latrines from each of the schools visited.

In general, latrine structures in schools were found to be in poor condition. The structural problems vary from school to school and latrine to latrine. In general, all latrines have broken doors or nonexistent doors, affecting the privacy of the users, subsequently causing hygiene problems (see below). No pit covers were found in any of the latrine chambers. Other structural problems observed in the different schools include broken roofs, broken walls, no windows, broken floors and very small chambers.

The conditions in Sinai primary school were the worst of all visited schools: the school has one pit latrine construction fitted with four chambers (Figure 6.1). Two chambers are allocated for boys and two for girls. Only one chamber (on the boys' side) is fitted with a door[42].

The ground around the latrines in Sinai was muddy from urination, and all chamber floors were smeared with excreta. There is practically no separation between the boy's and girl's side. The children are all bare footed and step in urine and excreta while using the latrines. The conditions in other schools were only slightly better than in Sinai, offering separate structures for boys and girls and in some cases, offering more hygienic conditions (see below). It is important to emphasize here that public toilets, whether in Africa or anywhere else in the world, are rarely clean, unless there is a person responsible for cleaning that does it several times a day with proper materials.

[42] According to the students, this chamber is reserved for teachers; nevertheless, students were observed using this chamber as well.

Table 6.2: Latrines in schools, Ruhiira 2008

		Sinai	Kabugu	Kanywamaizi	Ruhiira	Nyampikye
# of latrines		1	3	4	3	2
# of chambers for girls		2	3 + open urinal	9 + urinal	4	4
# of chambers for boys		2	4 + 2 open urinals	6 + urinal	4	4
# of chambers for teachers		0	0	2	1 + urinal	0
Total amount of chambers		4	7	18	9	8
# of broken or nonexistent doors		3	2	6	9	Reed screens
Type of construction	*Brick*	1 Ventilated	2 Ventilated	4 Ventilated	1	N/A
	Mud	N/A	1	N/A	2	2

According to the MVP 2007 Annual Report for Ruhiira (MVP 2008: 19), the project constructed pit latrines in Sinai primary school and Ruhiira primary schools. No such constructions were found at these sites.

The lack of pit covers result in a smelly environment, and attracts a large amount of arthropods. All latrines were found extremely unclean (Figure 6.2). There is defecation and urination outside pit holes within the chambers, outside chambers and around latrine structures. This is caused partially because of privacy issues, and partially because of bad hygiene practices. In many cases walls are smeared with excreta. Latrines are cleaned once a day by the children, mostly with leaves. In some cases water and brooms are used as well. Soap is never used for latrine cleaning.

Figure 6.1: Ventilated pit latrines at Sinai primary school, Ruhiira 2008

Figure 6.2: Examples of hygiene state of latrines in Nyampikye (left), Kabugu (center) and Ruhiira (right), 2008

C. Hand Washing Facilities

The importance of hand washing after use of latrines for the prevention of diarrheal diseases has been discussed above (see Chapter 3). There are a number of elements to consider when looking at hand washing facilities:

- Availability of hand washing facility
- Availability of soap

- Water disposal
- Use patterns

Some schools do not have hand washing facilities (see Table 6.3). When hand washing facilities are present, they are of two predominant types (Figure 6.3):

- Jerry-can on a stand fitted with tap
- Improvised hand washing facility

The improvised hand washing facility consists of a jerry-can, mounted on a horizontal pole or rope, supported by two vertical poles. A rope is fitted through the handle of the jerry-can, and is attached to a wooden pedal. Stepping on the paddle tilts the jerry-can and causes water to pour through the opening.

Soap is usually not available for hand washing in schools. In Kabugu School, some detergent powder has been added to the water in the Jerry-can. According to the headmaster, this is done in order to prevent the children from drinking water from this jerry-can, not as means to improve hygiene.

Water is disposed on the ground where it is used. There are no water disposal facilities or basins associated with hand washing facilities in school.

Use patterns refer here to the actual use of hand washing facilities at any of the schools, if they are present. As specified below, the presence of a hand washing facility does not necessarily mean it is used by the school children (see below, Table 6.4).

Figure 6.3: Hand washing facilities in schools

Table 6.3 summarizes some of the data collected on hand washing facilities in the five schools visited during the study. As a result of some of the observations made during this study, a number of changes were introduced in Sinai primary schools by MVP Ruhiira. These changes are reflected in the second column in Table 6.3[43] (grey column).

Table 6.3: Hand washing facilities in schools observed in Ruhiira MVP

	Sinai (initial)	Sinai (improved)	Kabugu	Kanywamaizi	Ruhiira	Nyampikye
Hand washing facility available	-	+	+	+	-	-
Hand washing facility type	N/A	Jerry-can on a stand fitted with tap	Jerry-can on a stand fitted with tap	Improvised	N/A	N/A
Water present in facility	N/A	+	+	-	N/A	N/A
Soap Available	N/A	+	+	-	N/A	N/A
Water source	N/A	Rain water tanks/water hole	Water tap	Rain water tanks/Water tap	N/A	N/A
Usage percentage	N/A	~50%	~50%	~50% (when water is present)	N/A	N/A

There are a few notable points relating to hand washing facilities in schools. Initially, two out of the five visited schools had hand washing facilities. The MVP provided two jerry-cans fitted with taps for hand washing in Sinai School after the initial observation was conducted (one for toilet use and one for kitchen use). The presence of hand washing facilities changes the personal hygiene practices of both pupils and personnel. When facilities are not present, hand washing does not occur. In Kanywamaizi, when water was not present in the hand washing facility, no one was observed making an effort to wash hands[44]. When hand washing facilities are present and fitted with water, approximately 50% of all latrine users wash their hands[45]. This behavior was observed in all five schools during a 30 minutes break, and 30

[43] It is important to note the commitment of the MVP team in Ruhiira; whenever possible, faults identified during this study, were rectified immediately.

[44] Before water was filled in hand washing facilities, 22 pupils used the latrines; none washed hands. For figures after water was filled see Table 6.3.

[45] It is important to emphasize that this figure represents the result of *simple-structured non-participant observation*, when students were not aware that they are being observed. When the observation took the form of *structured non-participant* observations, where students were aware that they are being observed hand washing after latrine use was close to 90%. The results of the *simple-structured* observations are probably a more accurate reflection of reality.

minutes during class time. Table 6.4 summarizes observations relating to hand washing in schools.

It is important to note that even though specific facilities for hand washing were not available in Sinai, Ruhiira and Nymapikye Schools, the pupils do have access to water. In Sinai and Ruhiira, there is limited access to the rain water collection tanks. These tanks are fitted with a tap, but are not located in proximity of the latrines[46]. In Nyampikye, the pupils have constant access to a tap connected to a protected source. This tap is not located near the latrines, but is located in a convenient place in proximity of the kitchen. The tap is used throughout the day by the children for drinking, but none used it for hand washing after toilet use.

Jerry-cans fitted with a tap seem to be a better hand washing facility than the improvised type. The improvised water facility is fitted with a small 5-10 liter Jerry-can. When used, water runs out fairly quickly, and is usually not replenished. In Kanywamaizi, there was initially no water in the hand washing facility. The headmaster requested to fit the jerry-can with water after it became apparent to him that we were observing the latrines[47].

D. Kitchen

In all schools visited, the MVP constructed a kitchen for the school feeding program. The kitchen is a brick construction within the school compound, fitted with an improved stove, two inbuilt cooking casseroles and a chimney. During the time of the visit, the MVP kitchens in Kabugu and Kanywamaizi were not completed, and the schools were using traditional kitchens for preparation of meals.

In general, the kitchen and food preparation areas were clean. The surrounding area of the kitchen was however littered. In many cases casseroles and utensils were found stored dirty with food residue and piled wet or damp. The cooks did not receive any training in sanitation and hygiene, and were practicing poor personal hygiene while preparing food, including not washing hands after toilet use during meal cooking.

[46] In the case of Sinai School, the rain water collection tank near the latrines is locked. The only accessible rain water collection tank is located approximately 60 meters from the latrines.

[47] In Kanywamaizi, a teacher was assigned to follow us at a distance, and he dispatched pupils to correct faults wherever we were conducting observations.

Table 6.4: Hand washing practices observed in schools, Ruhiira 2008

	Sinai (initial)	Sinai (improved)	Kabugu	Kanywamaizi	Ruhiira	Nyampikye
# of boys using latrines	19	17	13	14	11	28
#of girls using latrines	20	15	14	17	14	16
# of school personnel using latrines	1	1	1	0	0	0
Total # of latrine users	40	33	28	31	25	44
# of boys washing hands	0	5	8	11	0	0
# of girls washing hands	0	7	6	7	0	0
# of personnel washing hands	0	1	0	0	0	0
Total # of people washing hands	0	13	14	18	0	0

Water is carried to the kitchen in jerry-cans. The cans are filled from the school's water sources (see below). With the exception of Nyampikye[48], all jerry-cans were extremely dirty on the inside. The water is used for cooking, dish and hand washing, and drinking. The water is not being treated in any way before use[49].

With the exception of Kanywamaizi, there was no soap found in any of the kitchens. Cooks informed us that there is usually no soap for hand and dish washing in the school. Upon revisiting Sinai School, soap was present in the kitchen and on the hand washing facility sent to the school by the MVP after the initial visit. All schools, with the exception of Sinai, have a dish drying rack.

Food is stored in a locked storage room, usually located in the main school building. Access to the storage room is limited, and the key lies with the teachers. The food is stored elevated from the floor, placed on wooden logs. The storage rooms were found to be clean and dry, and there was no visual presence of arthropods in the rooms visited and on food sacks.

[48] In Nyampikye there is a tap connected to a protected source very close to the kitchen. Jerry-cans are filled from that tap, and therefore remain clean.

[49] Normally, when used for cooking, the water is boiled over a long period of time during the cooking process.

The kitchens in Kanywamaizi and Kabugu were not serving food during the visit due to a lack of food supply. During the month of November, all five schools visited suffered from a food shortage and failed to prepare meals.

Food serving procedures include some unsanitary and unhygenic practices. The following procedures were observed in the three schools where meals were served under the school feeding program during the visit. These practices were repeated for both the 10 AM meal and lunch:

Before meal time, a group of female students is sent to fetch water with Jerry-cans. A small amount of water is then poured into dirty casseroles and the students proceed by rinsing the casseroles with their hands (Figure 6.4). After the casseroles are rinsed, fresh water is poured into them. The students then align before the casseroles, and each student rinses his/her hands by dipping them into the collective casseroles. Soap was not used for cleaning the casseroles or for hand washing. The children then pick up utensils and proceed to the kitchen to receive food. Food is consumed with hands.

Figure 6.4: Cleaning casseroles before lunch, Ruhiira 2008

After food consumption the children proceed to the same casseroles where hands are rinsed, and using the same water, plates are rinsed in the casseroles (Figure 6.5). The plates are placed in another casserole or on a dish rack, where they are picked up by the next batch of students for receiving food. The second batch of children rinses their hands in the same

casserole where the first batch rinsed both their hands and utensils. A number of children were observed scooping water from the casseroles with their plates immediately after rinsing them, and drinking water from them.

E. Water Facilities

Schools rely on different sources of water during the wet and dry seasons. When rain is ample in the wet season, rain water is collected in storage tanks. Water accessibility varies between the lowlands and highlands. Both areas receive approximately the same amount of precipitation, and therefore the potential for harvesting rain water in collection tanks is similar. Most natural water sources, however, are located in the lowlands (see below, section 6.2.4), and are therefore relatively easily accessible year round for those who live in low areas. For those living in high areas, accessing natural water sources involves walking long distances both downhill to the source and uphill carrying the container with water. The location of schools affects their accessibility to water sources, which entails various different challenges relating to water.

Figure 6.5: Rinsing hands and casseroles, Ruhiira 2008

E.1 Wet and Dry Season Sources

Wet season water sources are usually seasonal sources which run dry during other seasons. These sources are mainly seasonal streams, water holes[50] (some natural, but most manmade) and rain water collection tanks. In schools, the MVP installed rain water collection tanks in order to harvest rain water for school use. Dry season sources are sources that are usually available all year round. Sometimes wet season sources are preferred because they are located closer to schools. During periods of prolonged dryness, some of the dry season sources may also run low on water. When this happens, other dry season sources are sought. Table 6.5 indicates the type of water sources used by each school during the wet and dry seasons.

Table 6.5: Seasonal water sources used by schools in Ruhiira, 2008

Name of School	Wet season water sources	Dry season water sources
Ruhiira	• Rain water collection tanks (3) • Water holes (1)	• Omukagyera protected source (300 meters downhill) • Nyakyziba shallow well (300 meters downhill)
Kabugu	• Tap water (protected sources) • Rain water collection tanks (2)	• Tap water (protected source) • Stream (when protected source water runs low)
Kanywamaizi	• Tap water (protected sources) • Rain water collection tanks (1)	• Tap water (protected sources) • Stream (when protected source water runs low)
Nyampikye	• Tap water (protected sources) • Rain water collection tanks (2)	• Tap water (protected sources) • Swamp (when protected source water runs low)
Sinai	• Rain water collection tanks (2) • Water holes (2)	• Kakoni protected source (1.2 km downhill • Parents send water with children

E.2. Water Infrastructure and Use

The MVP contribution to water infrastructure at the school level can be divided into direct and indirect:

[50] By water holes we mean cavities in the ground which collect runoff water.

Direct contributions include the installation of rain water collection tanks, which collect runoff water from roofs. The project installs a tank fitted with a tap, rain water collection system (funnels), water basin and water drainage channel in schools. Indirect contributions of the project to water infrastructure in schools include the protection of water sources and in some areas, helping the community to dig and maintain water holes which are used by schools. Protected sources are constructed for general purpose use of the community, and are used by schools.

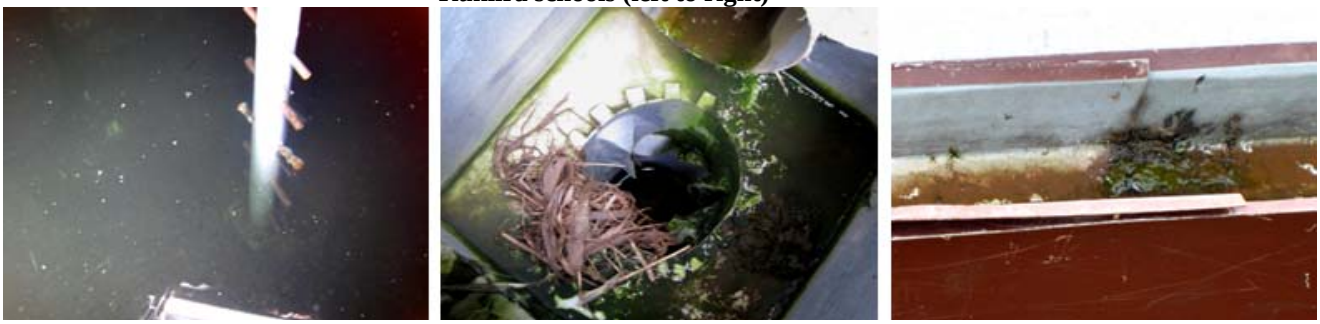
E.3. Use of Water by Schools

Water in schools is mostly used for cooking food. Kitchen staff in the kitchens installed by the MVP use water for washing casseroles, utensils and cooking. Water is also used in hand washing facilities where available and for drinking. According to answers given in interviews, water is very rarely used to wash floors or latrines.

In Sinai and Ruhiira the only water source available on school premises is water from rain water collection tanks. This water is used by the schools for cooking and washing dishes. Some students were observed using the water directly from the tank for drinking. In Sinai, following the introduction of hand washing facilities during this project water is also used for this purpose. In Kanywamaizi, water from the rain water collection tank is frequently used for all purposes even though a tap bringing water from a protected source exists on school premises. This is because the tap is located approximately 70 meters from the nearest classroom building, and therefore the rain water collection tank is often used by students and teachers during the day. In Kabugu and Nyampikye, the tap is located in a convenient place in the middle of the school and used for most purposes. Nevertheless, students were observed drinking from the nearby stream in Kabugu, and from rain water collection tanks in Nyampikye.

According to interviews with school staff (teachers and cooks) and students, the water in the rain water collection tanks is believed to be clean and therefore is being used directly. According to observations, the water in the rain water collection tanks was found to be dirty (Figure 6.6). As the rain runs off the roofs, the water collects dust, rust, bird feces and insects. The funnels are dirty with organic material, including bird feces, rodent feces and insects. Birds often nest in the funnels, and insects are abundant. The water collects all the contaminants and deposits them in the tanks.

Figure 6.6: Water inside rain water collection tanks and funnels leading to it in Sinai, Kabugu and Ruhiira schools (left to right)



This observation is consistent with the WHO Water Monitoring Guidelines, specifically the description in the sub chapter on rain water harvesting (WHO 2008c: 17). Water samples taken from a number of rain water collection tanks in Ruhiira (see Appendix B) reveal that water in rain collection tanks is contaminated with fecal coliforms and *E. coli*, and therefore not fit for human consumption without treatment.

In Sinai School, when the rain water collection tanks are empty, the school sends students to collect water from two water holes. This water is used directly without any treatment. The water holes were found to be extremely dirty, collecting runoff water from the hill side (Figure 6.7). The water was visually contaminated with manure from a nearby cattle field. These observations are consistent with water quality tests conducted by the MVP following initial findings of this study. The tests show detectable levels of fecal coliforms and *E. coli* in rain water collection holes (Appendix B).

6.2.3 Health Services and Infrastructure

As defined by the WHO (1946) health is "not merely the absence of illness or infirmity", but "a complete state of physical, mental and social well-being". Health is anchored in the physical and social environment. Environmental conditions create specific health challenges in different locations. The social environment is double edged, as it is responsible for creating and solving health challenges.

Health is central to the success of any development project. Poor physical and environmental health will reduce the efficiency and effectiveness of a project, and its long term sustainability. As such, health interventions are arguably the most important undertakings of the MVP. Without health, there will be no sustained economic, educational and social development. The ability to move out of the poverty trap is considerably comprised when poor health is predominant.

Following the MDGs, the health sector objectives of the MVP aim at directly reducing child mortality, improving maternal health, combating diseases (HIV/AIDS, malaria, TB and other diseases) and eradicating hunger (Konecky & Palm 2008, 82).

Figure 6.7: Water holes used as water sources by Sinai School

Improving health services in Ruhiira implies not only the presence of health personnel and materials, but also development of supportive infrastructure and a functioning health care system. Improving overall health in Ruhiira, will reduce the disability-adjusted life years (DALY) and increase the ability of the people in the community to invest efforts in achieving the development goals.

In order to reach the MDGs, the MVP, together with the local government and community, applies a number of interventions to improve health services:

- Building and refurbishing Health Centers (HC)
- Building and refurbishing supporting infrastructure for HCs, such as latrines, water tanks, piped water schemes, surgical theater (Kabuyanda HC), solar panels etc.
- Supply of materials such as: medication, medical instruments, ambulance, bed nets, laboratories
- Providing funds for hiring and training proficient health care personnel such as doctors, nurses, midwives, clinical officers, community health workers (CHWs), laboratory technicians, etc.

- Providing technical solutions and support such as: computers, access to internet, digitization of patient data (OpenMRS), etc.
- Help planning and support medical care programs and services such as: immunization programs, nutrition, maternal and child health, community sensitization, HIV/AIDS counseling and testing, family planning services etc.

During this study, observations in four of the six HCs in the project area took place:

- Ruhiira HC III[51]
- Kabuyanda HC VI
- Nyakitunda HC III
- Ntungu HC II

The observations were accompanied by semi-structured and unstructured interviews. A checklist was used as a guide for the observations and interviews in the HC (Appendix A: II). In addition to data collected in HCs, additional interviews with CHWs took place, as well as FGDs with CHWs, mother of children aged 5 or less, traditional healers and household interviews with parents of children who suffered from diarrheal diseases during the period of the study. The following section contains a synthesis of the data collected from the observations, interviews and FGDs relevant to health services and infrastructure.

6.2.3.1 Infrastructure, Sanitation and Hygiene in HCs

Each day of observations in the HCs began with a transect walk to map the resources within the facility, and observe their use. All four HCs have the same basic infrastructure, although there are variations in their size. In all four HCs one can find an Outpatient department (OPD), Inpatient department (IPD) and maternity ward. In Kabyuanda and Nyakitunda the OPD, IPD and maternity ward are in separate buildings, while in Ruhiira and Ntungu they are separate rooms in a single building[52]. Ruhiira, Kabuyanda and Nyakitunda HCs have a medical lab where blood samples can be analyzed. All four HCs have a dispensing room and a medical storage room. Kabuyanda HC has a surgical theater refurbished by the MVP.

[51] Level II clinics have medical officer, but not necessarily a regular physician. Level III clinics have lab facilities and Level IV has a surgical theater. According to MVP health officials, the classification levels of clinics may vary, i.e. Ruhiira may be considered level III according to the MVP, but a level II facility according to official Ugandan classification.

[52] In Ntungu, a new building is being completed. This building will serve as the IPD and maternity ward.

In terms of supporting infrastructure, all HCs have latrines and rain water collection tanks. Kabuyanda HC is connected to a secured source of water through a piped water scheme (gravity). There are plans to connect Ruhiira and Nyakitunda HCs to the planned piped water schemes of the MVP (see section 6.2.4, Water infrastructure). The piped water schemes will eventually extend to Ntungu HC[53]. Ruhiira, Nyakitunda and Kabuyanda have computers with internet access through the MVP Mbarara office connection. All HCs have limited sources of power through solar panels (all HCs) and generators (Ruhiira, Kabuyanda and Nyakitunda).

A. Ruhiira HC III

A.1 General Description

Ruhiira HC is located in the highlands, approximately 1 km south of Ruhiira Research Village, and has a catchment area of ~10,000 people (MVP 2008a). This HC was recently upgraded from a Level II facility to a Level III, including services of a medical doctor, clinical officer, midwives, nurses and lab technician.

The health center is comprised of two structures. The main structure is divided into two main sections: Admittance ward and maternity ward. The medical supplies storage room is located at northern edge of the building. The admittance ward is comprised of a room with 3 beds, dispensing room, and two examination rooms. The maternity ward includes an ante-natal room with three beds, mid-wife's office, medical supply room, labor room, delivery room, sterilization room and an unfinished room, currently used for storage.

The second building comprises a lab, a battery room (in transition into data entry room) and staff housing.

A.2 Latrines

The HC has a new latrine construction and two old latrine constructions. The latrines were built by the MVP, and consist of a four chamber brick construction ventilated pit latrine. All the chambers are fitted with doors. There are three chambers designated for general public use and one locked chamber reserved for personnel. The two old latrines are not in use.

The latrine chambers are cleaned by a designated person who is responsible for washing the HC with water and brushes every day. During the observation day and subsequent visits, the latrines were relatively clean. There is an improvised hand washing facility near the latrines

[53] Through the water schemed planned to carry water to Nyakitunda sub-district HQ, and from there by gravity flow to Ntungu and Nyakitunda HCs.

(Figure 6.8). During the observation day and subsequent visits, the jerry-can was filled with water and soap was present. The latrines were used by several patients. Only one washed hands and used the soap. None of the other users (including CHWs) washed their hands after using latrines.

Figure 6.8: Latrines and hand washing facility, Ruhiira HC III

A.3 Hand Washing Facilities inside the HC

The HC has a total of five sinks fitted with taps. There is one sink in each doctor's examination room, one in the delivery room, one in the unfinished room in the maternity ward and one in the lab. As mentioned above, the piped water system is not in place yet, therefore there is no water in the taps. A number of taps are broken, and will need to be fixed when the piped water scheme is installed. On the day of the visit, one jerry-can with water was in place in the delivery room and one in the lab for hand washing. There was no water, soap nor gloves in the doctor's examination rooms. Gloves were present in the lab and the delivery room. Soap was present in the maternity room and lab.

The doctors using the examination rooms during the visit could not have washed their hands between patients since there were no available provisions to do so. The lab technician did not wash hands before or after taking blood samples from patients, even though soap and water were present in the lab. The technician did not use gloves even though they were present in the lab.

A.4 Water

There is one functional 10,000 liter rain water collection tank in the HC. The water tank collects rain water from the main HC building and is fitted with a tap and a basin. The basin has water stagnated in it. The water in this tank was sampled and found contaminated with fecal coliforms and *E. coli* (See Appendix B: Ruhiira Health Center Reserve Tank).

The elevated 1000 liter tank which is planned to be connected to a future piped system, will bring water from a protected source to the HC. This will allow use of the sinks and taps inside the HC and lab.

B. Kabuyanda HC IV

B.1 General Description

Kabuyanda HC is located in the lowlands in Kabuyanda village, approximately 17 km from the Tanzanian border. The HC is the health referral facility for the sub-district, and serves over 140,000 people (MVP 2008a). The HC is a Level IV facility, and includes medical doctors, nurses, midwifes clinical officers, lab technician, a theater and an ambulance.

Ksbuyanda HC is comprised of seven main buildings: office and medical storage, OPD, HIV clinic, maternity ward, IPD, theater and the new OPD building which is still not operational[54]. In addition there is staff housing, three latrine constructions (in use) two placenta pits, patients kitchen, and six water tanks.

B.2 Water

The HC is connected by pipes to a secure water source. The pipes transport water to tanks located outside the different buildings by gravity. These tanks also serve as rain water collection tanks and the rain water is mixed with secured source water. In order to get water to the sinks, one needs to manually turn on a tap on the outside of the building. The water will then be carried by gravitation to the sinks.

B.3 Sanitation and Hygiene

The OPD building includes a waiting room, and administration room, two examination rooms, medicine delivery room, and the lab.

The building has an old, non operational tin rain water collection tank. There is no running water in the facility. There is one tin-can hand washing facility with water, but no soap. This

[54] This information is correct for January 2009.

facility is being used from time to time by the staff, but according to their own statements they rarely wash hands between patients. The walls of the injection room are smeared and extremely dirty (Figure 6.9).

Figure 6.9: Injection room and hand washing facility in the OPD, Kabuyanda HC IV

The lab is clean and arranged. There is a hand washing facility based on a jerry-can and soap. A sink in the room is not connected to a water source. It is used for drainage of urine and other liquids. There are bats nesting in the lab.

The delivery room has a sink with a broken tap and no other running water facility. The sink has an open drainage pipe and needs to be fitted with a bucket when used. Water can be turned on and off by turning the water tap located outside. This tap allows water from the water tank to reach the sink. As mentioned, the actual tap on the sink is broken and therefore the flow of water can only be controlled from the outside.

The theater is kept clean and sterile. The theater is fitted with a water closet and sinks with running water (when turned on from the outside). The handle of the elbow-tap used for sterilizations of personnel before an operation was broken during the visit. In order to use it for sterilization the doctor shouts “on-off” to a nurse outside the theater operating the tap leading water to the theater.

The IPD consists of two departments: general and pediatrics. The general department admits adult males and females. The pediatrics department suffers from bed shortage, which leads to a lack of space. When the ward is full, 2-3 children must share one bed (lying horizontally). This may result in cross contaminations. The treatment room has a sink, but is not connected to a water source. There is a tin-hand washing facility with soap in the room.

The maternity building is divided into an ante-natal room, the general ward (where pre and post delivery women are staying) and a delivery room. The ante-natal room has a hand washing facility with soap. One of the rooms in the building has a sink which is not operational and with a broken tap. Food is being cooked both in the building and around it[55].

Outside the maternity ward is a makeshift cooking area where admitted pregnant women and their families store and cook their food. The area is littered, even though the area is being cleaned by the HC personnel. There is defecation in the open behind the generator and the theater building in the HC compound (Figure 6.10).

B.4 Latrines

There are a number of latrines on the HC compound, but only three are currently in use. The three latrines consist of a two chamber urinal, a two chamber pit latrine and a four chamber pit latrine.

The two chamber urinal is a brick construction, divided into men's and women's urinals. There are no pits in this construction. The urinal is dirty and there is defecation in chambers and the entrance. There is no hand washing facility in the vicinity of this construction.

The two chamber, brick construction, ventilated pit latrine is located in the proximity of the theater. The latrines are dirty and arthropods are present. There is no hand washing facility in the vicinity of the latrine.

The four chamber brick construction, ventilated pit latrine is located near the OPD, and is the main latrine used by patients in Kabuyanda HC. There are doors fitted to all chambers, and an open urinal attached to the building. There is urination and defecation outside the pits and the urinal. There is an improvised hand washing facility outside the latrines, but there is no water in the jerry-can and no soap present (Figure 6.11).

[55] Food is being prepared by families of patients for them.

Figure 6.10: Open defecation behind the maternity ward, Kabuyanda HC IV

Figure 6.11: Latrines and hand washing facility, Kabuyanda HC IV

C. Nyakitunda HC III

C.1 General Description

Nyakituda HC is located in the highlands, approximately 500 meters south of Nyakitunda village, with a catchment area of ~47,000 people (MVP 2008a). The HC is a Level III facility, offering the services of a medical doctor, midwifes, nurses, clinical officer and lab technician.

The HC is comprised of three main buildings: The OPD, the IPD and the maternity ward. In addition there are two staff housing buildings, three latrines (including staff latrines), a patients' kitchen, and five water tanks.

C.2 Sanitation and Hygiene

The OPD consists of a waiting room, two examination rooms, lab, dispensing room and injection room. All the rooms in the OPD are fitted with sinks and taps. The connection of the sinks to a water source is planned for the future, but some taps are broken and need to be fixed before connecting the HC to a piped water scheme. Nevertheless, water and soap is present in all the rooms of the OPD. All the rooms have clear signs reminding the staff to wash hands and remain vigilant to disinfection procedures (Figure 6.12). Various members of the HC staff were observed washing hands most of the time between patients and procedures.

The IPD consists of two wards (one not functional), two staff housing rooms, medical storage room and an unused office. The building has no sinks, no hand washing facilities, no soap nor water.

The maternity building consists of an ante-natal office, delivery room, ward, storage room and shower room. There are hands washing sign in the ante-natal office, a sink and tap, but water does not reach the sink. There is a plastic water container and soap present in the room. There is open defecation outside the maternity ward.

The delivery room has clear signs reminding of the importance of personal hygiene and disinfection procedures. The mid-wives were observed washing before procedures.

Figure 6.12: Hand washing facilities and reminder signs in Nyakitunda HC III

C.3 Water

In the wet season, the HC relies on rain water collection tanks. During the dry season water is fetched from an unprotected stream, and sometimes a water truck fills the containers with water. There are pipes in the HC which in the future will connect to a planned water scheme. The plan is to pump water from a protected source to the sub-district HQ, and from there by gravity to the HC (see section 6.2.4).

The rain water collection tanks accumulate water from the roof buildings and run through funnels. As indicated above and in Appendix B, water in rain water collection tanks is not fit for use without purification.

C.4 Latrines

There are two ventilated pit latrines with four chambers each. The pits are fitted with slabs. There is one urinal/shower in each construction. The latrines are clean, and no arthropods are

present. There is an improvised hand washing facility in front of each toilet. The facilities were fitted with water and soap (Figure 6.13.)

Figure 6.13: Latrines and hand washing facilities in Nyakitunda HC III

B. Ntungu HC II

D.1 General Description

Ntungu HC is a relatively new[56] unit in Nyakitunda parish. It is located at the eastern edge of Ntungu village, and has a catchment area of ~10,000 people (MVP 2008a). The HC is a Level II facility, and has a clinical officer, nurse and midwife.

Ntungu HC consists of one building which serves as OPD and maternity ward. There is a new building in the final stages of completion which will serve as IPD and maternity ward. There is one rain water collection tank attached to the current building and a five chamber ventilated pit latrine.

D.2 Sanitation and Hygiene

The OPD part of the building consists of a waiting room, consultation room, dispensing room, injection room and medical storage room. There are two unused rooms in the building.

The patient registration area is used as consultation room and dispensing room. There are no hands washing facilities or gloves in the consultation area. In the dispensing room (which is

[56] Constructed the 26.02.2008.

not being used since the medication is given in the consultation area) there is a bucket with water and soap. The room which is actually designated for consulting patients is empty. The consulting room is also the HIV testing room. No water or soap is available save the bucket in the unused dispensing room.

The maternity room is in the OPD building, but has a separate entrance. There is a jerry-can with water outside the building near the entrance to the maternity rooms and soap for hand washing. The maternity rooms are clean and well maintained. Gloves are present.

D.3 Water

The OPD building has one rain water collection tank attached to it. The tank is fitted with a locked tap. This tank serves as the sole source of water for the HC.

D.4 Latrine

The HC has a five chamber pit latrine with one open urinal. There is an improvised hand washing facility in front of the latrine. The jerry-can was fitted with water during the observation day and subsequent visits, and soap was added to the water. The latrines have cement floors, and are fitted with doors. One chamber is reserved for staff use and is locked. The latrines are washed daily by the HC cleaner, and were found to be relatively clean during the visits to the HC.

6.2.3.2 Practices in HCs

A. Diarrhea Treatment and Medication

Based on information from interviews of health personnel in the different HCs, patients who arrive to a clinic with diarrhea are usually treated with ORS. If they suffer from severe dehydration, an IV will be administered. The rehydration treatment will be followed in most cases with administration of antibiotics. Most patients will also receive vitamin A, and are encouraged to eat fermented foods.

When asked why antibiotics are given to almost all patients with diarrhea, the answer given was that there are no tools to identify accurately the causes of diarrhea in the HCs. Lab technicians say that they have the ability to identify *Giardia lambila* and *E. coli* under the microscope, but do not have the capacity to handle stool samples. Cultures cannot be done on the HC level with current conditions.

Antibiotics are usually administrated if the patient is not diagnosed with malaria. If the diagnosis is malaria, anti-malarial drugs are given. It is important to note that the diagnosis of malaria is mostly based on symptoms and not on the results of a smear. Information obtained from the OpenMRS system indicates that between 46-77% of patients with negative smears receive anti-malarial treatment[57]. This has implications on the diagnosis and treatment of diarrheal disease which will be addressed below (Chapter 7, Discussion).

B. The Perspective of Health Personnel on Sanitation and Hygiene

MDs, nurses, midwives and clinical officers in the various HCs were interviewed on their hygiene habits as well as their opinions on sanitation, hygiene, common causes and treatments of diarrheal diseases and morbidity and mortality relating to diarrheal disease.

In general, hand washing by medical personnel is not satisfactory. Most of the time, medical personnel do not wash their hands between patients or procedures. The reason is mainly a lack of facilities. The exception is Nyakitunda HC, were a considerable effort to have water and soap available at all times and to raise awareness for proper medical hygiene habits is made. But even in Nyakitunda HC, the MDs indicate that at times they skip washing hands between patients since water in the improvised hand washing facilities is empty. It is important to note that the number of patients attending Nyakitunda HC is considerably lower than the number of patients attending Kabuyanda HC. In Kabuyanda the sanitary and hygiene conditions, according to observation and indications from health personnel, are considerably worse. This is partially due to the number of patient attending, but also due to lack of proper facilities, such as easy access to water. The MDs in Kabuyanda indicated that they would like to have access to hand washing facilities on wheels, which can be easily moved. In addition “fast hand disinfectant” should be available for hand cleaning in order to minimize the risk for cross infections. The health personnel emphasized that sinks are not in use. If they were connected to water sources hand washing would become a much easier task.

Health personnel indicate that they lack proper training in disinfection procedures, and suggested attending a workshop to both raise their own awareness and enable them to train other people on these issues.

[57] These figures originate from report generated by J.J. Dick who worked on the OpenMRS system during the time this study was conducted.

C. Medication in Storage and Dispensing Rooms

Oral Rehydration Solutions (ORS) were missing from dispensing rooms and storage rooms consistently during the period of the study (November 2008 – January 2009). At times, a limited number of ORS bags were present in Ruhiira and Nyakitunda. Health personnel complained about a general shortage of medicine during the study period. This shortage included ORS, paracetamol and antibiotics. This was observed in all visited HCs (including Kanywamazi HC II and Kabugu HC II) during the period of this study.

6.2.4 Water Infrastructure

6.2.4.1 General

One of the major targets of the MDGs is to reduce by half the proportion of the population without sustainable access to a safe source of drinking water and basic sanitation (See Appendix C: MDG 7, indicators 7.8 and 7.9).

Access to a clean water source is significant not only for the well being of people, but also a crucial element in achieving other MDGs. Access to a safe water source is instrumental to achieve the targets of many MVP project interventions, such as in the health, agriculture, enterprise and education sectors.

The Ruhiira cluster is located in a hilly landscape. The geochemical composition of the landscape affects the availability and quality of water, and poses major challenges to the MVP (MVP 2008: 28). Water in Ruhiira is not only limited to the lower regions of the project areas, but is also generally not fit for drinking and washing according to WHO standards (WHO 2008c) because of high concentration of metals, minerals and biological organisms (MVP 2008: 28).

Uganda has national guidelines for adequate accessibility and quality of water sources. In line with the MVP strategy (Konecky & Palm 2008), the project aims at reaching the MDGs conforming to national policies and guidelines. Therefore, creating a safe source of water must meet national requirements such as (MVP 2008: 28):

- A source that yields 20 liters/day per capita
- Is at no more than 1.5 km walking distance from users
- Covers at least 250 persons, and
- Has zero fecal coliforms colonies per 100ml of water.

In order to accommodate the national requirements and achieving the MDGs, the MVP creates a number of solutions relating to water infrastructure (MVP 2008b: 4):

- Locating and protecting springs with good yield, and, if needed, constructing an aeration channel and a sand filter to reduce solids, irons and minerals in the water.
- Planning and constructing piped water schemes, including pumping stations that will carry water to a designated location, and distributing the water through selected locations to the community.
- Protection of shallow wells.
- Construction of rain water collection tanks in public locations such as schools, churches and HCs.

Responsibilities for carrying-out these activities are shared with the communities who contribute with materials and labor. In addition, the community assumes responsibility for the maintenance of the water sources protected by the MVP. The community must form a water committee, which coordinates activities relating to the maintenance of water sources, such as: weeding, clearing soil erosion, digging erosion channels, fixing broken materials (e.g. taps), etc. (MVP 2008b: 6-7).

As mentioned above (See Chapter 3) all major diarrheal pathogens are either water-borne, water-washed or both. Water plays a significant role both in contraction and prevention of diarrheal diseases. In order to gain detailed knowledge on MVP interventions relating to water sources in the Ruhiira cluster, a number of visits to different water sources where made. A water engineer from the MVP infrastructure sector was present at all visits to water sources and was interviewed during them. The purpose of the observations was to gain firsthand knowledge of where water sources are located, what is the quality of the source and yield, seasonal variability of water sources, potential sources of pollution, periodical testing of water, state of maintenance of sources, and interaction with users on site for semi-structured interviews.

The observations were performed at nine different water sources, covering pre and post MVP water infrastructure interventions. The water sources visited included MVP protected sources, unprotected sources, protected shallow wells, unprotected shallow wells and sources planned for piped schemes. A GPS was used to record the locations of the visited sources in order to

facilitate the understanding of the planned piped water schemes and the location of sources relative to the concentration of population.

6.2.4.2 Water Sources

A. Kakoni Pumped Water Scheme (Figure. 6.14)

This scheme combines a number of spring sources which were protected by the MVP, and transferred by pipes to two 50,000 liter collection tanks. A pump house is being built near the tanks. The intention is to pump the water to a collection tank which will be placed in Ruhiira trading centre, and from there the water will flow by gravity to the MVP office, Ruhiira HC, market place and a few distribution points for the community.

Kakoni (Figure 6.15) was a water logged source, resulting in a swamp. The spring-eye was identified by the project and protected. The amount of water varies seasonally, but always gives good yield and does not dry (approximately $60m^3$/day: MVP 2008b: 5). Two other spring eyes are combined (Figure 6.14: Kakoni combined) and transferred by pipes to two water tanks. In the future an aeration channel and sand filter will be constructed before the water reaches the collection tanks. In the first stage a diesel pump will be installed, and will pipe water up to Ruhiira trading centre. In the future, when electricity becones available in Ruhiira, an electrical pump will replace the diesel pump.

For the system to work properly, the filter will need maintenance and should be cleaned every 2 years. The community will assume responsibility for the maintenance of the filter. According to the water samples collected in December (Appendix B), the water from the protected source is free from fecal coliforms and *E. coli*, thus fit for drinking without treatment.

The Kakoni water scheme will be supplemented in the future by another source, Kanyerere, located on the valley running to the east of Kakoni (see below).

Figure 6.14: GPS location of Kakoni water scheme relative to Ruhiira village

Figure 6.15: Kakoni source and water tanks, Ruhiira MVP

B. Kanyerere: Source and Planned Water Scheme

Kanyerere source was protected by the MVP in December 2007 and yields approximately 140m^3/day (MVP 2008b:5). Kanyerere is planned to be the second source for the Ruhiira water scheme. The water will be collected in two water collection tanks, and pumped up hill to Ruhiira trading centre, where it will join the water pumped from the Kakoni water scheme.

For the Kanyerere scheme, the project protected two springs, upper and lower Kanyerere. The Kanyerere springs are located on the bottom of a deep valley. The upper spring was protected by the project and a mineral removal plant consisting of an aeration channel and sand filter was installed. The community has the responsibility to maintain the source.

During the visit on December 9, 2008, the protected spring was found in poor condition (Figure 6.16). Erosion from the hills has blocked the drainage channel, resulting in the spring basin becoming water logged. The ground surrounding the aeration channel and filter was waterlogged due to excess weeds. The community has failed to maintain the source, and contaminated water is infiltrating the channel resulting in a contaminated source. The pools of standing water caused by the maintenance failure are potential breeding grounds for malaria.

Water samples collected from Kanyerere source on November 29, 2008, and analyzed in Chemiphar lab, Kampala on December 1, 2008 (See Appendix B) indicate that the water is contaminated with faecal coliforms and *E. coli*.

The eroding soil from the hills is one of the main reasons for water logging. The soil erodes during heavy rainfall from the steep hills, and because of land use by an uphill community. The uphill community is not within the MVP area.

There are two distinguishable problems in this case: failure of the local water community to properly maintain the source, and inability to harness cooperation of the uphill community in order to minimize erosion which affects the Knayerere source.

The second source in the Kanyerere scheme is located further downstream from the main source. This spring was protected by the project, but the eye has moved, and the yield is low. In addition, no maintenance work is being carried out by the community around this spring. Weeding is not taking place, and the source is not used due to its low yield. There are plans to relocate the eye when the work on the water scheme will begin during the months of March-April 2009.

Figure 6.16 Kanyerere protected spring, December 9, 2008, Ruhiira MVP

C. Karoli Spring

Karoli spring is located on a mountain slope and produces a relatively low yield. In order to render it more efficient, the project built a large collection tank (Figure 6.17) which will accumulate water during periods of low usage (namely night time).

As with other sources of water, maintenance of the protected source is the responsibility of the local community. During the visit, the tap fitted to the tank was broken (Figure 6.17).

Interviews with locals revealed that the tap had been broken for at least a month prior to the visit. Since the tap is not useable, the community reverts to the overflow pipe for getting water from the source. The responsibility to fix the tap lies with the local community.

Figure 6.17: Karoli spring and broken tap on the collection tank, Ruhiira 2008

D. Nyakiziba Bore Hole (Figure 6.18)

Before the project protected Nyakiziba shallow well and installed a pump, the community was using surface water accumulating from the shallow well in a dammed pond. The dam still exists and is accessible and located a short distance from the hand pump installed by the MVP. Water samples collected from the dam, both from surface and deep water, indicate that the dam water is contaminated with fecal coliforms and *E. coli* (Appendix B).

In order to protect the well water, the MVP dug a bore hole and installed a pump. An elected users' committee has the responsibility to maintain the pump and its immediate surroundings and report problems to the MVP. The pump and its surroundings are well maintained and water samples from the bore hole indicate that the water is drinkable according to WHO standards (Appendix B).

Figure 6.18: Nyakiziba borehole and nearby dam, Ruhiira 2008

E. Omukagyera Protected Spring

Protected by the project in June 2007, the water from Omukagyera spring was found to be hard and contained high concentrations of iron. To overcome this, the project installed a mineral removal plant, consisting of an aeration channel and sand filtering basin. This improved the quality of the water dramatically. It can now also be used for washing clothes. The maintenance of the spring and the mineral removal plant is under the responsibility of the local community.

Water samples taken from the spring indicate that the water is slightly contaminated with fecal coliforms (Appendix B), and cannot be used for drinking without treatment.

F. Kyenyange – Protected Source

Kyenganya is a spring protected by the project and planned as part of the piped water scheme which will carry water to the Nyakitunda sub-district HQ together with the Omukabaare spring (see below). The scheme will bring pumped water to a water collection tank in the sub-

district HQ, and from there will flow by gravity to Nyaktitunda HC and trading centre (MVP 2008b: 5).

The Kyenganya spring was protected by the project and yields approximately 60m^3/day (MVP 2008b: 5). A water treatment facility consisting of mineral aeration removal channel and sand filter were constructed in order to reduce concentration of solids and minerals in the water. The spring is located in a valley bottom, and two erosion channels were dug on each side of the spring in order to prevent downhill erosion from blocking the source. The erosion channels are poorly maintained. One of the channels allows erosion to pass it and reach the outer part of the source basin. The community has the responsibility to maintain the channels and the source. The source is also poorly maintained. The area is overgrown with weeds, and water is stagnated around the aeration channel, causing contamination of the source and creating a potential malaria habitat (Figure 6.19).

G. Bwisho – Shallow Well

Bwisho shallow well was protected by the MVP, and fitted with a hand pump in 2007. In the past the community used a dammed pond accumulating water from the shallow well. This well is located in proximity of Kyenganya protected spring (above), but is under the responsibility of another community. This water source is well maintained by the community and stands in contrast to the neighboring Kyenganya spring, which is neglected (Figure 6.19).

Figure 6.19: Two neighboring sources maintained by two different communities: Bwisho (Left); Kyenganya (Right), Ruhiira 2008

H. Omukabaare Spring

Onukabaare spring was protected by ACTS (Africa Community Technical Service, a Canadian catholic NGO) before the MVP was established in Ruhiira. The source was neglected for many years. The MVP plans to rehabilitate the source and include it in the Kyenyanga piped scheme (MVP 2008b: 5). Omukabaare yields $36m^3$/day. It was visited to assess a neglected protected source. The protection structure is poorly maintained and collapsing (Figure 6.20).

Figure 6.20: Omukabaare spring, protected by ACTS prior to the MVP in Ruhiira

I. Karwenyi Protected Spring

Karwenyi was protected by the project in order to add it to the existing Kabuyanda gravity flow scheme. The Kabuyanda scheme was established in 2001 by ACTS and consists of 2 sources. The project plans to rehabilitate one of the exiting sources in the scheme (Kisiyoro) and add Karwenyi to the scheme. The sources are currently joined in Kisiyoro tank, from which they flow by gravity to several points in Kabuyanda. The first stage of adding Karwenyi to the Kabuyanda scheme was completed by protecting the source and installing a collection tank. The source is still not connected to the Kisiyoro tank. Construction is planned for March-April 2009. Karwenyi is well maintained by the community, but the samples reveal that it is still contaminated and not fit for drinking without treatment (Appendix B).

6.2.5 Improving Livelihood and Increasing Income

As a part of the effort to make a sustainable contribution to the community in Ruhiira, the MVP implements a number of strategies, including: developing the community's capacity for collective action through sensitization, building institutions, encouraging enterprises, transferring knowledge, encouraging gender equality and encouraging participation and policy building within local governments (MVP 2008: 5-30).

Incorporation of capacity building strategies is a part of all MVP interventions. A number of capacity building activities have been mentioned in the sections above, such as creating local water committees with the responsibility to maintain water sources created by the MVP, and encouraging active participation in designing interventions and decision making.

This section will focus on two subjects that fall under the intention to reduce poverty and improve livelihood: market places[58] and sensitization activities. Data was gathered on these two subjects since they can directly affect diarrheal disease (potential contraction and prevention). Market places are locations where people gather to buy, sell and socialize. They have a potential impact on health issues since there is close contact between people and between people and food. Sensitization activities can contribute to the accumulation of critical knowledge relating to diarrheal diseases, and therefore was also a focus of this study. These interventions or parts of interventions are also capacity building activities for the long term sustainability of the project.

6.2.5.1 Market Places

A. General

There are four periodical markets in the Ruhiira cluster:

- Nyakitunda on Fridays
- Kabuyanda on Tuesdays
- Ntungu on Wednesdays
- Ruhiira on the first Monday of every month

Of the four markets, Ruhiira market is a direct MVP intervention, meaning it was established by the project as an income generating activity for the community in Ruhiira (see below). Ntungu market was established recently as a result of project interventions. It was established

[58] By market places I refer to periodic trade centers where goods and other services are exchanged.

by the community as their own initiative to produce more income generating activities in Ntungu village. The two other markets, Nyakitunda and Kabuyanda (the biggest), are the main markets of the cluster region and have been there for some time.

Market places incorporate in them many activities:

- Buying and selling of raw foodstuff, such as fruits, vegetables, meat and fish
- Buying and selling of goods and haberdashery such as clothes, shoes, casseroles, soap, hats, combs etc.
- Buying and selling of cooked and grilled food
- Buying and selling of domestic animals
- Buying and selling of alcohol

All market places in Ruhiira cluster have basic infrastructure which includes: public toilet, designated market area (with or without structures) and stands. Every market has an area designated for buying and selling of cooked food. In addition, during market days many vendors in the area surrounding the markets offer special goods like roasted goat, roasted and fried pork[59] and alcohol.

Because food and water are major sources of diarrheal pathogens, observing the community's habits in markets could indicate potential reservoirs for pathogens. Since the market in Ruhiira is a project intervention and the market in Ntungu is inspired by the project, it is important to try to identify externalities produced by them. In addition, it is important to remember that it is mostly the people from the community that attend these markets. Some of their sanitary and hygiene habits can be observed in markets and correlated with the application or non-application of knowledge acquired through sensitization, and help identify certain gaps in that knowledge that may lead to increased risk for contraction of diarrheal diseases.

B. Communal Latrines in Market Places

With the exception of Ntungu, all markets have communal latrines. In Ntungu, the community has plans to install communal latrines. In the meantime, the community uses a mud constructed pit latrine belonging to a household neighboring the market area. The owner of the house does not always allow the people attending the market to use his latrines.

[59] Commonly referred to as "goat joints" and "pork joints".

In Ruhiira market the MVP constructed a four chamber ventilated pit latrine. The construction was completed in September 2008. The latrine chambers are usually locked and are supposed to be open for market day (once a month). The market attendant has the responsibility to open and clean the latrine for communal use. The latrines in Ruhiira market have never been used since they were built[60]. The structure has been locked since the construction was completed, and never opened during market days. Apparently the community representative (Chairman Local Council II: LC2) lost the keys for the structure and therefore the latrine remains locked. This has severe hygiene implication, since people who attend the market urinate and defecate in the open urinal, structure corridor and around the structure. This has never been cleaned (Figure 6.21). There are no hands washing facilities in the vicinity of the communal latrines of Ruhiira market place.

Figure 6.21: Communal latrines at Ruhiira market place: open defecation around structure

The latrines in Nyakitunda market place were built by the government in 2007, and consist of a seven chamber ventilated pit latrine (Figure 6.22). There is a separation dividing the construction into four and three chambers. The four chambers are for the exclusive use of vegetable sellers who have paid for a place in the market structure. They hold individual keys to the locked door of each chamber. The owner of a key is responsible for keeping his chamber clean. The person designated by the community as the market attendant has the overall responsibility to ensure that the latrines are kept clean.

[60] Up until the completion of this study in the end of January 2009

The other side of the structure (three chambers) is for public use. It is under the responsibility of a second market attendant. This market attendant holds the keys to the structure and opens it on market days, as well as make sure that they are clean.

The side that belongs to the vegetable sellers is clean. The public side was extremely dirty. The latrines were locked during the visit, even though it was market day. There was open defecation in the access corridors to the chambers and in the urinal. When the market attendant was located later in the day, and asked to unlock the chambers, the latrines were found to be dirty with defecation outside pit holes (Figure 6.22). There are no hand washing facilities associated with the latrines in Nyakitiunda, though the vegetable sellers have access to a rain water collection tank attached to the market structure.

Figure 6.22: Communal latrines: Nyakitunda market place, Ruhiira MVP

Kabuyanda market place, held on Tuesdays, is the largest in the project area. There are two communal latrines in the market area, both built by the local government. The main latrine structure is an EcoSan[61] type. The second structure is an ordinary ventilated pit latrine.

[61] Ecological Sanitation – based on the principles of separation and recycling of waste in ways which are safe and promote sanitation, hygiene and health (e.g. http://www.kwaho.org/t-ecosan.html).

The EcoSan latrines (Figure 6.23) were built in the middle of 2007, and consist of five chambers. Each chambers is fitted with two pit holes. Each pit is covered with a slab which has two holes: one for excreta and one for urine. The urine is transferred through a pipe to a container outside were it is stored and used at a later point as organic fertilizer. The excreta are stored in a shallow pit. When the pit is full, the hole is sealed, and the second hole in the chamber is opened for use. It takes approximately 18 month to fill a pit, which is the time needed for the excreta in the other pit to dry. When the excreta in the sealed hole is dry, it is removed from the pit through a plastic door fitted at the back of the latrine. The excreta is then safe for usage as fertilizer.

During market days, an attendant has the responsibility to open and maintain the latrines. He stands outside the latrines during the whole day. He makes sure the latrines are clean, that ashes are used to cover the excreta after each user, that there is paper to hand to users and that there is soap and water available for hand washing. For this, the attendant charges each user 100 UGX (approximately 5 US cents). The hand washing facility consists of a water container fitted with a tap, fixed inside a cement basin, with a wash basin and a drainage canal. Soap was available for users during the visit. Latrine users were observed using the hand washing facility frequently.

The latrine was found well maintained and clean. The sub-district official responsible for health and sanitation was interviewed on issues relating to the EcoSan latrines. He was found to be well informed on the use cycle, cleaning procedures and disposal of urine and excreta.

Figure 6.23: EcoSan latrines at Kabuyanda market place, Ruhiira MVP

The second latrine construction at Kabuyanda market is new, and was open for the very first time the day the observation took place (December 2008). The latrines consist of four ventilated chambers and one open urinal. There is an attendant responsible for the latrines present at the entrance during market day, charging 100 UGX from each user. His responsibility is to keep the latrines clean. The attendant brings with him a jerry-can with water and soap to serve as hand washing facility for users, and has the responsibility to have water at all times available for hand washing.

C. Raw Food at Markets

Raw food refers here to all sorts of foodstuff sold uncooked in markets. This includes: fruits, vegetables, meat and fish.

Fruits and vegetables are displayed in the open in markets. The most obvious risk for transmission of diarrheal diseases from fruits and vegetables are related to external contamination of the foodstuff. Unless peeled or boiled, there is a certain risk of contracting diarrheal pathogens from fruits and vegetables. In Ruhiira most fruits are peeled (banana, pineapple and mango). Vegetables are rarely consumed raw, and are mostly cooked with other ingredients. The risk of transmission diarrheal pathogens through fruits and vegetables in markets relate to the personal hygiene of the seller and buyer.

The picture is different when it comes to meat and fish. These foodstuffs may contain diarrheal pathogens when they are raw, and the risk increases the longer they are displayed in the open without refrigeration. In order to remove potential diarrheal pathogens from meat and fish, they need to be thoroughly cooked before consumption.

Raw meat is sold mostly in Kabuyanda but can also be found in Nyakitunda. In Kabuyanda the butchers are located outside the market, but offer meat twice a week, once on market day. The meat is slaughtered in a structure (Figure 6.24) which serves as a slaughter house. The structure consists of a cement floor with channels for draining the blood to the outer part of the structure. Water from the nearby swamp is used to wash the floors of the structure. The structure was found dirty with blood, the channels were clogged and a large amount of arthropods were present. In addition, around the structure there were indications that animals are slaughtered on the grass. All this indicates that slaughtering animals in Kabuyanda is done in unsanitary and unhygienic conditions, which increase the risk that the meat will contain diarrheal pathogens when sold.

Figure 6.24: Slaughter house and surroundings in Kabuyanda, Ruhiira MVP cluster

When in the butchery (Figure 6.25), the meat is hung in the open, often under the sun, for the better part of the day. For meat handling, the butchers lay the meat on wooden surfaces, sometimes covered with leaves. The surfaces and knives used for parting the meat were visually dirty. There are no hand washing facilities in the butchers' shop, and meat handlers were observed practicing unhygienic behavior when handling raw meat. This results in an increased risk for the meat containing diarrheal pathogens when sold to customers. As stipulated above, if the meat is not cooked thoroughly before consumption, the chances of contracting a diarrheal disease from this meat would have to be high.

Figure 6.25: Butcheries in Kabuyanda, Ruhiira MVP

Fish is sold in all markets, but the largest quantity can be found in Kabuyanda. There are no fishing activities in the project area. All fish are brought from other areas. The main problem with the fish sold in markets is that it lies all day in the open under the sun without refrigeration, and can be a source of diarrheal diseases (Figure 6.26).

Figure 6.26: Fish sold in markets, Ruhiira MVP cluster

D. Cooked Food at Markets

Cooked food in markets is sold as a service for people attending the market. There are three predominate types of food sellers in markets: Temporary hotels, permanent hotels and food "joints". The temporary hotels are spaces within the market area which are rented to those who wish to sell food in markets. Depending on the market, the allocated space may include an indoor area (Nyakitunda and Kabuyanda). Those who set up a temporary hotel, usually create a space for a kitchen and a space where food is served. All ingredients, water, fuel wood, casseroles, utensils, benches and chairs are brought to the market place by the tenant.

Permanent hotels are located outside the market compound. These are usually locations where food is served daily, regardless of market days. By the permanent nature of these locations, all infrastructures exist on a regular basis.

Food "joints" are locations where food is grilled or fried. In most cases food "joints" will sell either goat or pork. These joints are mostly operating on market days only, but some serve food daily. They are mostly located outside the market compound, but in Kabuyanda they can be found within the market as well.

The cleanliness of temporary hotels varies, and ranges from extremely unsanitary and dirty to clean (Figure 6.27). The food is cooked outside in the open, and lies in casseroles most of the day. Flies are abundant and cover the food. The owners bring water with them and in most

cases a bowl and soap for hand washing. The water originates from the closest location the owners can get it, and varies from protected sources, rain water or pond water. The water is also used for cooking and drinking. It is not treated in any way before drinking. Utensils are washed or rinsed by the owners, and are often not cleaned before serving food to customers. Sometimes an animal is slaughtered onsite for cooking. In these cases, the slaughtering takes place on the grass or on banana leaves near the hotel. The meat is usually handled in an unsanitary and unhygienic way (handled with dirty hands and utensils), and often lies in the sun for long periods before it is cooked (Figure 6.28). The meat is often covered with flies. If the meat is cooked thoroughly then the chances for acquiring a diarrheal disease are low. In many cases though, the meat is still bloody when it is consumed. In general, most people take advantage of the hand washing facilities available at temporary hotels, and use soap before and after eating the meal. The owners of temporary hotels were very rarely seen washing hands before or after cooking, after using latrines or after rinsing utensils.

Figure 6.27: Temporary hotels in markets, Ruhiira MVP cluster

Figure 6.28: Handling food in temporary hotels, Ruhiira MVP cluster

Permanent hotels are usually located outside the market compound, and food is usually served daily. During market days many people dine at these hotels. By being permanent locations, these hotels usually have more basic infrastructure such as: a rain water collection tank, kitchen, an indoor area for food consumption and latrines. The levels of cleanliness of permanent hotels vary ranging from very clean to very dirty. There are very few clean hotels. Such a hotel can be found in Kabuyanda. This particular hotel used water from a nearby tap connected to a protected source. The hotel offered fresh food served at tables. The kitchen was relatively clean and there were hand washing facilities with soap in the kitchen, near latrines and near the dining area for customers. Most permanent hotels are of much lower standard, usually located in mud constructed houses. One example of such hotel is from Nyakitunda. It has its own rain water collection tank. The kitchen and latrines had unsanitary and unhygienic conditions (Figure 6.29): The water tank was loosely covered, causing a contamination of the water with anything from insects to bird feces. The water is drawn out of the tank with a scooper made of a cut jerry-can. According to the owner the scooper is never washed and was found to be dirty. The water from the tank is used for hand washing (no soap present), drinking and cooking. It is not treated in any way before it is used. The latrines,

kitchen and food preparation surfaces were also dirty. Such hotels are commonly used by the community for eating during market days (see below – household interviews).

Figure 6.29: Water collection tank in a permanent hotel, Nyakitunda, Ruhiira MVP cluster

Food “joints” are locations both inside and outside the market compounds that offer grilled meat usually during market days. There are two predominant types of food “joints”: “goat joints” and “pork joints”. Goat joints are easily found along the streets. Pork joints are usually located in back streets and indoors, and are harder to find if one does not know where to look. The reason for this is that pork is considered an unclean animal, and is forbidden for consumption by Muslims. Even though the Muslim population in the project area is almost non-existent, the practice of keeping pork joints out of view is still observed. Members of the community indicate that this is a relic practice from Idi-Amin’s regime, where selling pork was forbidden by law. Both types of food joints practice unsanitary and unhygienic habits (Figure 6.30). Pork joints tend to be slightly worse than goat joints, since things are done in a more covert way.

Both types of joints slaughter the animals on site the day it is served or in some cases, slaughter the animal a day earlier and transport the meat to the grilling site. Some joints offer hand washing facilities (with or without soap). In all joints visited utensils were dirty, owners handled food before and after grilling with hands and, animals such as dogs and chickens roamed freely near the food preparation area and in garbage around the compound. The

owners of food joints tend to be young men who take on this practice as extra income during market days. According to community members, this is especially true with pork joints, since selling pork is not considered an honorable practice (as mentioned above), but still pork tends to be very expensive, and profits from slaughtering one animal can be quite high.

In conclusion, food consumption in markets may be a source for diarrheal diseases. There are a few factors that may enhance the risk: no standards for cooking and serving food in markets resulting in bad sanitary and hygienic conditions; lack of infrastructure such as kitchens, latrines and water sources; lack of knowledge regarding possible causes of diarrheal diseases which result in serving undercooked food, negligent storage of cooked food and unhygienic handling of raw and cooked food.

Figure 6.30: Goat and Pork "joints", Ruhiira MVP cluster

6.2.5.2 Sensitization

A. General

Community sensitization is an integrated part of all MVP interventions (Konecky & Palm 2008). When it comes to the subject of this study, community sensitization that results in critical knowledge that leads to mitigating and avoiding diarrheal diseases takes many forms, and is delivered through many subjects. In school education, sanitation and hygiene is a chapter on the syllabus. In addition, it is emphasized to pupils in the daily and weekly lineup in schools. In the health sectors, sensitizing the community on the importance of hygiene and sanitation takes many forms:

- Community health days are organized to disseminate critical information to improve individual health. Sanitation and hygiene are among the many subjects taught during a health day. This includes a demonstration of proper sanitation and hygiene practices (MVP 2008: 21).
- Recruitment and training of Community Health Workers (CHWs) also plays a major role in sensitization of the community. The CHWs are each given a catchment area of approximately 200 households (HHs). One of their main tasks is to visit these households on regular basis and be aware of the many health issues in each. The CHWs are trained to give advice regarding health, including proper sanitation and hygiene habits, and contribute to regular sensitization of the community. The CHWs play a significant role in mobilization of the community to attend both health days and take advantage of the health services offered through the MVP interventions (MVP 2008: 21).
- Through the antenatal and postnatal services introduced by the MVP, young mothers are provided with detailed information on maternal care, including proper sanitation and hygiene practices of the mother before, after and while caring for the baby (e.g. hand washing, proper disposal of feces, clean breasts), and how to minimize the risks for the baby to contracting various diseases through proper hygienic care.
- Sensitization of community members on proper nutrition not only to mitigate malnutrition, but also emphasizing the importance of proper diversification of meals and good nutrition habits (MVP 2008: 26).

In the water and sanitation sector, community sensitization plays a significant role in the attempt to establish habits that will result in a reduction of health problems associated with drinking water and poor sanitation and hygiene habits. The sensitization efforts include:

- Sensitizing community people in proper maintenance and usage of water sources, emphasizing the importance of safe and clean water sources both biologically and chemically (MVP 2008b: 6).
- Sensitizing households on the importance of proper sanitary infrastructure such as kitchens, bath shelters, drying racks and pit latrines in order to reduce sources of contamination at the household level and keep a clean household environment that can contribute to preventing health problems (MVP 2008b: 3; 8-9).
- Sensitizing community leaders on the importance of water and sanitation infrastructure and training them in proper resource management in order to maintain the infrastructure such as water sources, public rain water collection tanks and public latrines (MVP 2008b: 8-9).

Being sensitized by the MVP does not necessarily mean that the knowledge is being applied. In order to try to capture the knowledge that stakeholders possess after being sensitized by the MVP, a number of methods were used, including FGD and semi-structured interviews. These methods capture mostly what people know, not the application of their knowledge. In order to attempt to document the gap between knowledge acquired through sensitization and the actual application of the knowledge, a number of techniques were used, including triangulation by re-asking same type of questions by using different formulation, observations of behavior and confronting people on the gaps between what has been said to what has been observed (see respective sections below and Chapter 5 above).

The FGDs, semi-structured interviews and observations were carried out in relation to project interventions, sensitization activities and the data described in the sections above, in order to complement it and present a picture as accurate as possible.

B. Focus Group Discussions

A number of focus group discussions (FGDs) were carried out throughout the study with the aim of depicting particular stakeholders' perspectives, knowledge and implications of the MVP interventions and sensitization activities on their livelihoods. In order to capture the

diversities reflecting the different challenges of highland and lowland communities, as well as the perspective of different stakeholders, twelve FGDs were carried out (Table 6.6).

A guide was prepared before each FGD describing the rational and aim of the session outlining the basic questions to be used in order to reach the objectives (See Appendix D). The focus group discussions were conducted by a community facilitator provided by the MVP in the local language (Runyankole), translated simultaneously by my research assistant and recorded by me. Both the facilitator and research assistant received a copy of the guide, and were instructed on objectives of each FGD, including the tentative construct of the FGD. They were also informed about introduced triangulation in the question guide, clarifying the purpose of asking similar questions formulated differently. Some of the answers received in each FGD were also triangulated through observations conducted in visited locations and household visits conducted at a later point.

Table 6.6: Focus group discussions undertaken in Ruhiira, Uganda, fall 2008

Stakeholder Group	# Of focus group discussions Undertaken	Locations
Children aged 5-17	5	One in each visited school: Sinai, Ruhiira, Kanywamaizi, Kabugu and Nyampikye
Mothers of children aged 5 or less	2	One highland group; one lowland group
Community Health Workers	2	One highland group; one lowland group
Traditional Healers	2	One highland group; one lowland group
Local leaders	1	Highland group

In general, the purposes of the FGDs conducted in Ruhiira were to:

- **Focus research** :
  1. To understand the extent of the severity of diarrhea in Ruhiira, i.e. are there many sick children? are there deaths associated with diarrhea?
  2. To identify potential causes of the problem as it is observed, understood and explained by different stakeholders.
- **Formulate questions for a future study:**

1. To identify how diarrhea is defined and understood in the eyes of the different stakeholders; their level of knowledge.
2. To identify what the solutions for diarrhea are according to different stakeholders.
3. To identify how different stakeholders envisage prevention of diarrhea.
4. To identify how stakeholders consider their level of knowledge on diarrhea, its causes, treatment and prevention.

- **Contribute to identifying, understanding and solving unanticipated/unintended problems related to project interventions**
    1. Which educational activities regarding diarrhea are carried out by the MVP at different levels?
    2. Which additional activities would stakeholders like to see in the area?
    3. What is the role of different stakeholders in preventing diarrhea related deaths?
    4. What are the activities that are undertaken by different stakeholders related to identification of diarrhea, its causes, prevention and treatment?

Every FGD provided different perspectives on some of the diverse purposes described above. Some purposes could only be clarified by specific stakeholder groups like CHWs or community leaders. This section is divided into sub-sections, each presents the synthesized data gathered from each stakeholder group.

B.1 Children Aged 5-17 in Schools

General

During the fall of 2008 in Ruhiira, five FGDs were conducted with children aged 5-17. Each of these took place in the schools visited: Ruhiira, Sinai, Kanywamaizi, Kabugu and Nyampikye. A total of 90 student participated in these FGDs. Each discussion lasted approximately 60 minutes.

Objectives

There were two main objectives for the FGD with school children:

1. To get an idea of the extent of morbidity related to diarrheal diseases in school children.
2. To determine the level of knowledge and understanding of diarrheal diseases: causes and prevention.

The first objective aims at getting a sense of morbidity related to diarrheal diseases. Since children older than 5 years of age are at considerably less risk of dying from diarrheal disease than younger children, an attempt was made to capture the risk of infecting siblings of the participants aged 5 or less with diarrheal diseases (see Appendix D – FGD I).

The second objective was to determine the knowledge of the participants in relation to diarrheal diseases. The first question aimed at understanding what diarrhea is according to the participants, as well as their understanding of how it can be acquired, transmitted to others, mitigated and prevented. In addition, efforts to determine what the sources of knowledge for the answers given by the participants were made. This objective helps to determine the impact of MVP sensitization when it comes to diarrhea, sanitation and hygiene.

Results

All school children who participated in the FGD indicated that they had suffered from diarrhea more than once in the past.

With the exception of six participants, all school children had siblings aged 5 or less at home. All children reported participating in the upbringing of their young siblings by:

- Carrying them around
- Playing with them
- Feeding them
- Cleaning up after them when they defecate or urinate

All participants knew that diarrhea meant loose stools[62]. When asked how they can contract diarrheal diseases, the most common[63] answers were:

- Drinking contaminated water (dirty; un-boiled; contaminated with feces)
- Eating food with dirty hands
- Eating dirty food (spoiled; rotten; old; uncovered)
- Bad personal hygiene
- Eating food with dirty utensils
- Contact with flies (personal contact; through food)

[62] There was no attempt to determine if the school children knew the WHO definition of diarrhea, namely three or more loose stools a day, nor was any attempt made to discuss the severity of cases.

[63] The answers that repeated themselves the most, in variations, in each FGD, and between similar FGDs.

The FGD participants could relate the contraction of diarrheal disease to the fecal-oral route either directly or through mediums. In addition, the relation between diarrheal diseases through eating contaminated food was known to them. The concept of human-human transmission of diarrheal diseases was unknown to them (see below).

Others causes of diarrhea mentioned by many participants included:

- Overeating
- Eating unsalted food
- Eating unvaried diet

When it comes to preventing the contraction of diarrheal diseases almost all participants[64] knew the importance of personal hygiene, i.e. hand washing. The use of soap was, for the most part, not considered as a necessity in order to prevent the contraction of diarrheal disease. The participants emphasized that hand washing was important:

- After using the latrine
- Before eating
- After eating

There was no need to wash hands after playing or working outside, cleaning up after the young siblings or before attending to young siblings.

Other ways mentioned for preventing the contraction of diarrheal diseases included:

- Drinking boiled water
- Covering pit latrines
- Covering food leftovers
- Washing fruits and vegetables
- Keeping utensils clean

In general, the participants displayed good knowledge relating to causes of diarrheal diseases. The fecal-oral route was understood as one of the main causes of diarrheal diseases both at the direct and indirect levels. Also knowledge relating to prevention of diarrheal diseases was good, and covered the most important prevention measures. No participant was aware of the human-human transmission route of diarrheal diseases, and therefore it did not occur to them

[64] With the exception of 2-3 young individuals in each of the five FGDs.

that they could communicate diarrheal pathogens to one another and to (younger) family members.

The participants indicated the following as their main sources of knowledge on contraction and prevention of diarrheal diseases:

- Health days
- Teaching at school
- Information from parents
- Personal observations

B.2 Mothers of Children Aged 5 or Less

General

During the fall of 2008, two focus groups discussions with mothers of children aged 5 years or less where held. The first FGD took place at Sinai church in Ruhiira, and included ten participants from the highland villages. The second FGD took place in Kabyuanda Primary school, and included eight participants from the lowland villages. The FGD was moderated by a community facilitator, and translated from Runyankole by a research assistant. The moderator followed a FGD guide (see Appendix D – FGD II) prepared by the researcher, and followed a procedure agreed upon beforehand. Each discussion lasted approximately 90 minutes.

A minimal amount of personal information (e.g. age, total number of children, education level) was recorded during the FGD in order to evaluate the relative experience of mothers with children, correlation of experience with the level of education and to better understand the group dynamics. This information was used in order to manage the group dynamics and to provide some context for better understanding. No identifiers were recorded, and therefore no information can be traced back to particular individuals.

Objectives

The FGDs were carried in order to better understand how MVP interventions are viewed and understood by mothers and to learn the level and origin of knowledge regarding contraction, treatment and prevention of diarrheal diseases.

This information was gathered in order to help learn how current interventions might produce externalities in the future and to identify what type of intervention mothers would like to see materialize in the project area in the future.

In order to achieve this, each FGD was divided into two sections (see Appendix D – FGD II):

1. To determine, in the opinion of mothers, which are the most significant interventions of the MVP and how they see them developing in the future.
2. To determine the extent of knowledge of mothers about diarrheal diseases: its causes, treatment, and prevention.

Results

When it comes to MVP interventions, both groups listed all the major undertakings of the project. Medical interventions are considered the most important ones by both groups. All the mothers mentioned the benefits of free medication, 24h availability of health services and the presence of trained MDs in the village. Since malaria is thought to be the main reason for morbidity in the community, mothers believe that distribution of bed nets have had a significant impact on the reduction of malaria.

The reasons emphasized for ranking medical related interventions as important are related to the economical possibilities associated with the new situation. In the past the HCs services were not available all the time; there were few drugs in HCs; there were no maternity wards which meant women gave birth at home or had to travel to Mbarara and there were no lab services. Seeking health care meant spending both time and money. In the context of health interventions, having HCs in the village reduces the time spent on seeking medical care, thus freeing more time for activities that contribute to livelihood improvements and generate income.

The highland group considered water related interventions as the second most important MVP intervention (the lowland group did not mention water as an important intervention). Reference was made to both protected sources and rain water collection tanks. This group emphasized that water was now cleaner. Most importantly, rain water collection tanks reduce the need to travel long distances to fetch water, and free more time to engage in income generating activities.

Both groups, however, mentioned that the walking distances to water sources are still an issue. They all agree that water should be available closer to households. The reason for this relates to the time saving issue, but also to creating more water related income generating activities such as irrigation and animal husbandry. Ease relating to bathing and clothes washing were also mentioned as a reason for having water sources closer to households.

The highland and lowland groups both mentioned building roads as the third most important intervention since it reduces time spent on traveling to HCs and brings economical opportunities to the area.

Education and school feeding programs were mentioned as means to improve the future of the community as were MVP interventions in agriculture.

When asked if they see any problems with current interventions, complaints relating to their personal economy were brought up. The examples given were expensive fertilizer, expensive improved stoves, quality of roads and distance from roads which makes it difficult for merchant lorries to pass and difficult to move produce to roads, distance to water sources which results in less time spent in the fields or less time for other income generating activities.

In general, for the participants of these FGDs, MVP interventions were perceived as an opportunity to maximize personal utilities, mainly facilitate engagement in income generating activities and reduce costs of necessary services. Their major complaints focused on matters that cause them to lose time and money.

Regarding diarrheal diseases, the aim was to identify the extent of knowledge on causes treatment and prevention. It was also an aim to identify if local traditional beliefs and practices are still applied even though MVP solutions and knowledge is spread in the cluster.

All participants indicate that all of their children had suffered from diarrhea more than once in their lives. Usually the span of the symptoms lasted between two days and one week. When asked what causes diarrheal diseases, the answers given by the highland and lowland groups were similar, and included: worms, change of diet (moving from breastfeeding to other food), eating beans, using oil for cooking, eating dirt, eating feces and poor food. The lowland group added the following causes: poor hygiene, food allergy, poor feeding (undiversified diet) and

malaria. To the question, *why* are children contracting diarrheal diseases[65], a notable difference between the answers given by the highland and lowland groups was noticed. Among the answers given by the highland group:

- Babies drinking amniotic fluid during birth
- Poor feeding, i.e. mixing a certain root with beans
- Teething
- Exposure to sunlight and wind
- Mother sick with syphilis
- Forcing the child to sit before time
- Stopping breastfeeding too early
- Breastfeeding during pregnancy

Among the answers given by the lowland group:

- Eating dirty food
- Eating food which had flies on it
- Eating unwashed fruits
- Eating food with dirty hands
- Children picking up food from the ground
- Eating food which was lying around for a long time
- Worms
- Eating food one does not like
- Overfeeding on one type of food
- Transition to solid food in babies too early

The answers suggest that the highland group has a deeper persistent belief in traditional explanations, while the knowledge of the lowland group reflects more modern understanding. One mother in the highland group attributed diarrhea to evil and suggested attending church as a mitigating solution. Some traditional beliefs were brought up by the lowland group as

[65] This question is different from "what are the causes of diarrhea" and was asked in an attempt to identify if there are persistent traditional beliefs regarding the contraction of diarrheal diseases.

well, including breastfeeding during pregnancy, teething and seasonality (during maize harvest[66]).

Herbal medicine was mentioned by the respondents as their primary remedy for diarrheal diseases and is used whether the child was taken to the HC or not. If the sickness persists medical attention at HCs is sought. Even when HCs prescribe medicine, herbal solutions are usually used in addition. Some parents seek solutions with local healers (mainly herbalists) before attending HCs. Many parents rely on personal experience with herbal medicine, and administer it themselves without seeking help from a local herbalist.

The participants in the FGD indicated other homemade solutions for diarrheal diseases which are used less frequently:

- Homemade ORS.
- Raw eggs mixed with amoxicillin (antibiotic).
- Administrating liquid squeezed from cassava roots.
- Feeding babies with small fish mixed with cow butter.

When mothers were asked to outline what the main causes for diarrheal diseases are according to local traditional healers (namely herbalists), most attributed diarrhea to worms. They also reported that some herbalists view wind, drinking amniotic fluid, stopping breastfeeding too early, breastfeeding during pregnancy and sleeping in the same bed with a child while in pregnancy with another, as possible reasons for the contraction of diarrheal diseases.

The concept of taking preventive measures in order to avoid the contraction of diarrheal disease was in general well known to the participants of the FGD. Both groups displayed knowledge that is essential for preventing diarrheal diseases. The preventive measures suggested by the participants included:

- Washing hands
- Boiling water
- Covering food
- Cleaning breasts before breastfeeding

[66] Associating diarrhea with maize harvest can be an incorrect explanation to an actual seasonality prevalence associated maybe with weather patterns.

- Regular de-worming
- Cooking food well before eating

In addition to actual actions for preventing the contraction of diarrheal diseases, the participants suggested that enhanced education, provision of more drugs by HCs, construction of pit latrines at household level by the MVP, advancing water sources closer to households, providing kits for water treatment at the household levels (water-guards), providing cooking stoves, providing hand washing facilities and supplying CHWs with drugs may contribute to the reduction of diarrheal diseases among children in the project area.

B.3 Community Health Workers

General

During the month of December 2008 two FGDs with CHWs were conducted. During the time of this study there were a total of 48 CHWs in Ruhiira MVP. Of these, a total of 43 participated in one of two FGDs. The CHWs were divided into one group representing the highlands and one representing the lowlands. The highlands group consisted of 20 participants, and took place at Ntungu HC. The lowlands group consisted of 23 participants, and took place at Kabuyanda office space.

The FGDs were moderated by the village doctor, and conducted in English and Runyankole. A research assistant served as translator while the data was recorded by the researcher. The moderator received instructions concerning the goals and objectives of the FGD, was provided with a written guide (Appendix D – FGD III) and followed the procedure agreed upon prior to the conduction of the FGD. Each discussion lasted approximately 90 minutes.

Both FGDs consisted of a presentation of the participants and of the purpose of the discussion. The presentation and introductions where prepared in advance in writing. The participants were informed about the research project and were ensured that no identifiers would be used. Before the discussion began, all participants received a form on which the following information was recorded for the purpose of assessing experience and burden of work (Table 6.7; recording information from 37 CHWs who returned the form):

- Parish
- Period time of work as CHW for the project
- Number of households in catchment area

- Number of deaths of children aged 5 or less during the time the CHW worked for the project in his/hers catchment area[67]

Table 6.7: General information recorded from community health workers participating in focus group discussion, Ruhiira 2008

Geographical location of CHW (H=highland; L=lowland)	Parish	Duration of employment in months	# Of households in catchment area	# of children aged 5 or less who died in the catchment area in the last 12 months
H_CHW	Ruhiira	15	207	4
	Ruhiira	15	158	6
	Ruhiira	15	146	2
	Ruhiira	15	130	2
	Ruhiira	15	142	1
	Ruhiira	15	210	1
	Ruhiira	4	320	5
	Ruhiira	15	182	4
	Bugongi	12	201	5
	Bugongi	5	210	6
	Bugongi	15	296	6
	Bugongi	15	204	3
	Bugongi	15	253	4
	Ntungu	15	241	8
	Ntungu	15	250	1
	Ntungu	15	222	5
	Ntungu	16	148	5
	Ntungu	16	150	1
	Ntungu	15	180	2
L_CHW	Kabuyanda	16	206	1
	Kabuyanda	5	346	0
	Kabuyanda	16	210	2
	Kabugu	16	180	1
	Kabugu	16	215	2
	Kabugu	16	226	3
	Kabugu	16	212	2
	Kabugu	16	220	1
	Kabugu	16	225	3
	Kabugu	18	200	2
	Kisyoro	5	258	0
	Kisyoro	16	200	5
	Kisyoro	18	200	3
	Kisyoro	16	214	2
	Kisyoro	16	201	2
	Kanywamaizi	5	246	2
	Kanywamaizi	16	148	3
	Kanywamaizi	15	253	6
Total # of deaths:				**111**

[67] The information is memory based and should not be considered as reflecting the accurate number of deaths of children aged 5 or less in the project area. It only serves as a general indication to verify that there are deaths of children aged 5 or less, since this information could not be found in the MVP database.

Objective

The FGDs were conducted in order to understand the severity of diarrhea in Ruhiira (morbidity of young children) and to identify its potential causes according to the CHWs. An emphasis on the views and opinions of the CHWs was a main point of the FGDs, and included their level of knowledge on diarrheal diseases, their perspective on treatments and prevention, their perspective on the awareness and knowledge regarding diarrheal diseases at household level and their opinion on what else can be done in general and by themselves in order to mitigate the morbidity of diarrheal diseases and increase awareness to prevention.

There were four stated objectives for the FGDs:

1. To identify the extent of morbidity and mortality from diarrheal diseases in Ruhiira MVP.
2. To determine the extent of the CHWs understanding of diarrheal diseases (causes, treatment and prevention).
3. To identify the level of knowledge about diarrheal diseases, causes, treatment and prevention at the household level as observed by CHWs.
4. To identify current interventions to solve diarrhea-related problems and the proposed future interventions, as observed and proposed by CHWs.

Results

The first phase related to the knowledge of CHWs regarding diarrheal diseases. The answers indicate that knowledge is not uniform; it varies from person to person. When asked how diarrhea is defined, the answers varied from passing of at least 10 watery stools an hour to the WHO definition of 3 or more watery stools a day. Some defined diarrhea as dehydration, and others defined diarrhea as an acute loss of weight and paleness. Other definitions of diarrhea included the additional symptoms of vomiting, loss of appetite and stomach ache.

The answers also indicated that there is a basic misunderstanding and confusion around the difference between diarrheal diseases and loose stools in young children associated with breast feeding. The distribution of the answers suggested that younger CHWs showed more consistent and founded knowledge, while the older generation gave various answers[68].

[68] The age of participants was not recorded, and this comment is based on observations during discussion between CHWs in the FGD.

When it comes to ways of contracting diarrheal diseases, the CHWs demonstrated firm knowledge of the usual sources of contamination:

- Contaminated water
- Contaminated food (raw, unwashed, old cooked)
- Bad hygiene (hands, breasts)

Some CHWs (mostly the younger generation) were aware of the fecal-oral route source of contamination leading to diarrheal diseases, i.e. associated the consumption of contaminated agents to the source of contamination. Others (mostly the older generation) could not name the reasons water, food or bad hygiene can contain diarrheal pathogens.

In order to determine if CHWs are familiar with the importance of ORS as well as if they understand the difference between rehydration treatment and treatment targeting the pathogens, they were asked what the treatments for diarrheal diseases are.

Most CHWs demonstrated good knowledge relating to the importance of rehydration when suffering from diarrheal diseases. Their knowledge covered both commercial and homemade Oral Rehydration Solutions (ORS), and they were able to instruct how to prepare ORS at the household level, emphasizing the importance of using clean water. Their knowledge, however, does not cover the fact that rehydration does not address diarrheal pathogens but only prevents a severe result of a sickness. Nevertheless, the severity of dehydration caused by acute loss of liquids nutrients and minerals due to diarrheal diseases is well understood. Deaths related to diarrhea diseases are coupled by CHWs with dehydration. Some, though, associate diarrhea related deaths to loss of blood (three CHWs).

When asked about preventing the contraction of diarrheal diseases, the CHWs suggested:

- Boiling water (two emphasized boiling for at least 15 minutes)
- Installing and using hand washing facilities, especially after using the latrines
- Keeping good personal hygiene, especially mothers
- Covering food leftovers
- Covering latrines pits to avoid flies
- Avoiding open defecation and urination

The answers suggest that CHWs command good knowledge on the relation between sanitation, hygiene and elements in the environment and the contraction of diarrheal pathogens.

The CHWs in the lowlands seemed to be, however, better instructed than the CHWs in the highlands. Their advice to community members who had children suffering from diarrhea at the household level included:

- Giving the child ORS (instructing how to make it at home)
- Rehydrate the child with clean (boiled) water
- Avoid herbal medicine
- Avoid eating uncovered food
- Continue breastfeeding
- Practice good hygiene

The second phase of the FGDs focused on gathering information on general practices at household level regarding diarrheal diseases, as observed and understood by CHWs. According to the CHWs, the community mostly views the causes of diarrheal diseases in traditional terms. CHWs believe that at the household level, the people associate diarrhea with the following causes:

- "False teeth" – The pronunciation of milk teeth in the gums as a result of dehydration, a condition called *ebiinio* in Runyankole, believed to cause fever and diarrhea (See also Bwengye 1989). If help of a traditional healer is sought, the remedy may be digging out the milk teeth from the gums.
- "False Millet" – The collapse of blood vessels which manifests as a rash around the breast area, caused by severe dehydration; the rash is believed to be the cause of diarrhea. If help of a traditional healer is sought, the remedy may involve the removal of the Mammary glands (according to the village doctor).
- Prolonged breastfeeding – Over 8 months of breastfeeding. After 8 months, according to some traditional beliefs, the breast milk becomes bad. Consuming it at this point will result in diarrhea.
- Breastfeeding in pregnancy – If a mother breastfeeds a baby while pregnant with another, the baby consuming the milk will contract diarrhea.
- Worms.

- Unvaried diet – eating the same type of food repeatedly.
- Eating raw food.
- Eating certain types of food – beans, fatty meat, and consuming oil.
- Wind from passing vehicles – Some believe that if standing on a road where a vehicle is passing, the wind will cause diarrhea.

According to the respondents, many parents use traditional healers to treat diarrheal diseases. The most common type of traditional healer will be an herbalist who will administer some local herbal medicine. Taking children to the HCs for treating diarrheal diseases will most commonly occur in addition to the administration of local herbal medicine. Some other local solutions for diarrheal diseases involve stopping breastfeeding and going to church to say prayers. According to CHWs, some herbalists believe that using roots of plants where human defecation has occurred will cure diarrhea[69]. The CHWs estimate that approximately 60-70% of the community attributes diarrheal diseases to traditional causes.

When asked what the primary causes of diarrhea are at the household level according to the CHWs experience and knowledge of conditions in their catchment areas, a number of typical causes were brought up in the discussion:

- Dirty environment inside and around the household
- Contaminated water sources
- Failing to boil water or boil water for short periods of time
- Presence of flies
- Poor personal hygiene
- Leaving food leftovers uncovered

In addition, some CHWs mentioned that some believe that mixing soil with water enriches the water with nutrients and is healthier for consumption[70].

When asked what they can do in order to increase the level of knowledge and awareness relating to contraction, prevention and treatment of diarrheal diseases at the household level, the CHWs suggested conducting concentrated training at their level, where they will teach the

[69] This practice was not supported by discussions conducted with herbalists – see below FGD with local traditional healers.
[70] During household level observations and interviews this practice was not identified.

people in their catchment area what diarrhea is, its dangers, how to prevent it, which treatment to seek and which treatment to abandon.

The third phase of the FGD focused on identifying how the MVP approaches mitigate diarrheal diseases through CHWs, as well as other relevant interventions and what they believe are done now and should be done in the future to mitigate the burden of diarrheal diseases.

The main criticism of CHWs towards the MVP was that they did not receive formal structured training on medical topics, such as the ones described above. They must rely on their common sense when advising people in their catchment areas. The CHWs emphasized that they did not receive any instructions on what to say to people in order to advise them how they can avoid the contraction of diseases, or what they should do when someone is sick.

The term "verbal autopsy"[71] was unfamiliar to the CHWs. When the purpose of the procedure was explained to them, the respondents identified it as the "death form". They claim that they received a form for the registration of both deaths at household level and the causes of deaths. At the same time they emphasized that they did not receive instruction on how to fill the form or its purpose. They simply follow the rubrics on the form. The CHWs told that they received instructions from the MVP management not to fill out the forms for the time being, since a change in the format is going to be introduced.

In order to improve the conditions at the household level, and to improve the services that CHWs provide to the community, they suggested that the project provide water treatment facilities for the household level (water-guards). In addition, they would like to carry first aid kids (including ORS) to the households with them. They emphasize that they would like to receive further training so they could use first aid kids when going to visit households.

B.4 Traditional Healers

General

During the month of December 2008, two focus groups discussions with local traditional healers were held. The first FGD took place at Sinai church in Ruhiira, and included four participants from the highland villages. The second FGD took place in Kabyuanda Primary school, and included three participants from the lowland villages.

[71] A management tool introduced by the MVP health team which aims of uncovering causes of deaths which occurred in the past and where not recorded at HCs by asking structured questions.

The FGD was moderated by a community facilitator, and translated from Runyankole by a research assistant. The moderator followed a FGD guide (see Appendix D – FGD IV) prepared by the researcher, and followed a procedure agreed upon beforehand. Each discussion lasted approximately 90 minutes.

The FGD began with a general presentation of the purpose and the research, followed by an explanation on the procedures. The informants where ensured of total anonymity.

A minimal amount of personal information was recorded from the participants and included:

- Profession (self definition)
- Age
- Years of experience
- Cell
- Origin of acquired skills

This information was recorded in order to evaluate the experience of the healers, background and better understand the dynamics of the FGD.

Objectives

From discussions with mothers, CHWs and various members of the community, it seems that traditional healers play an important role in the society. There are a few types of traditional healers including herbalists, witch doctors and traditional birth attendants. The FGDs focused on herbalists since it seems that herbal medicine is the most common type of traditional remedy for diarrhea and other diseases in Ruhiira.

The FGD aimed at understanding the role of the traditional healers in Ruhiira, how their role and practices relate to the MVP and the impact of traditional healers on diarrheal diseases, especially in relation to the MVP health interventions (See Appendix D – FGD IV).

The FGD was divided into two phases, each designed at reaching the objectives:

1. To identify the role of traditional healers in the society.
2. To identify the knowledge of traditional healers on causes of diarrheal diseases and how they identify and differentiate between causes.
3. To learn of the methods used by traditional healers to treat diarrheal disease and their relation to health interventions in the MVP area.

Results

Table 6.8 summarizes some of the information recorded in the first phase of the FGD, focusing on the role of the traditional healers in the society. The information includes:

- Location (highland/lowland)
- Profession (self defined)
- Age
- Years of experience
- Cell (where the trade is practiced)
- Origin of skills (to learn where how their knowledge was acquired)
- Total number of patients treated per month (to understand the scale of impact)

Table 6.8: General information on traditional healers participating in the focus group discussion, Ruhiira 2008.

Location	Profession	Age	Years of experience	Cell	Origin of skills	# of patients per month
Highland	Herbalist	~75	~50	Kahurrwa	From a witch doctor	~12
Highland	Herbalist	50	38	Kahurrwa	From herbalist brother	2-4
Highland	Herbalist; Traditional Veterinarian	~65	~25	Ruhiira	From mother, neighbors and experience	3-7
Highland	Herbalist; Traditional birth attendant; Traditional Veterinarian	~55	~40	Ruhiira	From her herbalist grandmothers	~20
Lowland	Herbalist; Traditional birth attendant	67	~20	Kabuyanda	From mother (a traditional birth attendant); one year training at HC	~50
Lowland	Herbalist; Traditional birth attendant	50	~30	Ndani	From mother (a traditional birth attendant); one year training at HC	~80
Lowland	Herbalist; Traditional birth attendant	40	~20	Ndani	From step-mother	~40

This information was gathered in order to help evaluating the proficiency of the healer and the scale of their impact, meaning how many people seek and receive treatment. The information indicates that *herbalist* is a traditional profession, usually acquired through learning skills from a family member. The people who practice herbal medicine have many years of experience, and see many patients per months (especially in the lowlands), even though western medicine is available in the cluster. Some herbalists received training as birth attendants in HCs through government program prior to the arrival of the MVP in Ruhiira, but do not collaborate with HCs when pregnant women seek their services.

According to the participants in the FGD, most patients seeking help from herbalists suffer from one of these conditions:

- Syphilis.
- Sore breasts.
- Injuries.
- Worms (diarrhea).
- Eye infection.
- Skin infections.
- Skin rashes.
- Muscle pain.
- Convulsions.
- Vomiting.
- Hair loss.

In addition, pregnant women seek an herbalists' help during pregnancy for general advice and for help when different types of pains occur during pregnancy.

The most common condition in young children visiting herbalists is diagnosed as diarrhea caused by worms. Other common complaints of young children include vomiting, fungus on the scalp, constipation, skin rashes, chest pains and stomach pains.

Diarrhea is almost exclusively attributed to worms by traditional healers. When asked how a child can contract worms, their responses included eating the following:

- Uncovered food.
- Cold food.

- Leftovers.
- *Matoke* (Plantain) without sauce.
- Food on which flies sat.
- Raw food.
- Dirt.
- Ground nuts.
- Peas.
- Food which one does not like.
- Failure to administer preventive herbal medicine
- Drinking un-boiled water

Other causes of diarrhea other than worms according to traditional healers are: malaria, syphilis[72] infection of the mother and consumption of bad breast milk. From these, malaria is considered the second most common cause of diarrhea after worms.

Traditional healers do not usually differentiate between types of diarrhea, unless they believe that the cause is malaria. The conditions are considered similar and so is the treatment. The informants mentioned though, that diarrhea can sometimes be bloody. Nevertheless they do not distinguish between regular and bloody diarrhea, and rely on mothers for this information. But this information is not considered as important by the traditional healer, and the treatment they prescribe in cases of bloody diarrhea is similar to the treatment of "regular" diarrhea.

The treatment of diarrheal diseases is by the administration of herbal medicine. There are different types of herbs and roots given to children with diarrhea. The herbal medicine administered to patients suffering from diarrhea depends on the cause (worms or malaria) and age of the patient. If diarrhea is believed to be a symptom of malaria, the *Omubirizi* plant is used. If, however, the cause of the diarrhea is related to worms the: *Omugonampiri, Omubarama* and *Omutarabana* are used (depending on the age of the patient).

Herbal medicine consisting of roots is usually prepared by boiling and mixing the roots with a variety of spices (mainly salt). If the medicine consists of leaves, then they are usually pounded in order to extract the liquids and then mixed with water.

[72] When asked what they meant by syphilis, the traditional healers referred to skin rashes in general. Given this description, and explanations received from the local translator, there is a reason to doubt that what they refer to as syphilis is the actual disease medically associated with this term.

The medicine for diarrhea is administered orally, usually three times daily as long as the patient suffers from diarrhea. The actual dose of medicine is determined by the age of the patient.

Herbalists usually recommend the following (one, some or all, depending on the herbalist and/or the patient) in addition to the herbal treatment:

- Not to drink cold water
- Not to eat cold food
- Eat vegetables
- Eat porridge
- Increase intake of food and drink
- Eat small fish
- Drink milk
- Eat pumpkin seeds
- Eat hard food

According to the herbalists, if the patient follows the prescribed treatment and recommendations, the disease will be solved usually in 1-3 days. If the treatment does not resolve the patients' condition, then a different type of herbal remedy will be prescribed or the dosage of the medicine will be changed. If after the second treatment the patient is still sick, the herbalist refers the patients to the HC.

According to the traditional healers, herbal medicine does not work well when administered with western medicine. If patients use western medicine while using herbal medicine, they will vomit. When asked when they believe people prefer herbal medicine instead of western medicine, the healers replied that in cases where people have been to HC and the prescribed western treatment did not work then herbal medicine is preferred. In addition, it is known that certain types of illnesses such as worms and convulsions can only be treated by herbal medicine. In the case of diarrhea, herbalists claim that children heal faster and better with herbal treatment. This is especially true when it comes to babies aged 2-3 months.

Traditional healers believe that pregnant women prefer treatment with them[73] and suggest that the HCs in the project area should supplement their treatment with herbal medicine.

B.5 Local Leaders

General

During the month of December 2008, a focus group discussion with community leaders (Local Council 1 – LC1[74]) took place in Ntungu HC. A total of 6 LC1 from the highland communities participated in the FGD. Another scheduled FGD with lowland LC1 was cancelled due to low turnout. The FGD was moderated by a community facilitator and translated into English from Runyankole by a research assistant while data was recorded by the researcher. The moderator used an FGD guide (see Appendix D – FGD V) prepared beforehand, and followed the procedure agreed upon prior to the FGD. The discussion lasted approximately 120 minutes.

The FGD consisted of a presentation of the project and the purpose of the meeting. The participants were informed about the procedure and were insured that no identifiers will be used.

Objective

The FGD with local community leaders was designed to understand how project interventions are seen at their level. Local community leaders not only play a role in decision making relating to project interventions, they also have personal stakes in outcomes since most of them are business owners in the community. This offers an opportunity to understand how decision makers view the current interventions and the benefits from these interventions in the present, as well as in relation to the past and future. The future dimension may help identify future externalities of project interventions.

In order to achieve the objectives, the FGD was divided into four phases:

1. Identify and rank by importance the intervention introduced by the MVP.
2. Identify the present impact of the interventions on the community and individuals.
3. Assess how local community leaders perceive the future benefits of project interventions.
4. Identify future goals and needs of the community

[73] The three healers participating in the lowland FGD claimed that between them they delivered 18 babies in the four weeks period preceding the meeting.
[74] The lowest level of community leaders.

Results

In order to understand what the LCs defines as project interventions, they were asked to list all the MVP interventions in their area. As a result, the following list was produced:

- Provision of scholarships to pupils
- Protecting water sources
- Provision of seeds
- School feeding program
- Health interventions at HCs
- Sensitization on farming methods
- Producing trees at nurseries for planting in the project area
- Provision of fruits
- Road construction and improvement
- Provision of rain water collection tanks at a number of public places
- Construction work in schools
- Building of staff quarters (HCs, schools)
- Establishing a bank in Ruhiira

The participants identified five main areas of interventions stemming from the list above: health, roads, agriculture, education and water. They were then asked to discuss and rank these areas of interventions according to their importance to the community, and to explain why they were ranked in this order.

Ranking:

1. Health.
2. Education.
3. Roads.
4. Agriculture.
5. Water.

Explanation to the ranking order:

Health – There are a number of reason for which health was ranked the most important intervention. The respondents stated that “without health there is no life”. When asked what they meant by this statement, two dimensions were distinguished: personal well-being and

livelihood. The first portrays an individual feeling and ability to feel well and function as a human. The second dimension, which was emphasized time and again as a major consideration in decision-making, is the ability to produce (either by physical work or to earn direct income). Health centers in the project area are seen as supplying both. The first dimension is served by the ability to receive prompt, quality treatment, and thus to be healthy. Being healthy is seen as enhancing the ability to produce and improve livelihood. But the second dimension is also served, as mentioned by the respondents, by the time and money saved on seeking treatment. Before the MVP improved health services, community members had to travel long distances to receive medical treatment (including any kind of sickness for young and old, and pregnancy and delivery). Travelling always means time, which could be otherwise spent on income generating activities and expenses, which could otherwise be used for buying food or other daily necessities. In addition, the local leaders indicate that the health interventions of the MVP include sanitization on a few levels. All these activities are viewed positively by the LCs as they enhance the ability of the community to change practices that have earlier resulted in the acquisition of a disease, and in turn affecting the two dimensions mentioned above.

Education – Education was ranked the second most important intervention by the participants, who referred mainly to the school feeding program. The increased attendance to school of children in the MVP area is viewed as an important investment for the future. The LCs mentioned that education can result in a positive trend for the development of the villages, as children will be able to study, and in the future become doctors and engineers, and reinvest their knowledge in the villages. Education also increases the awareness to sanitation and hygiene, and as a result LCs feel that it benefits the community at the household level. In addition the LCs discussed at length the immediate economic benefits the school feeding program bestows on the community. Most importantly, the farmers are able to sell surpluses of maize and beans to the MVP, which buys it in order to supply food for the school feeding program. This also eliminates middlemen in the selling process such that monetary benefits are higher and direct. In addition, the farmers receive seeds from the MVP in order to produce food for the school feeding program, so their relative costs are lower.

Roads – The LCs were not sure if they should rank road development as the third most important interventions, and hesitated between this option and water. In the end all the participants agreed that roads should be ranked third since there are more economic benefits

through this intervention. Roads are important to the community because they allow for the transport of goods and facilitate selling them either by moving them to markets, or by enabling lorries to come closer to their fields. Roads also save time since moving the produce is easier and less time is used on transporting goods to markets. They help increase trade in the MVP area, as well as connect the area to the rest of the country. Roads also improve the availability of services. The example given by the respondents related to veterinary doctors who are able to reach almost everywhere faster, and help reduce the deaths of animals. The LCs also mentioned that roads make the community want to buy more means of transportation like cars and motorcycles, which is seen as a positive development and sign of progress. They also mentioned that ambulances can move faster and reach more places thanks to the development of roads in the project area.

Agriculture – As in the previous case, the LCs hesitated between water and agriculture for ranking the fourth most important intervention, but concluded that agriculture should precede water since the economic benefits are more important. The MVP provided seeds for planting pastures, trees, vegetables, fruits and various crops. Farmers attended training, and some visited other sites and learned improved farming practices. The project taught the community the benefits of using fertilizer and consequently yields improved. Crop diversification and improved farming methods created new possibilities for farmers, and their incomes increased from selling produce. The MVP also taught improved practices relating to animal husbandry, and supplied donkeys for transport.

Water – Water is considered the least important intervention of the five[75] because of two main reasons: there are no direct monetary benefits from water interventions, and many in the community still need to cover long distances in order to get to a protected source. The LCs recognize that the project has protected water sources, improved water quality and installed rain water collection tanks. There was a discussion among the LCs around the issue of rain water vs. piped water. Rain water is considered better quality by some, and these expressed the view that it is more important to install rain water collection tanks than piped water schemes. Eventually, everybody agreed that piped water will constitute a better improvement for the community. The respondents emphasized that most protected water sources lie at relatively long distances from the highland communities.

[75] Even though it was ranked last, it is not implied here that water related interventions are not viewed as important. This ranking only indicates the relative importance of the interventions as perceived by community leaders.

In conclusion, the ranking of project interventions and the reasons given for it suggests that this group values interventions that proved to be important in terms of monetary benefits. The ranking is based according to the current impact of the interventions. The respondents were also asked to discuss which interventions or elements in interventions are not carried out to their satisfaction and explain why. There are a number of issues raised by the LCs:

Water – As mentioned above, the highland communities still need to walk long distances first down and then return uphill in order to reach a protected source of water.

Buying produce – According to the LCs the MVP promised to buy produce from them, and provided them with seeds to plant. Apparently most of the produce was not bought and was left to rot. In addition, the MVP promised to buy maize for 350 UGX, but ended buying it for the much lower price of 200 UGX.

Providing animals – The LCs claim that the project promised to plant pastures, give them goats and build shelters for the goats, but has not done so.

Building latrines – The MVP promised to select a number of people from each community and build latrines for them at the household level, but it has not carried out the promise.

Fertilizer – The project taught farmers the importance of fertilizer, and initially supplied it to them. Later, the project decided to subsidize half the cost of the fertilizer "forcing" people to invest money in order to obtain it. The word "forcing" was used since, according to the LCs, once fertilizer is used, failing to repeat the use in the next season results in crop failure, and therefore they had no choice but to ask for a loan in order to purchase fertilizer.

These types of complaints reinforce the interpretation that for the participants in this focus group discussion, success of the MVP interventions is measured in economic benefits for themselves and the community.

Generally, the LCs are optimistic about the future and believe that current MVP interventions will bring numerous benefits in form of increased income and improved livelihood for the inhabitants of the cluster:

- The health sector intervention will increase life span through improved health and the population will increase. In addition, the benefits of the MVP will hinder people from migrating out of the region.

- The education sector will help teach pupils how to use computers and will bring internet to the villages. This will enable the community to seek knowledge and find good prices for their produce. In addition, good education will enable people to seek better jobs and earn more income.
- The road construction works will encourage people to acquire means of transportation, and the numbers of vehicles in the cluster will increase. This will facilitate moving produce to markets, allow merchants to send lorries to the area, and prices received for goods will increase. The roads also allow the possibility of creating a market for farm animals.
- Agricultural interventions will result in better general health and diet diversification. Better health will bring better productivity. The increased diversity of different farm products will create better income. Tree planting will decrease soil erosion and result in better crop yields.
- Water related interventions will reduce the need for women to travel long distances in order to fetch water and will allow them to spend more time on income generating activities such as working in the fields. Bringing water nearer to households will result in better sanitation and hygiene practices. People will bath more frequently and cloths will be washed more often. In addition, easier access to water will improve irrigation and will allow the community to sustain more farm animals at the household level.
- The respondents look forward to electricity being provided in the village area. The LCs believe that this will considerably improve their livelihood. Electricity will offer the community a possibility to establish industries. They will be able to buy grinding machines, store milk and install soda factories. Electricity will improve education by allowing people to have light to read and to access information through television. They will also be able to iron clothes and look smart, use electric cooking stoves and charge cell phones.

In conclusion, community leaders judge the impact of current and future project intervention by the monetary benefits they bestow on the community. This is also true for the future dimension as it is perceived by the LCs. There are a number of possible health implications

related to the future plans. The implications relating to diarrheal diseases will be discussed in Chapter 7[76].

C. Educational Activities in Schools relating to Sanitation and Hygiene

During school visits, a number of semi-structured interviews were conducted with headmasters and teachers. The purpose of these interviews was to identify the extent of educational activities relating to sanitation and hygiene in schools and asses their effectiveness.

All schools undertake educational activities relating to sanitation and hygiene, but the frequency and extent of these activities are not uniform, varying considerably from school to school.

Schools have a designated teacher responsible for sanitation and hygiene. The definition of this position varies from school to school, and is either a permanent responsibility, or shift duty (usually weekly shifts). The type of duties under the responsibility of the teacher responsible for sanitation and hygiene vary as well (see Table 6.9 for a summary of sanitation and hygiene activities in each of the schools visited). A number of duties are standardized:

- Oversee toilet cleaning in the morning
- Oversee cleaning of classrooms and school compound
- Check children's sanitation and hygiene in the morning lineup

In practice, the responsible teacher for sanitation does not always fulfill his daily duties, mainly the toilet, classroom and compound cleaning (see Table 6.9).

Some schools have a weekly assembly where sanitation and hygiene is a repeated topic. Other schools have a sanitation committee which, according to the respondents, convenes regularly or *ad-hoc* to address various sanitation and hygiene issues.

With the exception of Kanywamaizi School, no school has teaching aids relating to personal hygiene practices, health and proper sanitation. Kanywamaizi School, the largest visited during the study, had an aid issued by the government[77], which can be used as wall posters in classrooms. These posters cover a multitude of issues, from disease prevention, to proper

[76] Health implications that do not relate to diarrheal diseases directly, such as increased risk for respiratory diseases from car pollution relating to improved roads are beyond the span of this study, but deserve attention.

[77] Color chart teaching aid for sanitation and health issued by MacMillan press for the Uganda government (MacMillan primary science wall chart ISBN 0-333-53163-9).

sanitation practices and personal hygiene. The issues are explained on each poster and accompanied by illustrations. Unfortunately, this teaching aid lies in the school library and does not hang in classroom where is could be viewed by the children during sensitization activities on sanitation and hygiene.

The designated responsible for sanitation and hygiene in schools carry out this task in his/her capacity as a teacher. They have not been provided with an opportunity to participate in a specific seminar or workshop framing their activities and instructing them on how best to achieve the objectives of their duties.

D. Household Visits

D.1 General

During the field work, a number of households were selected for semi-structured interviews and non-participant observations. A purposive specific group of households were chosen. The common factor for inclusion in the research was the presence of children aged 5 or less which attended a specific HC during one chosen month suffering from diarrheal symptoms[78]. What guided the choice of location for data collection (the HC visited by patients) was the quality of the data series. Most HCs were found to have a limited amount of completed data series during the time of study. The location chosen had a complete data series for the specific month. Ideally, if all HCs had complete data series for a specific month, a random sampling among the affected under-five patients' families would have been the choice, capturing patients visiting highland and lowland HCs[79]. A total of 28 households where identified for this purpose. Out of the 28 households, 25 where located[80] using a research assistant. Seven of the 25 households were outside the project area, but were located and participated in the study.

[78] The name of the HC and month chosen are omitted from this study in order to prevent possible identification of the respondents.

[79] Generally, patients visiting a highland HC will come from a highland community, and patients who come from the lowland communities go to lowland HCs. This is not exclusively the case and many patients visiting highland HCs come from lowland communities and vice versa.

[80] Services of HCs are given to any patient who seeks medical help. Some patients come from outside the project area. In the past, HCs charged a small amount of money from any patient who was not from the MVP cluster. This was done since community members contributed to the establishment and refurbishment of HCs either with materials, work or money. In order to collect a contribution from patients who came from outside the project area, a sum of 1000 UGX (approximately 0.5 USD) was charged. This practice has long been abolished, but some patients from outside the MVP cluster are wary that money will be charged, and therefore sometimes give false names and addresses. Out of the sample of 28 households, 3 could not be located. They were not known to the community. An attempt to track them through CHWs, community leaders and members, including during church sermons and funeral gatherings failed.

Table 6.9: Responsibility for sanitation and hygiene in schools, related activities and observations, Ruhiira, Uganda 2008

Name of school	Responsibility for sanitation and hygiene	Sanitation and hygiene activities	Teaching aids	Observed sanitation and hygiene during visit
Sinai	• Designated teacher	• Morning inspection. • Toilet Cleaning. • Compound and classroom cleaning.	N/A	• Classrooms, compound and toilets dirty. • Poor personal hygiene and sanitation practices of students.
Ruhiira	• Duty teacher	• Morning inspection. • Toilet Cleaning. • Compound and classroom cleaning. • Supervising hand washing procedure during meals.	Old destroyed chart hanging behind the door of the food storage room	• Classrooms, compound and toilets dirty. • Poor personal hygiene and sanitation practices of students.
Kanywamaizi	• Sanitation committee (5-7 members) • Duty teacher from committee	• Inspection during weekly assembly. • Morning inspection. • Toilet Cleaning. • Compound and classroom cleaning. • Raising issues at committee meetings.	Available, stored in library.	• Classrooms, compound and toilets dirty[81]. • Moderate personal hygiene and sanitation practices of students.
Kabugu	• Duty teacher	• Inspection during weekly assembly. • Morning inspection of classes P1 and P2 (youngest children). • Toilet Cleaning. • Compound and classroom cleaning. • Fill water in hand washing facilities.	N/A	• Classrooms, compound and toilets dirty. • Moderate personal hygiene and sanitation practices of students.
Nyampikye	• Designated teacher	• Inspection during weekly assembly. • Toilet Cleaning. • Compound and classroom cleaning.	N/A	• Classrooms, compound and toilets dirty. • Poor personal hygiene and sanitation practices of students.

[81] Once the visit at the school began, the headmaster requested from a teacher to clean the compound, place garbage bins outside classrooms, clean classrooms, fill water in hand washing facilities and send children outside into classrooms. This provided the researcher with an example of how the school looks before and after it is cleaned.

The potential respondents were all contacted prior to the visit and asked if they were willing to participate in a research partially relating to the visit of their child in the HC. All respondents agreed to participate in the research, and were assured of anonymity. Once potential respondents consented to participation, a meeting for an interview was scheduled at the respondents' convenience. A questioner guide prepared beforehand (Appendix E) served to facilitate the inclusion of all data to reach the objectives[82].

D.2 Objectives

The visits aimed at identifying conditions, practices and habits that may increase the risk for contracting diarrheal diseases at the household level. Children aged 5 or less are at greater risk for severe consequences from acquiring diarrheal pathogens, and therefore an effort to locate all the children that suffered from diarrheal symptoms in a specific area was made. The questioners were designed to collect data in order to contribute to the following objectives:

1. To assess how the treatment in HC is viewed by parents, and evaluate how parents treat and view diarrheal diseases.
2. To identify the benefits of MVP interventions as they are perceived at the household level.
3. To check knowledge and awareness of causes, treatment and prevention of diarrheal diseases at the household level and correlate this with observed practices to identify possible causes for the acquisition of a diarrheal pathogen by the child.

D.3 Socio-Demographic Background of the Visited Households

The number of household members in the 25 household visited is between 3-10 members, where all (with the exclusion of one) families have more than one child. The age of most mothers and fathers in the households visited is between 20-40[83], while two households were female headed. With one exception, all household members are present during the entire year. Four fathers and five mothers stated that they could not read or write. With the exception of three fathers, all had some sort of education, usually primary. A minority of men and women had secondary education, and one man had further education. The primary occupation of most participants was agriculture. Some practiced commercial and service work as a secondary

[82] Many parts of the questioner used during this study were adapted from a structured questioner prepared by Razak Seidu for his PhD research at the Norwegian University of Life Sciences on causes of diarrheal diseases in Ghana. Mr. Razak kindly gave his permission to use his questioner at my discretion. The structured questioner was modified to suite the qualitative nature of this study, and was supplemented by a number of questions relevant for the objectives of the current study.

[83] Three mothers where outside of this range at 18, 19 and 48, two fathers at 50 and one at 45.

occupation. Most houses are traditional (wooden frame covered with mud, banana leaf roof). Two households were a combination of modern/traditional building (bricks and mud with metal sheet roof).

D.4 Knowledge Concerning Child Sickness

During interviews, mothers were asked what, in their opinion, caused their child to be sick with a diarrheal disease. Three mothers answered they did not know. Three related diarrhea exclusively to a traditional belief: false teeth and breastfeeding while pregnant. The rest related the contraction of diarrhea by their child to a reason concerning food consumption coupled with various other reasons (including traditional beliefs). Among the reasons concerning food consumption, mothers said their children ate:

- Dirty food.
- Soil.
- Unvaried diet (only maize or only beans or only *matoke*).
- Food that is known to give diarrhea (beans)
- Shift of diet (e.g. liquid to solid food).

In addition to food related reasons, ten mothers replied that their child had worms; five that their child had malaria and four mentioned that water related reasons caused the contraction of diarrhea. Three mothers said that their child contracted diarrhea from fever.

Most mothers recall the treatment their child received in general terms (e.g. tablets or injection). The reported recovery time of the child was five days (8 children) and one week (9 children). Eight mothers reported that their child did not recover from the sickness and still suffers from diarrhea (seven of these visited the HC a week or longer before the interview).

It is common to seek or administer other treatment in addition to the one advised by HCs, either before or after attending the HC. Eleven mothers sought alternative treatment before attending the HCs (out of which five are from outside the project area), and ten after. Four mothers did not seek nor administer any other treatment than what was advised to them in the HC. The most common additional treatment is herbal treatment. The treatment is either given by a traditional healer or administered by the mothers based on self knowledge. Some mothers administer western medicine before taking the child to HC. This medicine includes various types of antibiotics which they either have home as leftovers from previous treatments or purchased from a pharmacy based on treatments family members received in the past.

Eleven mothers said that they sought other treatment after visiting the HC since the medicine prescribed did not affect the child's sickness. In one case[84], a mother sought advice from neighbors and relatives when her child, who had diarrhea, was not improving after receiving HC treatment. She was told her child suffered from "false teething". The mother took her child to a traditional healer who proceeded by pulling out the child's teeth from within the gums.

D.5 MVP Intervention Viewed From the Household Level

During the interviews, an attempt was made to identify how people in households view benefits from project interventions, and what kind of intervention they would like to see in the future at the household level.

All respondents mentioned benefits from health interventions, namely the fact that the current situation considerably reduces their expenditures on health-related issues, chiefly the fact that medicine is free. The installment of HCs and distribution of free medication at HCs was also mentioned by households outside the project area as the only benefit they receive from the MVP.

Many mentioned that that the MVP distributes seeds as the second most important benefit at the household level. In addition, the distribution of anti-malaria bed-nets and sensitization activities (mostly agriculture and health) are valued as important interventions by many respondents.

The respondents were asked to mention which interventions they would like to see in the future at the household level[85]. With the exception of two households, all respondents strongly emphasized that they would like to have better access to water at the household level. To them better access meant either the establishment of water sources very close to the household, or the installment of rain water collection tanks or tap water in households. When we mentioned that the project did a number of water related interventions in the project area, such as the creation of protected water sources, improvement of water quality and installment of rain water collection tanks in public places, the respondents said that they still needed to walk long distances in order to reach the protected water sources and that they did not have access to the rain water collection tanks in public places. Therefore, at the household level,

[84] A household from within the project area.
[85] The five households lying outside the project area were not asked this question since it is presently irrelevant for them.

the water related MVP interventions are barely felt (see also below – Water at the Household Level). According to the respondents, easier access to water at the household level will:

- Save time
- Allow more frequent clothes washing, bathing and dishwashing
- Grow vegetables.
- Enable possibly to maintain animals

Other than water, respondents frequently mentioned that they would like help from the MVP in building latrines at the household level, building better houses for them, giving them more land and bringing electricity to households.

D.6 Water at the Household Level

When it comes to water collection patterns in the 25 visited households, a clear pattern emerges. During the dry or wet seasons, members of households responsible for water collection (mainly the mother and children) will *always* prefer to fetch water from the closer source, even if water from that source are known to be unclean.

During the wet season, there are two predominant types of water sources used by 22 out of the 25 visited households: ponds and rain collected in tanks. As described above, ponds are rock catchments in low places that accumulate runoff water (see Figure 6.7 above). Water from ponds is visually contaminated and is not fit for human consumption without treatment. With the exception of one household[86], all visited households did not have a rain water collection system. Many households place a 20-200 liter tank or plastic buckets along roof edges to collect rain water (Figure 6.31). These tanks are temporary. The fact that they are open makes them easily accessible to children, and susceptible for many types of contaminations. In conclusion, the wet season water sources are not clean, and should not be used without treatment. Another source frequently used in the rainy season is streams.

One household reported that it uses an MVP protected source in the rainy season in addition to rain water collection. That household was located less than 500 meters from the protected

[86] This specific household had a homemade rain water collection and storage tank. The collection system consisted of funnels running along the roof and transferring the water into a homemade underground tank. The tank was basically a big hole dug in the backyard, lined with cow dung mixed with soil for isolation, and covered with tree branches and a plastic sheet. Useful for collecting water, and a commendable homemade effort for creating a solution for the water shortage in the area, the water in the tank is contaminated for the usual reasons. In addition, the tank is at the ground level, which makes is vulnerable to dirt and any type of animal that wishes to access it.

source and spent less than 30 minutes fetching the water. This household used the MVP protected source in both the wet and dry season. The other two households using safe sources of water in the wet season were located close to wells, and used it for both the wet and dry season.

Figure 6.31: Examples of rain water collection tanks at household level, Ruhiira 2008

All households using ponds and water accumulating from rain are located more than 500 meters from a protected source. In the dry season, all households used an MVP protected source (one used a protected shallow well), and spend between 1-4 hours/day on fetching water during that season. In the wet season, the time spent on fetching water is cut to less than 30 minutes, and most households had to walk less than 500 meters to get to a water pond.

Water is transported home in a jerry-can. The jerry-can covers are usually long lost, and a banana is used as a plug instead. All jerry-cans in all visited households where visually dirty on the inside. Jerry-cans are never washed, and are often used to store porridge or homemade alcohol in addition to transporting water. Most households report using the water for drinking, cooking and washing by pouring it directly out of the jerry-can. Some households at times use a larger plastic tank to store water. These use a cup to scoop the water out of the tank. The cup is also used for drinking the water directly from the tank, as well as for drinking porridge and scooping food from casseroles.

The picture is a bit complicated when it comes to treating water before use. The only reported treatment in households is boiling water. In this context it means cooking water until it boils and promptly removing it from the fire (the water is never boiled for more than a few seconds). All 25 households knew that they should boil water before consumption. Out of the 25 visited households, 11 said they never do anything to the water before consuming it. The reasons given for this were lack of time and lack of firewood.

Of the 14 households reporting that they do boil water before consumption, some initially said that they always boil water. When asked if they always have firewood, all replied that they do not. They were then asked how they boiled water when they do not have firewood. As a result, all replied that most of the time water is not boiled before consumption, but they know that it should be done. None of these 14 households had boiled the water available to the household during the visit. Many were observed using the un-boiled water during the visit. Based on the interviews and the observed patterns of using water directly out of the jerry-cans and on the observations made during the visits, it appears that water is being scarcely boiled before consumption in the visited households.

D.7 Sanitation and Hygiene

Bathing

Bathing is not a daily occurrence in households; the frequency varies according to the amount of water available. Soap is used most of the time when bathing both by adults and children. All households visited use a sponge during bathing. Two households had two sponges, one for the children and one for the adults, but most commonly a single sponge is used for all household members.

Hand Washing

The respondents were asked when do they think that hand washing is necessary. The most common answers where before and after eating and after using the latrines. To the question when would you use soap in addition to water from washing hands, the most common answers were after latrine use and after working on the farm. Most said that only some of time they wash hands after latrine use, and very rarely use soap. During observations, a single household had water available for hand washing including soap. Most households did not have soap present. During the observations, none of those using the latrines washed their

hands after use. Even though the knowledge exists, it was very rarely put to practice during observations.

Eating Outside Household

All members of households eat occasionally outside the house. The most common locations for food consumption outside households are:

- Vendors (at trading centers and markets)
- Funerals
- Weddings
- Neighbors
- On farm

Working on farm is an intra-house activity and therefore under the control of the household members. Soap is never sent to the farm, but water is often present, and hands are washed from time to time before eating on the farm. Hand washing at the other locations varies, and depends on the circumstances and availability of water and soap.

Baby Hygiene

A number of children were present at each interview in the households and many of these were young children aged less than five. While in the household, none of the young children had diapers/nappies/cloths around their genitals. Sometimes the children where half naked, at other times they wore a long shirt or skirts. While the interviews were in progress, the children often played on the ground around the households. Usually, there are a number of domestic animals in the backyard, mostly chickens and goats. The babies where observed many times picking items from the ground and putting them in their mouths. During the interviews, older children (7-14 years old) were in charge of the babies. Often the babies would defecate on the ground where they play, and the older child would then pick up some leaves and wipe the excreta of the ground. The babies would then proceed playing at the same location. None of the older kids were observed washing hands.

All mothers stated that diapers/nappies/cloths (mostly the latter) are used when leaving the household. Baby excreta at the household level are usually discarded in the backyard (save one household where the excreta was thrown in the latrine). Most mothers state that they wash their hands after cleaning the baby when he/she defecates at home and when water is

available. When outside of the household (church, market, neighbors etc.), mothers state that they almost never have the means to wash their hands when attending to their babies.

Latrines

Latrines at the household level are usually a traditional construction based on a wooden frame, covered with mud and a banana leaf roof (Figure 6.32). The pit is usually shallow, and doors are absent. In two cases, there was a banana leaf mat serving as a door. The latrines are usually muddy and the floor is soaked with urine. There are many arthropods present in and around latrines.

All family members use household latrines. Parents say that often the children do not bother using the latrines, and mostly urinate (but also defecate) in the open. Four households did not have household latrines. Two of these households were extremely poor; the third belonged to a very young couple who had just moved in; and the fourth was a rental. Three of the four had permission from their neighbors to use their latrines. The fourth household, which belonged to a very poor widow with a number of children, used the fields around the house for urination and defecation.

Figure 6.32: Latrines in households, Ruhiira 2008

Disease Burden in Households

The respondents were asked which symptoms and diseases are most common for adults, children and toddlers (aged 5 or less) in their households. It is important to emphasize that the following is not a medical diagnosis, but simply the way the participants chose to describe the most important causes of morbidity in the household. In order to rank the causes of morbidity, all similar complaints from all the households were summed for each category (adult, child, and toddler). When it is stated that malaria is the primary cause of morbidity for adults, it means that most households mentioned malaria as a cause of morbidity.

In adults, the most common cause of morbidity as reported by the respondents is malaria. When asked what malaria is, the answers varied and included the description of many symptoms such as: fever, vomiting, diarrhea, convulsions, joint pain, chills, worms, stomach pain, and loss of appetite. The second most important cause of morbidity for adults was reported to be cough followed by headache.

The most important cause of morbidity for children as reported by the respondents was malaria followed by flu, cough and skin rashes. When it comes to toddlers, diarrhea was reported as the most important cause of morbidity, followed by cough and malaria.

6.3 Secondary Quantitative Data

6.3.1 General

The scope and scale of this study as well as the bounded time frame influenced the design and focus. Secondary data was used in order to complement the primary data gathered. An attempt to use existent quantitative data gathered by the MVP and various other sources was made.

A number of objectives guided the search for quantitative data:

1. To identify the burden of diarrheal diseases in Ruhiira, and track changes beginning from a year before the project began up to present (January 2009).
2. To identify mortality rates of children aged 5 years or less for the same period of time.
3. To gather weather data in order to examine if it can help explain the peaks of diarrheal diseases throughout the year.
4. To gather relevant data to supplement observations (e.g. water-quality samples).

The quantitative data was meant to supplement the qualitative data and add an additional perspective to the discussion and recommendations. The burden of diarrhea in Ruhiira and

mortality rates was to be correlated with project interventions to try to identify the impact. The weather patterns, correlated with the burden of diarrhea and conclusions deriving from the qualitative data were meant to enhance the discussion relating observations to environmental factors.

Unfortunately, the quality of most existing quantitative data relevant for this study present at the MVP Ruhiira proved to be problematic and unusable for achieving the objectives above. The following section will describe the data received from the MVP in Ruhiira and will discuss the problems in the data and the reasons it was rendered unusable in its current form for this study.

Some data, namely the water-quality tests, proved to be comprehensive and usable, as it was described above in section 6.2.4.2 (see also Appendix B).

6.3.2 Diarrhea Prevalence in Ruhiira

An effort to gather data for diarrhea prevalence in the project area since 2005 was made. Since the project began in 2006, the hope was to capture prevalence rates beginning from a time period preceding the MVP.

In order to map the prevalence, certain data was requested from the MVP including a list of all identified cases of a diarrheal disease in HCs in the project area since 2005 and the number of deaths of children aged 5 or less in the project area, including causes of deaths.

Prevalence data received from the MVP office in Mbarara proved to be partial and problematic, e.g. for Ruhiira HC, the data received from the MVP covered seven months over the period 2005-2008. The data from Ntungu covered 12 months over the same period. No meaningful conclusion relating to prevelance could be drawn from this data. The only nearly complete data set is from Kabuyanda HC IV. This data indicates the diagnosis of all patients attending Kabuyanda HC IV between January 2005 and April 2008 (excluding the most recent: May to December 2008). The reason given for the general lack of data by the MVP was that personnel did not have time to complete the entry of data into the computer. An effort was then made to gather the data directly from HC records. This attempt unraveled further problems with the data: The Outpatient Department (OPD) and Inpatient departments (IPD) each keep a record of all patients attending the HCs. The record usually shows entries by date, including:

- Names of patients
- Age
- Diagnosis
- Medication

The entries were found to be inconsistent, lacking at times some of the elements described above, including dates. In addition, the diagnosis of a disease proved to be a problematic parameter when it is needed for mapping prevalence of diarrheal diseases. This is because *diarrhea* is mostly a symptom accompanying a number of medical conditions. Only diagnoses are kept on record at the HC. Symptoms for patients in Ruhiira MVP were meant to be recorded on personal notebooks which are held by the patients and brought with them when attending the HCs. These notebooks are often lost. This means that the entries in the medical record on HCs do not provide a reliable picture of the prevalence of diarrheal disease, since it is impossible to determine if a patient was suffering from diarrhea, unless the diagnosis was acute diarrhea, gastroenteritis or similar conditions.

A quick look at the data received from the MVP revealed that in Kabuyanda HC, between 2005 and 2008 58% of all patients were diagnosed with malaria (5490 out of 9416 patients). This is an extremely high number. Only 315 patients were diagnosed with a diarrheal condition[87] (3.3 %). A further problem relating to the diagnosis of malaria affects the interpretation of the data. New data from the OpenMRS[88] system for the three last months of 2008 shows that most patients are diagnosed with malaria and the diagnosis stays in the records whether the malaria smear was negative and the patient did not receive anti-malarial treatment or not. The suspicion that malaria might be over-diagnosed was confirmed with conversation with a few MDs and MVP officials in Ruhiira[89]. It is therefore impossible to determine from the records in HCs the accurate burden of diarrheal diseases since any of the patients diagnosed with malaria could have been suffering from another condition, including diarrheal symptoms which are not on record.

During the time of this study, the digitization of medical records project undertaken by the Earth Institute (EI) in collaboration with the MVP personnel in Ruhiira was under way. The

[87] Including: acute diarrhea, gastroenteritis, dysentery, colitis, amoebiasis, giardiasis, worms, abdominal pain, bloody diarrhea and dehydration. It is important to emphasize that no records show any diagnosis of a viral infection in Ruhiira cluster, such as rotavirus.

[88] The data was generated by J.J. Dick who worked of establishing the OpenMRS system in the village HCs.

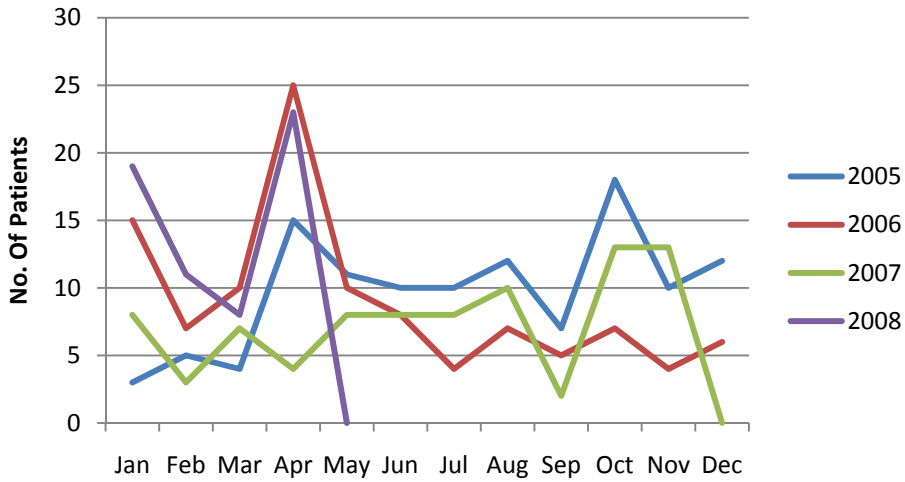
[89] This is also related to the national guidelines in Uganda, according to which every case of fever should be handled as malaria until proved otherwise (Village doctor in Ruhiira, personal communication).

problems mentioned above were discussed, and as a result a number of changes were introduced to the digital forms, including clinical symptoms[90]. This will facilitate, among other things, the study of diarrhea prevalence in the future.

Initial analysis of prevalence, using the new OpenMRS forms introduced in November 2008, indicate that when symptoms are included, the number of patients attending the HC with diarrheal diseases is tripled in comparisons to the numbers available from the period preceding the introduction of the new forms. It is emphasized here that this initial trend is observed based on a short time series (November 2008 – January 2009), and more data needs to be reviewed in the future.

The prevalence data in Table 6.10 is from Kabuyanda HC IV[91] for the period between January 2005 and April 2008. It shows the number of patients diagnosed with a condition associated with diarrhea (see footnote 87 for the medical conditions included in Table 6.10).

Table 6.10: Diarrhea prevelance, Kabuyanda HC IV: 2005-2008



*Data for 2008 are for Jan-Apr. No data was available for May-Dec 2008.

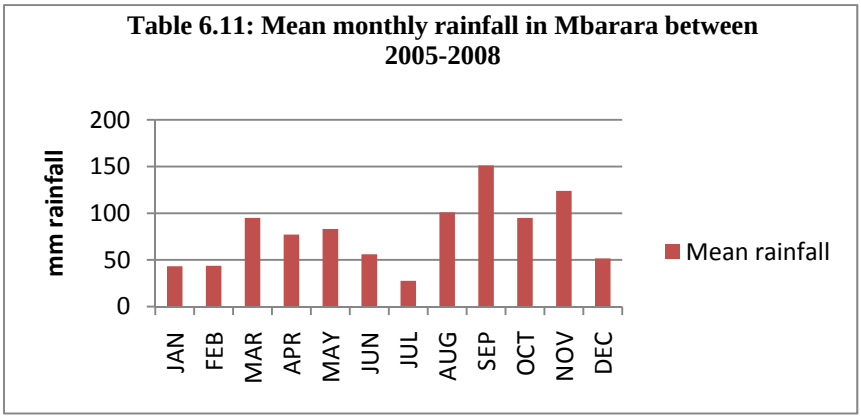
[90] The new forms were introduced with the help of J.J. Dick, who runs the OpenMRS project for the EI in Ruhiira.

[91] The data was received from the Ruhiira MVP data manager.

Even incomplete, that data suggests four diarrheal disease peaks in the lowland area of Kabuyanda (January, April, August and October). Ideally, this trend should be compared with weather data.

Daily total rainfall data in Mbarara for the period January 2005 to December 2008 was obtained from Mbarara meteorological station. Since there are no weather data collection stations in the project area, the only reliable weather data comes from two meteorological stations in the proximity of the region: Mbarara and Kabale. Meteorological data from Kabale was not obtainable due to bureaucratic and costs issues[92]. According to the Ruhiira MVP science-coordinator, the total rainfall from Mbarara meteorological station can give an indication of weather trends in Ruhiira, but data from Kabale will probably be more reliable for the area of Kabuyanda, while the Mbarara rainfall will reflect better the weather patterns of the highlands. Table 6.11 shows the mean monthly rainfall in Mbarara for the period 2005-2008:

Table 6.11: Mean monthly rainfall in Mbarara between 2005-2008



Ideally, diarrhea prevalence data from Ruhiira HC should be compared to weather data in Table 6.11, while diarrhea prevalence from Kabuyanda should be compared to weather data from Kabale weather station. Because of the problems relating to the currently available data from the MVP, the data above is not reliable for achieving the objectives it was gathered for, and therefore will not be used here.

[92] The weather station in Kabale refused to hand in their data directly, and referred me to the main offices in Entebbe. Due to time constraints and the relatively high costs involved in obtaining the data, the information from Kabala weather station was not procured.

6.3.3 Mortality Rates of Children Aged 5 or Less

The MVP in Ruhiira does not have the required data to establish the rate of mortality of children aged 5 or less in the project area. The data was supposed to be gathered from HCs and from CHWs who are instructed to perform a "Verbal Autopsy" procedure in order to determine causes of deaths in households. "Verbal Autopsy" is a management tool introduced by the EI, through which they hope to register deaths that do not occur at HCs, and by following a procedure, extract the likely causes of deaths. CHWs are the main contact between the project and community at the household level when it comes to health issues, and therefore they are the ones who are supposed to fill out the "Verbal Autopsy" form (also called "death from").

These forms are currently not used by CHWs. The reason given by the MVP in Ruhiira was that the EI has introduced a change to the forms, and therefore instructed the project to stop filling the old form until the new ones arrive. The new forms arrived during the last month of this study, and therefore the information was not available for the study period.

The only death related information available at the MVP office, according to the data manager, are the number of neo and post natal deaths from HCs, for the two last months of 2008 and data from the socio-economic baseline survey section on reported deaths between 2001 and 2006 (see Table 6.12). The mortality rates from the socio economic baseline survey indicate that 18% of the total 1003 surveyed households reported deaths. Of these, 39.8% were deaths of children under five years old (84 out of 211 cases). From the 84 cases, 21 (25%) of the total 84 were related to diarrhea (Table 6.12). Data from 2006 onwards was not available, as described above.

6.3.4 Data from the Surveys

Section F of the MVP baseline survey conducted in Ruhiira on 200 households in 2006 was devoted to diarrhea in children under five. The section consisted of 8 structured questions with coded answers:

1. Have you ever heard of a product call ORS that you can give for the treatment of diarrhea?
2. Has your child had diarrhea in the last two weeks?

3. How much the child was offered to drink during the diarrhea? Was he/she offered less than usual to drink, about the same a amount, or less than usual to drink? IF LESS, PROBE: was he/she offered much less than usual to drink, or somewhat less?
4. How much the child was offered to eat during the diarrhea? Was he/she offered less than usual to eat, about the same amount, or less than usual to eat? IF LESS, PROBE: was he/she offered much less than usual to eat, or somewhat less?
5. Was the child given fluids made from a special packet called ORS?
6. Was the child given a government recommended home-made fluid?
7. Was anything (else) given to treat the diarrhea?
8. What (else) was given to treat the diarrhea? …anything else?

Table 6.12: Causes of death in children less than 5 Y/O reported in 2001-2006, Socio-economic baseline survey, Ruhiira.

Causes of Death	Cases	Percent
Malaria	43	51
Flu/cold/Upper RTI	1	1
Eye disease	2	2
Skin problem/rash	1	1
accident	1	1
Pneumonia	2	2
STD	2	2
Diarrhea	18	21
Intestinal Worms	1	1
Dental problems	3	4
Convulsions with fever	4	5
Convulsions without fever	1	1
HIV/AIDS related	1	1
Urinary tract infection	1	1
Other	1	1
TOTAL	**84**	**100**

Some of the questions asked in the MVP baseline survey are similar to the questions in the Uganda Demographic and Health Survey 2006 (UDHS 2007). The section below compares the results from the Ruhiira baseline survey to the results from UDHS 2006 for the southwestern region of Uganda. This comparison indicates the relative state of project area to the entire region from surveys conducted during the same year.

1. Have you ever heard of a product call ORS that you can give for the treatment of diarrhea? (This question was not asked in UDHS).

Yes	88%
No	11.5%

2. Has your child had diarrhea in the last two weeks? (This question was not asked in UDHS).

Yes	28%
No	72%

3. How much the child was offered to drink during the diarrhea? Was he/she offered less than usual to drink, about the same a amount, or less than usual to drink? IF LESS, PROBE: was he/she offered much less than usual to drink, or somewhat less?

	Ruhiira Baseline 2006	**UDHS 2006**
Much less	11%	7.6%
Somewhat less	7%	22.8%
About the same	39%	49%
More	39%	18%
Nothing to drink	3%	1.6%
Do not know/missing	1%	0.3%

4. How much the child was offered to eat during the diarrhea? Was he/she offered less than usual to eat, about the same amount, or less than usual to eat? IF LESS, PROBE:

	Ruhiira Baseline 2006	**UDHS 2006**
Much less	36%	10.1%
Somewhat less	0%	19.6%
About the same	48%	45.8%
More	14%	8.8%
Stopped feeding	2%	15.5%
Do not know/missing	0%	0.3%

5. Was the child given fluids made from a special packet called ORS?

	Ruhiira Baseline	**UDHS 2006**
Yes	20%	27.3%
No	80%	72.7%

6. Was the child given a government recommended home-made fluid?

	Ruhiira Baseline	**UDHS 2006**
Yes	9%	2%
No	91%	98%

7. Was anything (else) given to treat the diarrhea? (This question was formulated differently in UDHS).

	Ruhiira Baseline	UDHS 2006
Yes	80%	81.6%
No	20%	19.4%

8. What (else) was given to treat the diarrhea? …anything else? (This question was formulated differently in UDHS).

	Ruhiira Baseline 2006	UDHS 2006
Pill or Syrup	7%	20.4%
Injection	7%	N/A
IV remedies	0%	0%
Home remedies/Herbal	70%	52%
Zinc	0%	0.4%
Other	16%	19.7

7. Discussion

7.1 General

The basic conceptual framework presented above was material to organizing the data collection and breaking down the observations into categories recognizable in the field. This allowed for connecting the data to the targeted objectives of this study and at the same time, testing the compatibility of the framework to this approach. This resulted in the adjustment of the conceptual framework to the actual mechanisms observed in the field, and enables proposing a revised framework for data collection and analysis.

The discussion will be divided into two sections. The first part will focus on the targeted objectives of this study pulling the data and analysis into coherence, while the second will focus on the emerging conceptual framework deriving from the mechanisms at work in Ruhiira.

7.2 Externalities Produced by MVP Interventions towards Diarrheal Diseases

Diarrhea mitigation in the project area is targeted by measures relating to sanitation and hygiene, access to medical care and water infrastructure. Sanitation and hygiene can be viewed as infrastructure and behavior (affected by education/sensitization - see above Chapter 2).

Some project interventions do not target diarrheal mitigation, but incorporate it indirectly through, for example, practices relating to basic hygiene. Knowledge of what constitutes good hygiene is not necessarily enough to apply the knowledge in action. In some cases, infrastructure is essential[93] to the practice of basic hygiene. In these cases, when infrastructure is lacking, the knowledge may not be applied. In addition, possessing the necessary knowledge and having access to proper infrastructure will not necessarily trigger the anticipated behavior. Here many other factors may come into play, such as time consideration, personal priorities, different rationalities, cultural beliefs etc.

[93] For example – children in schools cannot wash their hands if water is not available for this purpose.

The sections below will explore the relevant MVP interventions as they apply diarrhea mitigation. The sections focus on practices that modify the intended impact of the intervention either towards the target area, or towards the focus of this study, diarrheal diseases.

7.2.1 Externalities Produced by Interventions in the Educational Sector

7.2.1.1 School Feeding Program

The school feeding program takes place in schools, which incorporate a number of other MVP interventions such as infrastructure and education/sensitization. Some of the infrastructure is associated with the school feeding program, such as kitchens. Other infrastructure is associated with other target areas, for example rain water collection tanks. The tanks are installed to create a safe and readily accessible source of water. They also contribute to the school feeding program, since water is needed for food preparation. In addition, having water available in schools positively affects educational targets since children do not spend precious school time fetching water from afar for the feeding program, for drinking and for cleaning.

Let us review the relevant elements that influence the creation of externalities through the school feeding program:

- Kitchen
- Cooks
- Latrines
- Rain water collection tanks
- Hand washing facilities
- Knowledge

In order to avoid the contraction of diarrheal diseases the elements above must meet certain conditions, not only separately but also when connecting them together. The kitchens, the food preparation areas, the general area of the kitchen and utensils must meet certain criteria in order not to be deemed a health hazard. Standards for kitchens used to serve the general public are common throughout the world[94], and necessary in order to prevent health risks. Cooks and other kitchen personnel need to be aware of basic kitchen sanitation and hygiene as well as practice proper personal sanitation and hygiene while working in a kitchen. To achieve this, cooks need to be properly educated and periodically monitored for practice of

[94] See for example the U.S. Food and Drug Administration web site: http://www.fda.gov.

basic sanitation and hygiene in their work area. Naturally, the supporting infrastructure must be adequate in order for them to be able to comply with standards, e.g. hand washing facilities and soap must be present, otherwise washing hands becomes a difficult task.

While achieving its own objectives, there are certain practices associated with the school feeding program that can produce negative health consequences. If indeed these negative consequences occur, they reduce the impact of the actual intervention and impair its ability to help achieve the MDGs.

The schools visited in Ruhiira suffer from serious infrastructure shortcomings which taken together with the school feeding program intervention, resulting in externalities in the form of enhanced risk for the contraction of diarrheal diseases. The sections below will describe how these externalities are produced.

A. Cooks, Infrastructure and Knowledge

The cooks hired by the MVP did not, according to their own account, undergo any training relate to their jobs. No training was provided on matters of proper sanitation and hygiene when working in public kitchens. When asked about diarrheal diseases, what they are and how they can be contracted or prevented, most cooks failed to relate personal hygienic practices to possible transmission of a disease to people who come in contact with them, or the food prepared by them. Having said that, kitchens visited either did not have hand washing facilities or, if hand washing facilities were available, they were mostly not fitted with water. Soap was mostly absent from all kitchens during the visits, and therefore practicing adequate hygiene would have been extremely difficult.

As cooks use latrines during the day, the infrastructure conditions of latrines are relevant to their personal hygiene. As described in the data section, latrines in schools are generally in appalling condition, hand washing facilities are unavailable or not fitted with water and soap is not present. These elements enhance the risk for the creation of reservoirs for diarrheal diseases in kitchens and through possibly contaminated food served to the children by the kitchen personnel.

B. Pupils, Infrastructure and Knowledge

Pupils have demonstrated that they possess adequate knowledge relating to prevention of diarrheal diseases. Nonetheless, they are often observed not applying this knowledge in practice. This is largely due to inadequate infrastructure (latrines, hand washing facilities,

soap), but not exclusively, since in the rare cases where adequate infrastructure was present, half of all pupils observed did not use it. The school feeding program introduces the chance of contracting diarrheal diseases through the fecal-oral route because of inadequate latrines, hand washing facilities and failure to apply knowledge by students.

In addition, there is a genuine attempt to apply the knowledge acquired through education and sensitization to the school feeding program, by initiating a procedure that aims at achieving clean hands and utensils before food consumption. This hand washing procedure was described in the data section (Chapter 6), and involves rinsing hands and utensils in water poured into a casserole. Since the children have, for the most part, not rinsed their hands after using latrines, since there is no soap involved in this procedure and the same water is used repeatedly, one can only assume that the water in the casserole is quickly contaminated and thus potentially transferring pathogens to all (and everything) dipped in the water, utensils included. This procedure is the result of an attempt to apply knowledge in order to prevent contamination through dirty hands and utensils. But improper infrastructure (latrines and hand washing facilities) together with improper application (not using soap, not changing water in casseroles and washing utensils in the same water before reusing them[95]), results in the creation of reservoirs for diarrheal pathogens. It is important to remember that most children interviewed stated that they have younger siblings at home, and that they take an active role in attending to them, thus potentially creating a transfer route for pathogens acquired in schools to reach younger toddlers and babies (those most vulnerable).

7.2.2 Externalities Produced by Water Infrastructure Interventions

Water infrastructure interventions are also an integral part of the school feeding program mentioned above, as water is indispensible for cooking. Water in Ruhiira is a very difficult issue not only because it is scarce, but also because of its quality and difficult accessibility. Water infrastructure interventions consist of solutions that deal with the three problems mentioned above: scarcity, accessibility and quality.

The water scarcity issue is dealt with through solutions designed to accumulate existing water during the low use time, thus saving water that would otherwise be lost and through the collection of rain water. Accessibility to water sources is mainly difficult because of the geography of the project area, consisting of high steep hills while water sources mainly lie in the lower lands. This issue is addressed by the design of piping schemes which will pump

[95] As mentioned above, some children were drinking this water as well.

water to high locations, and will be distributed through gravity flow to key locations. Accessibility and scarcity of the water are also addressed by rain harvesting solutions such as the installment of rain water collection tanks in some public places (schools, HCs, churches). The quality of the water is a twofold challenge, and consists of chemical composition and biological contaminants. In order to make the water potable and usable for cooking and washing, it needs to be de-mineralized. Biological contamination of the water, mainly by fecal substances, renders some water sources undrinkable for humans without treatment. There are two main solutions for removing biological contaminates from water in Ruhiira. The first is achieved by the protection of sources, meaning isolation of the eye. The second is the removal of biological contaminants by users before consumption, namely through boiling the water, which is the most common way to disinfect water in Ruhiira[96]. This is achieved by sensitization of the community, emphasizing the importance of removing biological contaminates by boiling the water for about 20 minutes in order to prevent the contraction of diarrheal diseases.

A. Rain Water Collection Tanks

According to various project personnel, and as emphasized by interviews at the household level and FGDs, rain water is considered clean water.

As observed in the visited locations where rain water collection tanks were present, the runoff surfaces are not clean. The rain water is deposited in the tank along with various contaminants, which, as shown by testing water samples for fecal coliforms and *E. coli*, renders the water inside the tanks undrinkable without treatment.

The water from rain water collection tanks is used in many schools for cooking, drinking and washing. With the exception of cooking[97], the water is not treated in any way before drinking, rinsing utensils and rinsing hands. This can result in the transmission of various diseases to users, particularly diarrheal diseases.

In churches the tap fitted to the tank is usually locked. It is opened during sermons, or other occasions related to church activity. The water is mainly used for drinking, and sometimes washing. Once more, the water is not treated in any way before use.

[96] Water-guards are also available in the area, but not offered by the project as a solution due to costs (personal communication from MVP water facilitator in Ruhiira).
[97] Where water is boiled through the cooking process.

In some HCs, such as Ruhiira, Ntungu and Nyakitunda water from rain water collection tanks is the only currently available source of water[98]. When the tanks are empty, water is brought from elsewhere (ponds or sources, depending on the season). In other HCs, such as Kabuyanda, piped water from a protected source is available through a gravity scheme present before the MVP came to the area[99]. The water from the scheme can be used through one tap located in the HC compound. In addition, the water is transported to some rain water collection tanks and mixes with rain water. When water is used inside the various HC departments, including the surgical theater, it usually comes from rain water collection tanks, and therefore there is a high likelihood that it is contaminated. In addition to the HC personnel who sometimes use the water for drinking, washing and cooking, patients in the HCs use the water for the same purposes.

The installment of rain water collection tanks to solve the accessibility, scarcity and quality of water in Ruhiira, given that this water is usually not treated before use, results in an increased risk for contraction of diarrheal diseases. The main reason for this is that the users of this water believe it to be safe, and do not consider it necessary to boil the water before use. Some, however, did mention that water should be boiled. Nevertheless, it is not done due to time constraints and shortage of firewood.

B. Protected Sources

The protected sources provide clean and safe drinking water, The isolation of the eye serves as a separation of water from biological contaminates, while the de-mineralization plants removes chemical compounds and improve the quality of the water.

Protected sources need basic maintenance in order to avoid water stagnation and pollution of the sources. The basic maintenance involves weeding, especially in locations where an aeration channel is installed. It also includes the removal of soil eroded from the hills which may block the channel and cause stagnation. In addition to basic maintenance, there is a need to periodically open the sand filter and thoroughly clean it for the continuous effective removal of chemical compounds. Sometimes there is a need to replace broken parts, such as taps (where they exist), pipes and stone slabs.

[98] The personnel in Nyakitunda told that once a water tanker was sent by the MVP to fill the rain water collection tanks.
[99] The MVP will add a source (Karwenyi) to this scheme to increase the amount of water available.

It is the project that invests in the protection of the sources; the community assumes responsibility for the maintenance. This is an important objective of the MVP, aiming at involving the community in interventions, allowing them to see and understand the benefits they are receiving from the intervention, and rendering the intervention sustainable in the long- term since it is the community that will need to maintain it once the project ends.

Some communities maintain the sources for which they are responsible well. Some, as demonstrated in the data section, fail to fulfill their responsibilities. This results in the gradual destruction of the investment and, it contaminates the water. Many members of the community do not realize that the water is not clean once stagnated water is mixed with the source water, and they continue to use it believing it is a safe source. In addition, the water pools created by stagnation, specifically the ones around the aeration channel which drain very slowly, may result in the creation of suitable habitat for Anopheline mosquitos. This not only increases the risks for diarrheal diseases but also for malaria.

There are also external factors, not subjected to the project influence, that affect the state of the protected sources. In Kaneyrere, uphill communities which are outside the MVP area have land use practices that contribute to increasing soil erosion which results in a more frequent need to maintain the source downhill. This extra burden of work can be one of the reasons the community fails to maintain this specific source, since it is not easy to mobilize community members[100] often for work that does not result in immediate monetary benefits.

When asked why the sources are not maintained, chairmen of the water committees responded in many different ways. The most common response though, insinuated that they expect the MVP to fix the problem. One example of such response came from the community in Karoli, where a tap was broken and the community waited for the project to fix it. This raises serious sustainability questions. The water infrastructure development in Ruhiira is not finished. More elaborated interventions are under way, such as the installment of a sand filter in Kakoni, and the planned diesel pump which will transport water to Ruhiira trading center. In the future, more pumping schemes are planned, such as adding Kanyerere to the Ruhiira scheme and protecting sources and installing pumps for the Nyakitunda scheme (combining Kyenganya and Omukabaare sources). The main question is: if some communities do not maintain a tap, or weed and clear erosions, can the project expect them to maintain filters, fuel and in the

[100] This issue came up during the interview of the chairman of Kanyerere water committee and discussed with the water engineer accompanying the observations of water sources.

future electrical pumps and elaborated piped water schemes? Chapter 8 (Recommendations) will address the issues raised here.

C. Hand Washing Facilities

Hand washing facilities are not common in Ruhiira. Most of those found in places like HCs and schools are improvised most commonly with a small five liter Jerry-can, and in most cases not fitted with water. Even though this improvised solution is better than no solution, its overall impact is minimal since water is usually missing in most places[101]. Another type of hand washing facility is a bigger tank on a stand, fitted with a tap and a place for soap (see Figure 6.3, left picture). Since this type of tank has a much larger capacity than the five liter jerry-can, the water does not run out as often as in the improvised facilities which not only increases the chances of there being water available but also reduce the time requirement to frequently fill it up.

One of the most important ways to avoid the contraction of diarrheal diseases is proper hand hygiene. The fact that hand washing facilities were missing from certain project interventions, either because they were not included in the design, or, were not distributed yet, creates externalities in the form of a greater risk to contraction of diarrheal diseases. This happens for instance in the school feeding program as described above and HCs. The lack of proper hand washing facilities reduces the impact of other interventions. In the school feeding program it may cause sicknesses that will reduce attendance to schools, which is counter-effective to the stated objectives. In HCs poor sanitation of personnel and patients may cause cross infections, increasing the burden of diseases and the costs of treatments.

It is also important to recognize that the presence of hand washing facilities does not mean that they are used. As shown in the data section, many members of the community do not use hand washing facilities even when they are available and functioning. Increasing the use frequency of hand washing facilities will help to reduce the associated externalities. This is not a trivial challenge since the solution to this problem is not technological and needs continual, long term social interventions (see Chapter 8).

7.2.3 Externalities Produced by Medical Interventions

The following section should be read with some caution. The medical interventions discussed here are viewed through the lens the social sciences and not by a medical doctor. Professional

[101] With the exception of Nyakitunda HC, water was missing at one point or another from all visited locations.

health providers may disagree with the interpretation given to some of the medical discussions below. Nevertheless, it was judged to be important to outline here some questions raised on actual medical practices relating to diarrheal diseases and possible associated consequences that may be counter effective to the project objectives.

A. Diagnosis

A list[102] of all children aged five or less attending a specific HC in one chosen month was produced in order to check what the predominant diagnoses are relating to diarrheal diseases and which treatments are prescribed (See Appendix F).

From a total of 28 cases of children with diarrhea as a symptom or diagnosis, 18 were diagnosed as suffering from malaria as well. A blood sample from all 28 cases was taken as per routine of the HC at the time of diagnosis, in order to perform a malaria smear test. Only one child tested positive for malaria. It is understood here that because of the sensitivity of the smear test, it needs to be repeated three times in order to conclude with a high degree of certainty that the patient does/does not have malaria. In all reviewed cases, the smear test was performed only once[103], and despite the fact that 26 out of the 28 patients did not receive anti-malarial treatment, the diagnosis "malaria" remains in the record. This creates difficulties not only with respect to immediate patient care (which will not be discussed here), but is also problematic with respect to long-term understanding of local health problems. The latter could be greatly enhanced by the possibility to interpret with developed, complete and accurate health data. This limited sample raises questions if malaria is indeed the main cause of disability for all age groups in the area throughout the year. The reported prevalence of malaria may distort the picture when it comes to prevalence of other diseases. It is only recently that symptoms have begun to be recorded in an accessible data base. It is therefore difficult to interpret the numbers relating to prevalence of diseases in Ruhiira MVP. In Kabuyanda HC, for instance, 58% of all patients attending the HC between 2005 and 2008 were diagnosed with malaria (5490 out of 9416 cases). Only 3.3% were diagnosed with a diarrheal disease. Recalling how malaria is recorded on the 28 cases reviewed, may suggest that the burden of malaria is actually much lower, while the burden of diarrheal diseases may

[102] The list is anonymous. No identifiers are used and no data can be related to actual patients. A permission to generate and use the list was obtained from relevant MVP personnel. The IRB condition of not using any identifiers in the research was respected throughout the process.

[103] For additional testing, patients need to return twice more to the HC. This is a difficult task for locals, for many reasons, including distance, time management, and accessibility to transport.

be higher. This affects prioritization in the MVP, and may be counter effective when it comes to reducing the overall burden of diarrheal diseases.

B. Treatment

There are two important comments to be made on treatment. The first relates to the distribution of medication and the second to possible consequences caused by it.

In the 28 cases reviewed, some patients received treatment that may constitute as over-medication. This issue was raised in front of prominent health personnel in Ruhiira MVP office in Mbarara, who agreed that some over-medication is taking place at HCs. When looking at the list of medication distributed to the 28 reviewed cases (Appendix F) one can see that some patients attending the HC receive as a treatment in one visit consisting of anti-worm infestation medication and antibiotics. In one case a patient receives antibiotics, anti-worm medication and anti-malarial medication[104] in a single visit to the HC. Data from other months (not included in Appendix F) show patients with negative malaria smears receiving both antibiotics and anti-malarial medication.

It is important to emphasize that the issue of over-medication was discussed with a number of MDs in Ruhiira. All agree that some degree of over-medication exists. Due to resources and time constraints there are legitimate problems that inhibit proper identification or exclusion of pathogens from medical diagnosis. Therefore the policy is to give a treatment as a precaution. When asked, most lab technicians in Ruhiira claimed that they have the proper knowledge to conduct elaborate procedures that will enable the identification of pathogens (e.g. culture and stool sampling), but such procedures will require resources which are not present at this time in the village HCs (e.g. electricity, space). If indeed there is a problem of over-medication in Ruhiira as suggested by the data and discussions with health personnel, then a number of consequences relevant to this study can emerge. The issue of drug resistance was raised in context of the administration of antibiotics, since according to MVP officials in Ruhiira, approximately 50% of all patients attending the HC with a diarrheal disease probably suffer from a viral infection (rotavirus was mentioned as the most common pathogen). Viral infections are not indicated anywhere on the records reviewed. This may suggest that many patients suffering from a viral infection receive anti-bacterial treatment, which may lead to a

[104] This is supported by other OpenMRS data (for a two month period) reviewed together with various MVP personnel.

number of long term problems, chief among them bacterial resistance to antibiotics (Southwick 2004: 2-4; Palumbi 2001)[105].

Another important point is that there was a shortage of medication in HCs during the period of this study; all HCs lacked medication such as antimicrobial drugs, pain killers and ORS. In many cases, the data shows no other medication given to a patient than vitamin A and ORS[106]. This often means that the patients received instruction to purchase medication that was not available at HCs. These directions are not noted in the patients' record. During the household visits, the respondents were asked which medication was prescribed by the HC. Some affirmed that they had not received drugs from the HC because of shortage, and that they had received instructions to procure medication elsewhere. Therefore the number of patients who were advised to take antibiotics is higher than the one portrayed on the list in Appendix F.

Finally, wrong diagnosis or administration of wrong medication can lead to a loss or lack of confidence of the community in the HCs' treatment. Loss of confidence can be caused by many factors: Many households mentioned that the HCs' treatment did not cure the child. This can be due to wrong application of medication by the parents, not following the course of medication prescribed as directed, and lack of knowledge regarding the possible effects of medication (e.g. ORS which is not given as a cure but in order to rehydrate patients and since the diarrhea persists after taking ORS, many parents believe that the "medication" is not working). Unsuitable medication given by HCs, such as antibiotics for viral diseases, may indicate to parents that the HC treatment does not work, and therefore reduces the confidence in modern treatment. As a result many local people continue to seek alternative traditional solutions for the sickness of their children (and themselves). The end result can thus have long-term, counter effective consequences caused by HCs to health issues in Ruhiira. This, in turn, reinforces belief in traditional cures and healers.

C. Traditional Treatment of Diarrheal Diseases

There are different sorts of traditional healers in Ruhiira. The most common are herbalists who apply herbal medicine in an attempt to solve various diseases. Traditional healers are not addressed by project interventions, but as mentioned above and earlier, some applications of

[105] Bacterial resistance to antibiotics can affect health also through other human interventions such as agriculture (see e.g. Perron 2008). This issue was not investigated in this study and merits further attention.

[106] As indicated to me in households, some patients did not receive ORS and vitamin A because of shortage even though the data indicates it.

project interventions may cause people in the community to seek or prefer traditional solutions. For most people in Ruhiira, traditional medicine is their natural choice. A number of project officials have mentioned that in some cases even they prefer traditional medicine instead of conventional western medicine.

It is difficult to judge the effectiveness of herbal medicine when it comes to diarrheal diseases. With an assumption that conventional western medicine is more effective, the fact that many people in the community seek traditional solutions reduces the potential impact of project health interventions.

Some traditional practices, like pulling out milk teeth of dehydrated babies are potentially quite dangerous, and may increase the risk of serious long term injury or even death of children suffering from diarrhea[107]. One case of teeth-pulling was observed during the study. The parents took their child to an HC, and since they judged the HCs' treatment to be ineffective (according to their own testimony), they decided to seek traditional help, which resulted in uprooting teeth from the baby's gums. It was not possible to determine why the HCs' treatment was not effective in that particular case. It may have been due to a number of reasons, most related to the parents' practices. But there is a chance, as described in the previous section, that the child received the wrong medication due to misguided diagnosis. The example is meant to illustrate the potential consequences that may arise, including that some HCs' practices may result in the reversion of some community members to traditional medicine. This can both reduce the impact of health interventions and, in the worst cases, put young children at increased risk for severe injury and death.

Despite the critique expressed above towards traditional medicine, traditional knowledge in general, including medical knowledge should not just be dismissed. Many herbal remedies have positive effects, and may contribute to healing diseases (Tabuti 2004; 2003). But certain practices of traditional healers, such as teeth-pulling or late referral to HCs are counter effective. Combining traditional knowledge with modern knowledge may be a possible solution for offsetting the unwanted effects of traditional medicine. Since many members of the community seek traditional healing methods, the MVP, can, for example, convene the traditional healers in Ruhiira cluster, and develop a way to incorporate them into medical interventions. A system can be devised where a traditional healer will agree to refer certain types of patients to a HC without delay.

[107] Injury to the oral cavity can reduce the ability to consume food or liquids, and may aggravate dehydration.

7.2.4 Externalities Produced by Interventions Designed to Improve Livelihood

Improving livelihoods in Ruhiira is a cornerstone of the MVP. When the project is scheduled to end, the responsibility of maintaining the different elements introduced in Ruhiira by the MVP will be transferred to the local government. The local community will take charge, and it will be their responsibility to sustain the interventions of the project. In order to achieve sustainability of the project, the local community must both generate income to cover expenses and learn to apply management tools to carry-out administration related to the MVP interventions (Konecky & Palm 2008). It is therefore imperative that the MVP invest in the development of enterprises, markets and businesses and encourage creativity and income generating activities.

A. Market Places Infrastructure

One of the elements introduced by the MVP, following the advice and wishes of the local community, is a monthly market place in Ruhiira village. Before the project arrived, there were two weekly markets in the area: Nyakitunda and Kabuyanda. The project helped the community to establish Ruhiira market once a month. The local community in Ntungu followed the example and established a local weekly market in Ntungu village, across the road from the Ntungu HC.

The market in Ruhiira is also called the "women's market" since the idea to start it was suggested by the women's groups established by the project in Ruhiira. These groups meet once a month, on the first Monday of every month. Since many women gathered in the same location during that time, they approached the MVP and asked for help to establish a market place. The MVP responded to the request, building public latrines and a shed for the market place in Ruhiira.

On the first Monday of every month, when the women's groups meet, many villagers and vendors, both from the local area and from farther location in the district, arrive in Ruhiira for trading in the market place. This has created an opportunity for income generation and access to different goods that earlier could only be found in bigger markets in the area and outside.

Each seller in a market must pay a fee to the community for renting a space. Local community members not only have the opportunity to sell their produce, but to establish businesses such

as creating temporary “hotels” for selling food, opening “food joints” and offering other services.

Even though the Ntungu market is not a direct project intervention like the one in Ruhiira, it is most definitely a result of sensitization and awareness through project activities. Ntungu is a relatively new market, much smaller than the one in Ruhiira, and not as busy. Here, the project has not been involved in building structures for the market, and neither latrines nor a market shed are present so far.

As mentioned above, the introduction of a market place in Ruhiira included the construction of two structures. The latrines were meant to serve the community on market days, and to provide people a place other than the open fields for urination and defecation. But since an LC lost the keys to the latrine before opening day, defecation and urination have been taking place in the latrine passages and around the structure. There are no hand-washing facilities constructed with the latrines, and therefore users cannot wash their hands. The unintended consequence of the introduced latrine results in conditions that can increase the risk for diarrheal diseases, especially when markets involve dining in temporary hotels, hence eating with possibly contaminated hands. Open defecation in areas where children play, such as around the latrines in Ruhiira, can increase the risk for contamination with diarrheal pathogens. Once the latrines are unlocked and are opened for use, the hand washing facilities will still be missing, and users will still have contaminated hands.

The market shed was not used by sellers during the market observation days. The LC claimed that the current structure does not fit the needs of the sellers and therefore is not used for market purposes. Instead, it was found that the shed had both human and animal excreta on the floor. In addition, it was used during the observation day for a soccer game by kids, and later by various vendors as a parking space for their motorcycles. Naturally, the presence of excreta in the shed increases the risk of contamination with diarrheal pathogens, especially for the children playing there. The LC promised that the structure will be used in the future during market days for other purposes than parking and soccer games.

B. Market Places Activities

The main activities in market places are the exchange of goods and services. These are the intended positive benefits for introducing a market place, but with them come practices that may increase the risk to contract a diarrheal disease.

In the big market places, Nyakitunda and Kabuyanda, raw meat is offered for sale by butchers. The sanitary and hygienic conditions relating to butchering and selling raw meat was presented in the data section above. In Ruhiira and Ntungu markets, raw meat is not usually offered for sale. Sometimes fish is offered for sale in these markets. In these cases, the fish lies in the open, usually in the sun, for the best part of the day. It is therefore a potential reservoir for pathogens.

The food services offered in markets may also be an important source of diarrheal disease. As the only condition to become a food provider in markets is payment of the space rental fee, anyone who wishes to, can open a temporary hotel and provide cooked food for people attending the market. There are a number of elements that can enhance the risk for contraction of diarrheal diseases relating to food providers in markets:

- The quality of the food
- The quality and duration of the cooking
- The quality and quantity of available water used for drinking and washing
- Cleanliness of utensils
- Personal hygiene practices of the cooks
- Personal hygiene practices of the consumers

Any of these elements or their combination may result in a contraction of diarrheal disease. This is applicable to both food served in hotels and meat “joints”. Introducing a market place also introduces food providers, which introduces the elements mentioned above, resulting in an increased risk of contraction of diarrheal diseases if these elements are not addressed.

7.2.5 Possible Future Externalities Related to Current and Future Intervention

Different members of the local community have various ideas regarding how they would like the MVP to further develop the area and contribute to both the community and their personal livelihood. Many have business goals, personal, family and community goals; a vision of how the resources could be best used in different situations for income generation livelihood development and public investment.

There can be many implications of current and future interventions on environmental health and sustainability. The section below will describe a number of possible scenarios portraying externalities relating to relevant health implications. The conversation with community

members indicates the potential that more serious environmental implications may occur in the future if adjustments of development interventions and consideration of new types of interventions are not introduced[108].

A. Use of Water

Community members are expecting to drastically increase their use of water in the future. Their explicit wish is to have water as close as possible in order to both save time on fetching water for household use and to enable increased water use to generate income.

Today the amount of water used for any purpose is limited to the amount carried from the water source to the use point. Most households make one trip a day and carry between 1 and 3 20 liters jerry-cans (depending on how many live on the household and how many go to the water source from one household on a given day). This water is used primarily for cooking, but also for drinking, cleaning and washing. The limited amount of water affects the frequency of use for hygiene purposes. Increasing the amount of water available for households by installing closer water points will probably have positive effects on sanitation and hygiene. This, though, incorporates a trade off. Using more water at the household level, will also mean dumping more water near the household since, as of yet, no drainage systems have been installed in the area. This may cause perpetual dampness around households which may have health implications.

The use of water for income generating activities was mentioned by most households visited and in FGDs. The main wish of community members is to be able to maintain livestock and irrigate various crops. Some local business entrepreneurs plan to use electricity to pump more water facilitating the installments of industries in the region. One industry that was mentioned frequently was soda and beer factories. These types of industries not only use a considerable amount of water to generate one liter of the final product, but also create by-products which may cause environmental pollution if not disposed of safely[109].

[108] Most issues related to the future in the eyes of community members are outside the scope of this study, and include elements such as: increases green-house gas emissions from the addition of many motor vehicles in the area (and possible related health issues of this); *eutrophication* of water sources from chemical fertilization; land erosion from increased livestock and exceeding the carrying capacity of the land; environmental pollution from industry and deterioration of water sources (quality and water availability).

[109] This information was obtained through visits of factories in Nepal.

Since water sources in Ruhiira are used by all, and due to the nature of this resource in the cluster, increased consumption will decrease the total amount of water available[110]. This can potentially affect health as water availability will decrease and less water for sanitation and hygiene will be available. It may potentially also cause future conflicts relating to access of users. This means that proper institutions should be established in villages in parallel to infrastructure interventions that may change the current potential of resource use and social dynamics (see Chapter 8 – Long-Term Recommendations).

B. Health Services

Improved health services in Ruhiira are already having many positive effects on the community. But free health services and medication, coupled with the absence of proper local and national governance and unsatisfactory enforcement of existing policies, may also produce some negative outcomes.

This is already felt in many HCs, especially in Kabuyanda, and is expected to increase as time passes. All HCs receive patients from outside the project area. This increases the burden on health personal, the facilities and on the available medication. Kabuyanda is located approximately 17km from the Tanzanian border. Many patients from Tanzania attend the HC to benefit from the free improved health services. This is not to imply that health services should be denied to anyone, only to indicate that with the absence of national policies and their enforcements, e.g. border control, the burden on the resources within the project area will rise, and may reach a point in the future where sustainability will be compromised. Even today HCs run out of medication frequently, meaning that increased burden on HCs will result in deterioration of services which will affect the health of the targeted population in general (thus affecting the burden of diarrheal diseases).

7.3 Conceptual Framework for Data Collection and Analysis

7.3.1 The use of the Basic Conceptual Framework for Data Collection

The three objects of assessment in Figure 3.1 were used in order to identify the different elements of each relevant intervention in relation to the target area of this study – diarrheal

[110] According to water engineers in Ruhiira, the water sources recharge during wet-seasons. A prolonged dry-season affects the yield of sources. Therefore, the use of water in the region should not exceed the recharge rate of the sources. This has not been an issue so far. But in the future, installing industries (e.g. soda factories as suggested by some community leaders), may result in the depletion of water and/or deterioration of water quality.

diseases. The three objects of assessment taken together represent the application of a designed intervention, which aims at achieving defined objectives.

The *output level* of each intervention, are the rules, decision making processes and infrastructure that form the foundation of the intervention. It is what is being initiated in order to start the process of achieving the desired impact. In the education sector for example, the identified elements comprising the *output level* of the intervention include the constructed infrastructure, the rules concerning preparation and serving meals, the scheme that allows the procurement of food, the details of storage, the rules concerning use of infrastructure, etc.

The *outcome level* of each intervention is the behavior generated by an actor group for the relevant intervention. It is the implementation of the *output level* by the actor groups, and relates to what the *output* provides in practice. The *outcome* is also influenced by other factors, such as *output levels* of other interventions, existing social structures, tradition, personal preferences of actors, etc. Using the same example as above, in the school feeding program the *outcome level* is composed of, for instance, the behavior of the cooks, teachers, students and MVP officials in relation to food preparation, infrastructure usage, food consumption (procedures), etc.

The *impact level* of each intervention is the degree of effects on the objectives of the intervention. These effects are produced by the *outcome*, which is initiated by the *output* and other influencing factors. The impact can also be influenced by other factors, such as outcomes of other interventions.

Again, using the example of the school feeding program, the impact is the effects of the elements in the *output* and *outcome* on, for example, school attendance, improved ability of students to learn, malnutrition and hunger among school children, general health of students, etc.

In this study, these three elements are assessed in relation to a specific target area – diarrheal diseases. This means that the evaluation of the *output* and *outcome* will be towards a different *impact* than the one intended by the observed MVP intervention. In addition, the evaluation of the actual intended *impact* associated with the intervention is viewed in relation to diarrheal diseases and its effects on them.

7.3.2 Mechanisms at Work in the Field

The data collection and interpretation revealed that sometimes within an intervention the *output* and *outcome* levels are not applied as intended. In some cases, the effects on the *impact* are minimal, even though the efficiency and effectiveness could be improved with the proper adjustments. In addition, *output* and *outcome* which do not follow the design of the intervention produce externalities that may be felt in other areas.

One such example from the infrastructure development sector relates to the annual reports which state that latrines have been built in schools (*output* of infrastructure development interventions). In practice and contradictory to the report, in at least two schools such latrines were not present, even though they were reported as having been built. This compromises sanitation and hygiene which not only reduces the *outcome* intended by having these latrines present in schools, but also affects the *impact* of another intervention: the school feeding program. The lack of proper latrines affects sanitation and hygiene of actors involved, which results in an increased health risk. Taken together with the introduction of the school feeding program, the health risks are increased even further due to lack of proper infrastructure that was supposed to be in place. This is because an opportunity to use dirty hands for eating food is introduced through the feeding program. One possible result is increased morbidity affecting school attendance and a reduction of the *impact* of the school feeding program (as well as other desired *impacts* of the MVP). In this case, an intended *output* of an intervention is not present, affecting *outcomes* by increasing the risks for health hazards directly, and through relevant elements triggered by other interventions (e.g. school feeding program) and reducing desired *impacts* of a number of other interventions (sanitation and hygiene, health, education). In short the *output* level can be divided into two for the analysis: *Installed output* and *Missing output*.

The *Installed output* is the *output* that the project deemed necessary to be there as a part of any intervention, and installed what is necessary (rules, procedure and infrastructure) for it to play a role in the intervention. The *Missing output* can be *output* that was deemed necessary but for some reason was not installed, or *output* that was not recognized as necessary, and therefore is missing from the design.

It seems that the *outcome level* is the most important externality producing level. This is because it deals with factors that are less controllable and subjected to human social systems which are – at least to a certain degree unpredictable, since they involve personal rationalities.

By introducing *outputs*, one can predict certain *outcomes* which are general and may even have been tested in various settings. In a particular location and context, *outputs* may produce unpredictable *outcomes*, which should be analyzed and then adjusted through re-tuning to the *output level*.

There are a number of examples from the field, of externalities produced towards diarrheal diseases through the *outcome level* of various interventions. In the water and infrastructure sector, on the *output level* it was established that communities will assume responsibility for maintenance of water sources. If communities follow the established rules, it is assumed that the water sources will function as predicted yielding safe, clean, drinkable water for the use of the community. In some cases, the communities fail to behave as dictated by the *output level*, not maintaining the source as they are supposed to. This results in the deterioration of the investment, with health implications relevant for diarrheal diseases. In the examples of poor maintenance referred to in the study, the community did not respond as predicted, resulting in *unexpected behavior* producing externalities both to the *output* and *impact level* of the intervention, as well as affecting these three levels of other interventions. Not maintaining the sources causes deterioration of the infrastructure (*output* of the same intervention) and unsafe water (*impact* of the same interventions). It also causes health risks (*impact* of other interventions) which in turn may have implications, for example, on school attendance and education (affecting *output*, *outcome* and *impact* of other interventions).

Sometimes the *unexpected behavior* takes a different form. Again in the case of water infrastructure, in the wet season the community does not use the safe sources of water because they believe that the distance is a more important constraint (time) than the water quality. This is demonstrated by the preference of dirty water sources, like ponds during wet season (the rain water collection tanks are an unclean source, but believed to be clean by the community, while the water ponds are known to be unclean sources). Here the *output* did not produce the *expected outcome*, resulting in a non-elimination of risk for contamination from diarrheal disease through use of dirty water sources, affecting health, sanitation and hygiene (*output*, *outcome* and *impact* of other interventions), and reducing the effectiveness and efficiency of other intervention, causing an overall negative impact on objectives and eventually the MDGs.

It is important to emphasize that interventions are complex, and it is not a simple question of *installed* and *missing output* or *expected* and *unexpected outcome*. In a single intervention

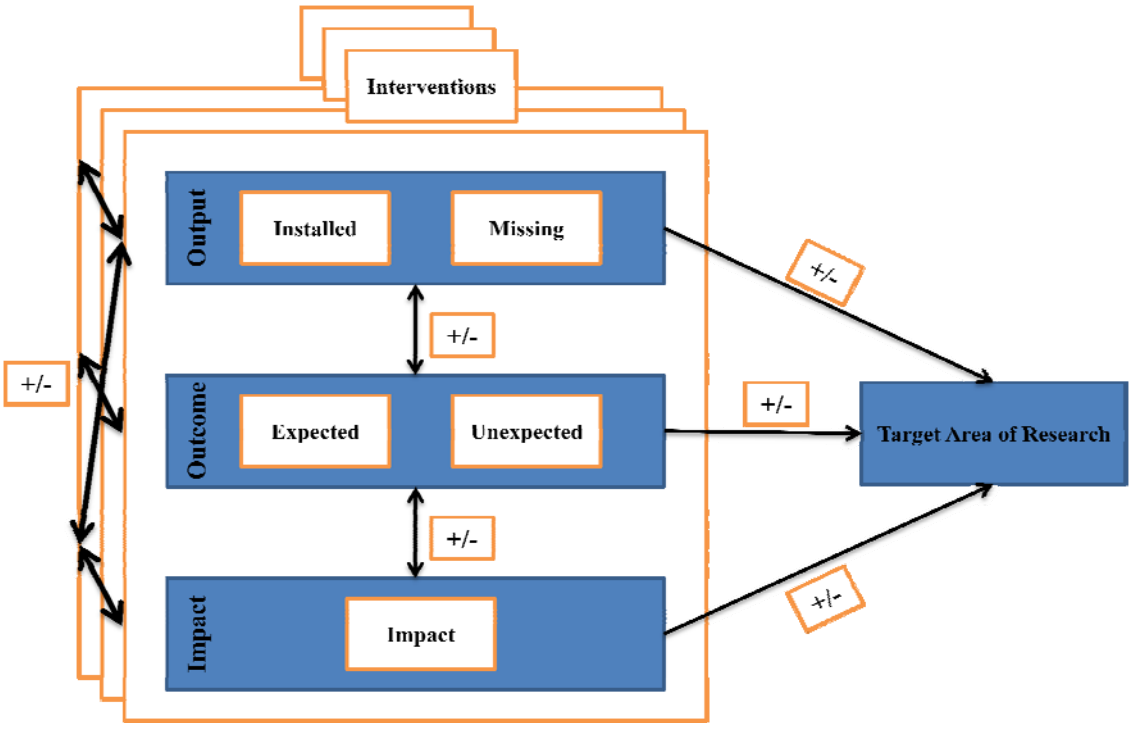
these levels can generate both types of *outputs* and *outcomes* since many elements are involved in each intervention. Therefore, one can expect to find both types of *outputs* and *outcomes*, generating both positive and negative effects on the *impact* level.

7.3.3 The Emerging Conceptual Framework for Data Collection and Analysis

The previous sections described the mechanism in the field in relation to the initial conceptual framework, which was used as a sensitizing concept to guide data collection and analysis. The work in the field revealed that the sensitizing concept can be adjusted in order to reflect more accurately elements of the three objects of assessment and relations between them, both within and between interventions.

The adapted conceptual framework is based on mechanisms installed for achieving the MDGs thorough MVP interventions, and is a result of the work in Ruhiira. It seems reasonable that this framework could be used in other MVP locations, since the basic assumptions and concepts of the project are similar in all the locations. There is also a possibility that the revised framework can be used to evaluate MDG related interventions outside the frame of the MVP. Below (Figure 7.1) is general representation of the adapted conceptual framework, followed by an explanation of the different elements it incorporates and its use.

Figure 7.1: Conceptual framework for the identification of externalities between MVP interventions towards a chosen object of research



7.3.3.1 Explaining the New Conceptual Framework

The conceptual framework deals with mechanisms that allow the identification of externalities produced by a project intervention and the interplay between them, towards a specific target area of a research. The framework facilitates the disaggregation of elements that constitute an intervention, and then checks the interplay within and between interventions. As such, the conceptual framework deals with *how* to identify externalities. There is an additional process that merits attention, but lies outside the scope of a master study. This process deals with explaining *why* these externalities appear, specifically referring to social mechanisms that influence decisions and their applications. Answering this question involves an in-depth analysis of cultures, motivations, priorities, rationalities, etc, of actors involved (on all levels, from those defining the goals to the member of the community influenced by it). The conceptual framework above is to be used for the identification of externalities, and provides only a partial explanation for their appearance.

Each intervention is composed of three objects of assessment: *Output* (rules, decision making processes and infrastructure that form the foundation of the intervention), *Outcome* (the behavior generated by an actor group for the relevant intervention) and *Impact* (the degrees of effects on the objectives of the intervention). The *Output* is divided into two general categories: *Installed* and *Missing.* The *Installed Output* refers to the *output* that was deemed necessary in the design of the intervention, and was actually installed in the field (e.g. protection of a water source; maintenance rules). The *Missing Output* refers to two different things: The *Output* that was recognized as necessary in the design of the interventions but was ***not*** installed in the field (e.g. latrines which were not built as planned); and the *output* that is missing from the design and identified through field work as a necessity that will improve and/or solve relevant challenges relating to the intervention or to reduce externalities towards the target area of the research (e.g. establish a rule relating to conduct for food providers).

The *Outcome* is divided into two general categories: *Expected* and *Unexpected*. The *Expected Outcome* refers to the desired and anticipated *Outcome* embedded in the design of the intervention that is supposed to positively contribute to the *impact* of the intervention (e.g. eating meals at schools). The *Unexpected Outcome* refers to *outcomes* that were not anticipated by the design of the intervention, and/or *outcomes* that turned out to be counter-effective to the target area of the intervention and/or affect target areas of other interventions (e.g. not maintained water sources).

The impact is the degree of effects on the objectives of the intervention. The analysis of the impact is done towards the target area of the research (e.g. diarrheal diseases; malaria; greenhouse gas emissions).

The positive or negative effects between levels of the intervention, between levels across interventions and in relation to the target area of the research are indicated with +/-.

The target area of the research represents the object of the study. In the case of this study the target area of the research is diarrheal diseases. The target area of the research can be a part of a specific intervention, and would then also be analyzed on its three objects of assessment.

The concept is used to structurally identify unintended consequence generated by elements of an intervention towards a specific target of interest, or, in other words, to identify externalities produced by interplay between interventions towards the object of study. As indicated by the arrows, the interaction between elements is complex. Vertically, within one intervention, all elements can co-exist at the same time as building bricks of the intervention, and all may cause externalities affecting the target area of the study in complex ways. Externalities can also be produced through interactions across interventions between all the elements of each level in numerous combinations.

In order to effectively use this conceptual framework, the research should begin with a comprehensive literature review relating to the target area of the research. The literature review will contribute to the accumulation of critical knowledge that facilitates identifying the different elements in each intervention relevant to the object of research.

The second step will be a review of all the interventions, their design, objectives, what has been installed, what will be installed etc. This involves both secondary data and semi-structured interviews with relevant stake-holders.

The evaluation in the field should be preceded by the preparation of basic guides in order to conduct a cross-sectoral review designed to extract the relevant data at each object of assessment. The guides should be dynamic and subject to change and evolvement in the field based on findings and desired follow ups. This may involve a multitude of methods, both within the qualitative and quantitative spectrum, and different techniques within each method. It is important to emphasize that all steps are set in order to asses externalities produced by

interplay towards a specific, delimited target, which should be well framed through the initial literature review.

8. Recommendations

In line with the MVP request, this chapter aims at providing concrete recommendations to MVP decision makers in order to improve some of the challenges outlined in this study. These recommendations can be further improved with future research based on the methodology used for this study. The same type of study can be carried out towards other topics of interest in any MVP site and perhaps even used for other projects where interventions are designed to reach MDGs.

The chapter will be divided into two sections: *Immediate Recommendations* referring to specific changes that should be made in relation to interventions in order to eliminate current reservoirs for pathogens; and *Long-term Recommendations* referring to incorporation of elements at the design level in order to reduce externalities appearing from interplay between interventions in the future.

The distinction between *sanitation* and *hygiene* (see above Chapter 3), is material for the recommendations. Even though it is clear from the data that the MVP recognizes both the importance of infrastructure and the behavior of stakeholders, it is argued here that the main focus of interventions has been on the creation of supportive infrastructure. The behavioral aspects associated with interventions are not emphasized enough. This may provide a partial explanation as to why the system is not capturing the externalities identified in this study. The *Immediate recommendations* target *ad-hoc* solutions to resolve identified problems. But in order to achieve long term sustainability, a shift from focus on infrastructure to focus on behavior, where infrastructure becomes supportive to the overall goals is needed. The *Long-term Recommendations* included here attempt to capture this perspective.

8.1 Immediate Recommendations

8.1.1. School Feeding Program

There are a number of issues that need to be incorporated into the school feeding program. The current focus of the program is to: establish kitchens with all necessary equipment to cook and serve food, hire personnel and procure the needed ingredients (buying, planting and receiving from parents). Sanitation and hygiene issues are not directly handled as a part of the school feeding program.

It is therefore recommended that the behavioral aspect of sensitization of kitchen personnel on issues relevant to sanitation and hygiene in public kitchens and personnel hygiene of food providers should be integrated to the program. In addition, basic infrastructure must be present in parallel to initiation and running of the school feeding program (hand washing facilities, pit latrines, soap, clean water, etc.), preferably as an integrated part of it. A specific teacher or identified group of teachers should take charge during meal times in order to make sure that pupils carry out proper hygiene practices before and after food consumption (hand washing, utensils cleaning, etc.). The whole feeding process can incorporate a daily emphasis on the importance of proper sanitation and hygiene, including periodic explanations of relevant health impacts.

8.1.2 Health Centers

Professional personnel in HCs are well aware of the importance of proper professional and personal hygiene practices in medicine. Nonetheless, the behavioral practice of this knowledge is inconsistent and, in many cases, absent. In order to require full compliance with personal hygiene and disinfection procedures, hand washing facilities, either water or alcohol based, are necessary in order to prevent cross infection. Once they are installed, sensitization and monitoring of personnel is needed on a regular basis in order to make sure that proper hygiene and disinfection procedures are practiced. Proper posting of reminder signs may improve practice records. As mentioned above, Nyakitunda HC III seems to be consistent in the application of good sanitation and hygiene practices, and is a good example that these issues can be carried out on the village clinic level. The presence of a strong leader, with authority over HCs for sanitation and hygiene practices on all levels (from latrines to medical procedures) could be beneficial. This individual should have the responsibility and authority to carry out regular monitoring of HCs and to demand accountability if his comments are repeatedly ignored.

A substantial contribution of the MVP is the provision of medication to HCs in the project area. Medication requires careful and professional dispatch to patients, which is provided by HC personnel. Over-medication is double-edged as it can cause long-term health implications in the village area, and may also lead to loss of confidence in HCs (when medication is not experienced as solving the health issue) with the consequence of the reversion (or continued use) by some community members to traditional solutions for particular health issues. In addition, over-medication certainly contributes to HCs running out of certain types of drugs

often, and to unnecessarily increasing the costs of running the clinics. In addition, proper explanation on the effects of medicine must be given to patients. This will help reduce lack of confidence in HCs and decrease the number of patients seeking other medical solutions (namely traditional solutions).

Improved decision-making tools and proper, sensible use of these tools may help HC personnel to better identify causes of diseases and limit distribution of medicine. This will help to improve diagnosis, prevent possible resistance to medicine and result in more reliable medical registries which will help carry out research. A reliable database will not only serve as a means to follow-up individuals attending HCs, but will contribute to the establishment of a reliable health system that contributes to the understanding of the area, its people and their health needs. This kind of system contributes to diagnosis and treatment of individuals and at the same time, provides data that allows comprehensive study of health issues in the area. As outlined by Landon (2006: 198-207), global-health is dependent on proper functioning of health systems, including the ones in remote areas. Proper functioning of a health system includes maintaining accurate and reliable health records.

8.1.3 Rain Water Collection Tanks

Rain water running off roofs and funnels is not necessarily clean – although it is perceived of and promoted this way in the project. Collection of rain water with open containers exposes the water to potential pathogens, mostly from animal sources (dogs, birds, chickens and other free running animals around households). Water from these tanks should not be used without treatment.

Sensitization of the community regarding possible health hazards relating to water in collection tanks should take place. This effort should emphasize how the water gets contaminated and the risks involved in consuming it without treatment. It is important to offer a number of possible solutions for water treatment (i.e. not only boiling), and make these solutions available for the community. It also needs to be recognized that behavioral change takes time: it will require a long-term commitment.

There are two main categories of tanks in the village, private and communal. The private tanks are those installed by individuals at their homes. Communal tanks, are installed by the project, local government or community, and serve people in schools, HCs, churches, markets, etc. With respect to communal rain water collection tanks, the most sensible solution

is to install these tanks with an integrated purification system. There are a number of possible solutions for rain water collection tanks, including filtering and chemical treatment. All solutions have trade-off and different costs, and therefore a specific solution is not suggested here since proper evaluation must be carried out in the particular context and in close collaboration with the users. The main emphasis is that communal solutions (such as rain water collection tanks) should be installed as a whole package, delivering a safe end product for users.

There are very few individuals in the villages who have installed rain water collection systems, consisting of large storage tanks and funnels that carry water to these tanks[111].The MVP can assist these individuals in improving their rain water collection systems in order to ensure that they are clean water sources. This requires proper planning in order to identify which water treatment method is best suited for this purpose. Establishing well functioning private rain water collection systems with the help of the MVP may encourage more villagers to put in the initial effort to construct private rain water collection systems. This solution is consistent with the MVP approach of shared effort and responsibility with the local community. Guidelines for building private collection tanks can be issued to the community; those individuals that will build private rain water collection tanks will receive MVP help for installing and maintaining a sustainable water treatment system.

8.1.4 Community Latrines

Communal latrines exist in HCs, schools, churches and markets. In some cases these latrines are a part of infrastructure installed by the MVP. In line with the targets of the MDGs, the MVP sets targets for how many latrines should be built. It receives reports of numbers of built facilities and reports these on in the system. This is inadequate with respect to the goal of installing toilets with the aim to improve health. First, without proper surveillance and monitoring, the system does not capture if these facilities are indeed built or in a condition to be used. Second, the target does not address the need to change people's behavior. One indication of this, it that public latrines are rarely clean if not attended regularly; this is a fact that can be observed by every person that uses public latrines anywhere in the world.

In schools, a designated teacher is responsible for the selection of children who carry out the physical act of cleaning latrines. This is usually done with leaves and without water, but

[111] There are a number of villagers who collect rain water directly in casseroles or jerry cans or from sporadic runoff from roofs. These are not proper rain water collection systems, but *ad-hoc* improvisations.

sometimes brooms are used and water is available. It is recommended that children should not carry out the task of cleaning latrines in schools. Instead, a designated adult should have the responsibility for the task and be compensated for his/her work. This individual should have a protocol specifying when the latrines are to be cleaned, and how the task should be done. A teacher in the school should have the responsibility to monitor the state of the latrines several times during the day. In addition, unannounced periodic inspection should be carried-out by MVP sanitation and hygiene personnel to note both the state of facilities and the practices associated with them. Sensitization of teachers, children, cooks and cleaners should emphasis proper use of latrines, and personal sanitation and hygiene procedures, including an explanation of their importance. These activities should be periodical, and enhanced with proper, highly visible signposting.

These recommendations should be carried out in HCs and markets as well. Since markets are weekly/monthly event, a person should be designated to be present for the entire day outside latrines in markets during activity times. This person should be responsible for cleaning, presence of soap, paper and water. As is the case in Kabuyanda market, the presence of a person outside toilets during market days greatly contributes to the improved state of the latrines. Charging a small sum of money (as it is done in Kabuyanda) for use of public latrines during market days can be beneficial and contribute to proper sanitation and hygiene conditions in latrines. If such a measure is implemented, it is important to explain to members of the community why this measure was undertaken and how they benefit from it.

8.1.5 Markets

The exchange of raw and cooked food in markets should be regarded as a potential important source for diarrheal diseases. The questions around food in markets do not only concern potential contaminants in the food, but also the personal hygiene of food providers, and the sanitary conditions in markets.

In order to reduce reservoirs for pathogens, protocols for sanitation and hygiene by public food providers in the community and markets must be developed, practiced, and enforced. This can easily be done in markets, since food providers must pay a fee in order to be able to set-up a business in the market area. At the community level, this can be incorporated through local government regulation. The measures should stipulate the need for proper infrastructure, such as hand washing facilities, soap and proper latrines, and advice on how to keep raw and cooked food hygienic in order to prevent contamination through consumption.

8.2 Long-term Recommendations

8.2.1 Monitoring and Evaluation

Higher level (above MVP cluster level) monitoring of practices and implementation of projects is necessary on a regular basis. This can help to identify current challenges and eliminate them directly at the site level and from future project implementation in other locations and in scale-up phases. There is a need for external monitoring of both progress reports and on sources of numbers presented. External, unbiased monitoring is essential for good governance. The monitoring should be independent and needs to establish its' own sampling decisions and goals.

Institutions for cluster level monitoring (monitoring at the local level) should be established. These institutions should define responsibilities and a system for accountability/enforcement and possibly sanctions: e.g. create standards for public food providers (schools and markets); perform sensitization and monitor execution of project implementation and use; designate relevant individuals who will go through proper training regarding sanitation/hygiene, e.g. teachers and food handlers. It is important to recall that observations made during this study were reported immediately to MVP officials in Mbarara, and many faults were corrected promptly. This indicates that an institution dedicated for this task at the cluster level could potentially eliminate many types of externalities through monitoring.

8.2.2 New Institutions

Reiterating the distinction between *sanitization* and *hygiene*, and the subsequent need to enhance the MVP emphasis on long term behavioral changes required in order to achieve the goals set, there is a need to recognize the existence of local institutions. The influence of pre-project institutions on the local communities should not be taken lightly. Here, a combination of top-down and bottom-up approaches working in tandem may be beneficial. I will therefore describe in general terms a possible course of action that could help create the necessary institutions needed to promote behavioral change that will contribute to sustainability.

A process of conscious *reciprocal typification*[112] where the top-down and bottom-up approaches can meet in order to help create new institutions is needed. This conscious process should reflect the experience of developed countries with preventions of diseases through proper hygiene. In order to bring this experience to the local communities, there is a need to incorporate local institutions in the process of change. A comprehensive dialog reflecting scientific and local knowledge as well as the wishes and needs of different community members is needed. In the course of this dialog, existing institutions in villages will undergo a self defined process through which the institutions will adjusted and change in order to reach hygiene targets proven indispensible for prevention of infectious diseases.

In order to achieve *objectivation* and *internalization*[113] of new conventions, norms and rules established by the new institutions, perseverance through education is needed. It is therefore imperative to set educational goals for an extended period of time (a generation?) and regularly reiterate the new norms, conventions and rules established by the new MVP institutions including the reasons for introducing them and the objectives that they are set to achieve in the long run. A collaboration with established local leaders and groups (businesses, church, traditional healers, community leaders) can positively contribute to the *objectivition* and *internalization* of new institutions. Through this, a gradual change will be achieved in the future.

[112] The term *reciprocal typification* is used by Berger & Luckmann (1967: 72) in their description of how institutions are formed. As Vatn (2005: 11-14) explains, *typification* alone is "not sufficient to guide and assure certain behavior". The addition of the word conscious is meant to fill that gap, and add the normative element into the process of creating institutions (Vatn 2005: 13; Scott 1995: 33). Vatn (2005: 56-67) emphasizes the need to bridge between two different methodologies which reflect the divide in social science between *agent* and *structure*: *methodological individualism* according to which individuals are self-contained, and institutions are constraints; and *methodological holism* according to which a social phenomenon "defines the act". Combining these two recognizes the iterative role of the actor and institutions in the process of defining new meaning.

[113] Vatn (2005: 31) refers to three phases in the process of institutionalization: *Externalization, Objectivation* and *internalization*. *Externalization* is the first phase where "subjectively constructed routines take form and are expressed". I emphasize in this paragraph the second and third phases, assuming that *Externalization* occurs in the beginning of the conscious *reciprocal typification*. The focus at this stage is *objectivation* where "others observe the routines as facts" and *internalization* where the habits are picked up and reproduced.

9. Conclusions

The anthropogenic effects on the Earth System are usually viewed through a global outlook. The mechanisms that are at work on the global level, are also at work at local levels. Development interventions incorporate elements that cause change to chemical, physical, biological and social processes locally. These changes may have global implications in addition to the changes they produce at the local level. As we increasingly notice at the global level, manipulating the Earth System may cause unexpected and unpredicted impacts. There is no reason to doubt that the same mechanisms manifest themselves at a smaller, local scale.

This study focused on the effects of human designed changes to systems through development interventions. Development interventions redefine elements of the Earth Systems in such a way that changes are apt to occur. In many cases, these changes will be unintended and unexpected. They are often not noticed at the beginning of the process. However, as time passes, and the magnitude of these externalities is amplified, new interventions may be designed and introduced to mitigate the new problems. The underlying causes of the new problems may or may not be recognized at the time the new interventions are designed for mitigation.

The main objective of this study was to choose a global target (mitigation of diarrheal diseases), and methodologically study a development project in order to identify elements in the interventions that increase risk for the chosen target, either directly, or through interplay with other interventions. The aim was to develop an approach that will enable identification of externalities during the design and early application phases of the development project, in order to offset these externalities. Applying such a methodological approach may contribute to the long term sustainability of projects in addition to the reduction of current and future negative health outcomes and costs.

The Ruhiira cluster of the Millennium Development Project in Uganda was chosen as the location for the conduction of this study. In preparation for the data collection in the field, a literature review was done. The aim of the literature review was to familiarize with aspects relating to diarrheal diseases. The literature review comprises medical and microbiological review of diarrhea, as well as the different approach for prevention, mitigation and treatment of such diseases.

A sensitizing conceptual framework was selected in order to facilitate the study of project intervention and the interplay between them. The framework facilitates the disaggregation of project interventions into recognizable elements that allow studying the mechanisms at play from the design phase to the intended impact of an intervention. These elements serve as the building bricks of an intervention, and enable the study of interplay between interventions. This framework guided the data collection and initial analysis.

A number of targeted objectives were selected in order to facilitate the collection of the relevant data:

- To identify possible externalities produced by the current solutions relevant for diarrhea mitigation in the village.
- To assess the long term synergies and tradeoffs that the current practices are producing in relation to environmental sustainability.
- To identify how the local population and decision makers understand the interventions, and assess how they perceive the future benefits (and costs) of a given solution.

A number of qualitative methods were used in the field in order to collect the relevant data, including transect walks, non-participant observations, unstructured and semi-structured interviews, focus-group discussions and review of secondary data.

The analyses of the data indicate that externalities increasing the risk for diarrheal diseases are produced by the interplay between project interventions in different sectors:

In the education sector the school feeding program coupled with current infrastructure and water challenges, may result in the creation of reservoirs for diarrheal pathogens. These externalities are produced due to contaminated water, poor latrines, lack of hand washing facilities and soap, and inadequate awareness relating to acquisition and transmission of diarrheal diseases (especially among kitchen personnel). Taken together with the consumption of potentially contaminated food by children in schools, result in increased risk for the acquisition of diarrheal pathogens.

In the health sector, practices associated with infrastructure challenges may result in cross infections. These practices include health personnel (MDs, nurses, lab technicians and mid-wives) practicing poor hand hygiene due to lack of hand washing facilities, water and soap.

Certain practices in the health sector, such as misdiagnosis of illnesses and over-medication may lead to loss of confidence in the health system and result in patients seeking traditional remedies. Over-medication causes efficiency problems and contributes to the fast depletion of medication in HCs. In addition, over-medication may lead to resistance of pathogens to anti-infective medicine, and may cause serious health problems in the future.

In the infrastructure sector, failure of some communities to meet their maintenance obligations results in contamination of protected water sources.

Poor or inadequate infrastructure and knowledge application deficiencies result in increased risk of acquiring diarrheal pathogens in markets, schools, HCs' and households. The results indicate that a number of externalities produced by certain project interventions create challenges that reduce the efficiency and effectiveness of impacts of other interventions, thus impairing the ability to achieve the MDGs.

The gap between knowledge and the application of knowledge plays a major role in the appearance of externalities. This gap is sustained by a failure to create new institutions that integrate traditional rationalities with the modern targets of the project.

There are a number of immediate (practical) recommendations that can contribute to offsetting some externalities. These recommendations relate to closing some infrastructural gaps and changing certain specific practices (such as the hand washing procedure associated with meal consumption in schools) in order to reduce the potential reservoirs for diarrheal pathogens.

The long term recommendations target building institutional capacity to help diminish the gap between knowledge and the application of knowledge within the community. These include proper monitoring and evaluation, and developing and implementing a system for accountability.

The study resulted in the adaptation of a sensitizing conceptual framework into a conceptual framework that, towards a specific target, could facilitate the identification of externalities produced by interventions as well as the interplay between them. This can contribute to the study of externalities in other MVP projects, and potentially other development projects designed to achieve the MDGs. The conceptual framework can be used to study externalities towards a range of topics in addition to diarrheal diseases, such as malaria, green house gas

emissions, soil erosion, eutrophication of water sources and many other development, health and environmental issues.

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Appendix A – Observation Checklists

Checklist I - School observation checklist

School Name: _____ Date_____

Water

Map water Sources

Who brings water?

How is the water stored?

What is the water used for

Is it being purified/filtered/cleaned/boiled before any of its uses - elaborate

Sanitation

Kitchen

- Food storage
- Cooking utensils state
- General cleanliness
- Presence of Arthropods in and around kitchen
- Presence of dish washing soap, hand soap
- Washing and drying facilities
- How is Grey Water Disposed?
- State of cooking preparation area
- Are there hand Washing facilities?

Toilets

- Type
- Construction state
- Cleanliness of usage area and construction
- Presence of Arthropods
- Immediate area of toilets state including disposal of contents (where does it go)

Are there hand Washing facilities? (water, soap, disposal, use)

Health care in school

Presence of health personnel in school:

Is there someone trained in basic medical care

Are there visits of nurse/doctor to inspect children? How often?

Are there hygiene/sanitation inspections (regular internal/regular external?)

Are there ORS in school?

Is there a teacher who has permanent responsibility for sanitation and hygiene?

Education

Sanitation/hygiene teaching activities (FREQUENCY)

Are there regular teaching aids

Sample children knowledge of diarrhea – prevention – treatment (FGD)

Are there instructions for kitchen personnel (are they aware/educated on the issue of sanitation and hygiene/diarrheal diseases)

Are there behavioral encouraging aids? (e.g. WASH HANDS SIGNS)

Behavior (observe behavior)

Cooking personnel practicing personal hygienic behavior

Cooking personnel practicing kitchen hygiene behavior

Teachers practicing hygiene behavior

Washing hands (all)

Before eating

After eating

After Toilet (observe practices of toilets use)

After playing outside

Before cooking

After Cooking

Utensils wash/dry/store procedures

Toilet use and related practices

Checklist II - Health center observation checklist

HC Name:_____ Date_____

Water

Map Water Sources

Who brings water?

How is the water stored?

What is the water used for

Is it being purified/filtered/cleaned

Sanitation

Clinic

- Medicine storage
- Medical instruments state
- General cleanliness
- Presence of Arthropods
- Presence of washing soap, hand soap
- Washing and drying facilities
- Water Disposal
- Biohazard disposal
- Washing hands facilities

Toilets

- Type
- Construction state
- Cleanliness of usage area and construction
- Presence of Arthropods
- Immediate area of toilets state including disposal of contents (where does it go)
- Hand washing facility + Soap

Medical hygiene

Wash hands between patients

Use of medical gloves; change them between patients

Wash hands after toilet

Before eating

Wear medical robes

Behavior (observe behavior)

Medical personnel are practicing personal hygienic behavior

Washing hands medical personnel: Before treatment, after treatment (observe practices of toilets use), after toilet

Washing hands, patients: After toilet, before eating

Doctor and lab

Doctor: How do you treat diarrhea? Can you distinguish between pathogens? Do you think it's important for your work to know the specific pathogen? Why?

Lab: What can you identify from blood and sample stools when it comes to diarrheal diseases?

To check medical supplies

Are there ORS stored in the clinics?

Do CHWs' carry ORS with them at all time?

What other drugs are given to people diagnosed with diarrheal disease?

What is the usual treatment for diarrhea?

What pathogens can be identified in lab?

Check how things are recorded

Appendix B – Water Analysis Results, Ruhiira MVP

Biological testing of Water Sources, Ruhiira MVP

During the month of December 2008, water samples from most water sources in Ruhiira were collected by the MVP. The water samples were sent to Chemiphar Laboratory, Kampala for analysis. The analysis was carried out by Membrane Filter method (MF), checking for total colonies of fecal coliforms and *E. coli* in 100 ml of water.

According to the WHO guidelines (WHO 2008c: 143), *E. coli* and fecal coliform bacteria must not be detected in water intended directly for drinking or water entering the distribution system. These requirements are also valid for treated water.

The certificate below show the total fecal coliforms and *E. coli* colonies detected in water samples taken from most water sources in Ruhriia MVP.

All the water sources suited for direct drinking are marked in yellow. All other water sources are not suitable for direct drinking. A total of eight sources are suitable for direct drinking in Ruhiira MVP.

Some of the sources protected by the project are not suitable for drinking (see Chapter 7.2.4).

Identification of Sample	Faecal coliforms (MF-water-T.col) Per 100ml	E. coli (MF-water-T.col) Per 100ml
Nyakamuri P/S Tank	75	75
Nyaruhanga-Bongi Parish: Ahakabale Unprotected	2400	480
Kyanyakahimbi (I) Unprotected Spring : Ntungo Parish	1000	1000
Kagorogoro Rugonyi - Unprotected Spring : Ruhiira	740	440
Omunonke Nyakamuri (II) Spring Unprotected	2600	960
Sematte-Kabare: Ruhiira	600	480
Kana's Place Unprotected Spring	0	0
Aharukiri-Ruhiira Unprotected Spring	14000	14000
Banyagente (I) Kabare : Ruhiira Unprotected Spring	2000	2000
Banyagente (I) Protected Spring: Bore Hole Kabare Ruhiira	0	0
Ahakijanjagara: Ruhiira	800	800
Babuza's Place Kabare: Ruhiira	25000	15000
Omwamba P/S Ferro Cement Tank	1	1
Ntungu Mixed P/S PVC Tank	4	2
Omwamba PVC Tank P/S	0	0
Ntungu Boys P/S	80	80
Mitobo Kyamyakhimbi Ntungu: Unprotected Spring	460	370
Ntungu Health Center Tank	20	20
Rwakashanda Kyanyakambi Ntungu Parish (I)	210	84
Rwendagara Rugongi - Unprotected Spring: Ruhiira	2700	1600
Kyandaro A.Antungu Uprotected Kyondora	15000	0
Nyakahandagazi Unprotected Ntungu	250	150

Ryamihina Unprotected Stream -Kitojo Cell Ntungu Parish	3800	3000
Kamiranjogyera Bore Hole, Bungongi Parish	440	440
Mutebi's Place Unprotected Spring	2700	2700
Rwanyinamagaba -Ngure Unprotected Bugongi Parish	600	600
Nyahitanda C.O.U Ferro Cement Tank	48	0
Katimba Protected Spring Kitojo Cell (I) Ntungu	78	0
Beda's Place Rwanyinamagangure Unprotected Spring	53000	42000
Kayanga Unprotected Nyandare	400	320
Bugongi (Ii) Well	6600	0
Nyakitunda Health / C - Ferro Cement Tank	3	2
Agaruyenye Ntungu	1400	1400
Rwetsinga P/S Ch	60	0
Rushayo Unprotectd Spring Kitojo Ntungu	50	20
Akabare Bugongi P/S	26000	26000
Kagorogoro Spring Unprotected Kitojo Cell	2000	2000
Rwangayaaha Pond Omukawara , Bungongi	55000	55000
Bataringaya Bore Hole	500	0
Nyakitunda Health / C - PVC Tank	130	130
Munahe's Place Tap Stand Rwendago	18	0
Migyera P/S Fellow Cement Tank	0	0
Kanywamaizi FC-Tank	0	0
Ekisinga Kanywameizi Prot.Sp	17	10
Baseka's Place - Rwemango Tap Stand	100	100

Rwempungu Kyeyare Protected SP	25	25
Butunda -Kakongi Spring Not Protected	260000	210000
Nyakagyera Not Prot. Kyeyare-Ryamiyengo	900	900
Rwanywameizi Kanywameizi (III) Prot. Springs	3	3
Kanywameize (III) Aheirare P/S Spring	4000	2400
Rwacece Protected Spring	12000	7200
Kamuhama Kagongi Not Protected	150	150
Ahakameri	10	10
Nyarukomo	11	11
Kahurwa II	2	0
Karurwa I	600	2400
Omukagyera	0	0
Kantizibwes Place	1900	0
Kasharira	18	14
Mahama	130	1
Nyakagyera	140	140
Kimunyus Pond	4500	4500
Rwabahima	13000	13000
Matende	3000	3000
Nyakagyera Protected Water Source	20	7
Ruhiira Health Center Reserve Tank	350	350
Karwenyi Protected Spring	80	64
Rutemba Protected Spring Kisyoro (1) Cell	50	17
Runonko Kisyoro (11) Protected Source	8	6

Katesaam Unprotected Stream Kisyoro Parish	300	200
Karweni Reserve Tank A	80	64
Kisyoro (111) Protected Spring	300	200
Omkugyera Protected	37	0
Kanyerere Upper P/S Town Cell	90	90
Nyakiziba Dam-Surface Water	3000	1500
Kanyerere Lower P/S Town Cell	600	150
Rwakabiri (1) Spring Town Cell Not Protected	1100	1100
Kishernyi Pond-Deep Water	3200	3200
Kyetobokire Ruhiira	12000	8600
Kyetobokire Up Pro-SP	12000	9300
Rwakabiri (1) Town Cell Spring Not Protected	1500	1500
Nyakiziba Bore Hole	0	0
Kishernyi Pond - Surface Water	8500	6400
Nyakiziba Dam - Deep Well	2100	530
Kakoni Lower Left And Right Tank	110	1100
Kakoni Upper Left And Right P/S	0	0

Appendix C - Official List of MDG Indicators

All indicators should be disaggregated by sex and urban/rural as far as possible.

Effective 15 January 2008

Millennium Development Goals (MDGs)	
Goals and Targets (from the Millennium Declaration)	**Indicators for monitoring progress**
Goal 1: Eradicate extreme poverty and hunger	
Target 1.A: Halve, between 1990 and 2015, the proportion of people whose income is less than one dollar a day	Proportion of population below $1 (PPP) per day Poverty gap ratio Share of poorest quintile in national consumption
Target 1.B: Achieve full and productive employment and decent work for all, including women and young people	Growth rate of GDP per person employed Employment-to-population ratio Proportion of employed people living below $1 (PPP) per day Proportion of own-account and contributing family workers in total employment
Target 1.C: Halve, between 1990 and 2015, the proportion of people who suffer from hunger	Prevalence of underweight children under-five years of age Proportion of population below minimum level of dietary energy consumption
Goal 2: Achieve universal primary education	
Target 2.A: Ensure that, by 2015, children everywhere, boys and girls alike, will be able to complete a full course of primary schooling	Net enrolment ratio in primary education Proportion of pupils starting grade 1 who reach last grade of primary Literacy rate of 15-24 year-olds, women and men
Goal 3: Promote gender equality and empower women	
Target 3.A: Eliminate gender disparity in primary and secondary education, preferably by 2005, and in all levels of education no later than 2015	Ratios of girls to boys in primary, secondary and tertiary education Share of women in wage employment in the non-agricultural sector Proportion of seats held by women in national parliament
Goal 4: Reduce child mortality	
Target 4.A: Reduce by two-thirds, between 1990 and 2015, the under-five mortality rate	Under-five mortality rate Infant mortality rate Proportion of 1 year-old children immunised against measles
Goal 5: Improve maternal health	
Target 5.A: Reduce by three quarters, between 1990 and 2015, the maternal mortality ratio	Maternal mortality ratio Proportion of births attended by skilled health personnel
Target 5.B: Achieve, by 2015, universal access to reproductive health	Contraceptive prevalence rate Adolescent birth rate Antenatal care coverage (at least one visit and at least four visits) Unmet need for family planning
Goal 6: Combat HIV/AIDS, malaria and other diseases	
Target 6.A: Have halted by 2015 and begun to reverse the spread of HIV/AIDS	HIV prevalence among population aged 15-24 years Condom use at last high-risk sex Proportion of population aged 15-24 years with comprehensive correct knowledge of HIV/AIDS Ratio of school attendance of orphans to school attendance of non-orphans aged 10-14 years
Target 6.B: Achieve, by 2010, universal access to treatment for HIV/AIDS for all those who need it	Proportion of population with advanced HIV infection with access to antiretroviral drugs
Target 6.C: Have halted by 2015 and begun to reverse the incidence of malaria and other major diseases	Incidence and death rates associated with malaria Proportion of children under 5 sleeping under insecticide-treated bednets

	Proportion of children under 5 with fever who are treated with appropriate anti-malarial drugs Incidence, prevalence and death rates associated with tuberculosis Proportion of tuberculosis cases detected and cured under directly observed treatment short course
Goal 7: Ensure environmental sustainability	
Target 7.A: Integrate the principles of sustainable development into country policies and programmes and reverse the loss of environmental resources	Proportion of land area covered by forest CO2 emissions, total, per capita and per $1 GDP (PPP) Consumption of ozone-depleting substances Proportion of fish stocks within safe biological limits Proportion of total water resources used
Target 7.B: Reduce biodiversity loss, achieving, by 2010, a significant reduction in the rate of loss	Proportion of terrestrial and marine areas protected Proportion of species threatened with extinction
Target 7.C: Halve, by 2015, the proportion of people without sustainable access to safe drinking water and basic sanitation	Proportion of population using an improved drinking water source Proportion of population using an improved sanitation facility
Target 7.D: By 2020, to have achieved a significant improvement in the lives of at least 100 million slum dwellers	Proportion of urban population living in slums
Goal 8: Develop a global partnership for development	
Target 8.A: Develop further an open, rule-based, predictable, non-discriminatory trading and financial system Includes a commitment to good governance, development and poverty reduction – both nationally and internationally Target 8.B: Address the special needs of the least developed countries Includes: tariff and quota free access for the least developed countries exports; enhanced programme of debt relief for heavily indebted poor countries (HIPC) and cancellation of official bilateral debt; and more generous ODA for countries committed to poverty reduction Target 8.C: Address the special needs of landlocked developing countries and small island developing States (through the Programme of Action for the Sustainable Development of Small Island Developing States and the outcome of the twenty-second special session of the General Assembly) Target 8.D: Deal comprehensively with the debt problems of developing countries through national and international measures in order to make debt sustainable in the long term	*Some of the indicators listed below are monitored separately for the least developed countries (LDCs), Africa, landlocked developing countries and small island developing States.* Official development assistance (ODA) Net ODA, total and to the least developed countries, as percentage of OECD/DAC donors' gross national income Proportion of total bilateral, sector-allocable ODA of OECD/DAC donors to basic social services (basic education, primary health care, nutrition, safe water and sanitation) Proportion of bilateral official development assistance of OECD/DAC donors that is untied ODA received in landlocked developing countries as a proportion of their gross national incomes ODA received in small island developing States as a proportion of their gross national incomes Market access Proportion of total developed country imports (by value and excluding arms) from developing countries and least developed countries, admitted free of duty Average tariffs imposed by developed countries on agricultural products and textiles and clothing from developing countries Agricultural support estimate for OECD countries as a percentage of their gross domestic product Proportion of ODA provided to help build trade capacity Debt sustainability Total number of countries that have reached their HIPC decision points and number that have reached their HIPC completion points (cumulative) Debt relief committed under HIPC and MDRI Initiatives Debt service as a percentage of exports of goods and services
Target 8.E: In cooperation with pharmaceutical companies, provide access to affordable essential drugs in developing countries	Proportion of population with access to affordable essential drugs on a sustainable basis
Target 8.F: In cooperation with the private sector, make available the benefits of new technologies, especially information and communications	Telephone lines per 100 population Cellular subscribers per 100 population Internet users per 100 population

The Millennium Development Goals and targets come from the Millennium Declaration, signed by 189 countries, including 147 heads of State and Government, in September 2000 (http://www.un.org/millennium/declaration/ares552e.htm) and from further agreement by member states at the 2005 World Summit (Resolution adopted by the General Assembly - A/RES/60/1,

http://www.un.org/Docs/journal/asp/ws.asp?m=A/RES/60/1). The goals and targets are interrelated and should be seen as a whole. They represent a partnership between the developed countries and the developing countries "to create an environment – at the national and global levels alike – which is conducive to development and the elimination of poverty".

Source: United Nations Statistical Division (UNSTATS):
http://mdgs.un.org/unsd/mdg/Host.aspx?Content=Indicators/OfficialList.htm

Appendix D – Focus Group Discussion Guides

FGD I - School children aged 5-17

Duration: 1hour.

Objectives:

1. To get an idea of the extent of morbidity related to diarrheal diseases in school children.
2. To determine the level of knowledge and understanding of diarrheal diseases: causes and prevention.

Guide for focus group discussion

Presentation

Present yourself, the project and the purpose of this FGD.
Emphasize that all answers will be kept anonymous and no identifiers will be recorded.

Discussion

Phase 1

To get an idea of the extent of morbidity related to diarrheal diseases in school children.
Q1 – Did you ever suffer from diarrhea? How many times?
Q2 – Do you have siblings at home which are aged 5 or less? Do you help taking care of them? How?

Phase 2

To determine the level of knowledge and understanding of diarrheal diseases: causes, treatment and prevention.
Q3 – Can you discuss what is diarrhea?
Q4 – How can you get diarrhea? (Follow up – can you give diarrhea to others if you have it? How?).
Q5 – What can you do to prevent getting diarrhea?
Q6 – How did you acquire the information above?

FGD II - Mothers of Children Aged 5 or Less

Duration: 1.5 – 2 hours

Objectives

1. To determine which are the most significant interventions of the MVP in their eyes, and how do they see them develop in the future. Their benefits from them.
2. To determine the extent of knowledge of mothers on diarrheal diseases: Their causes, treatment, and how to avoid them.

Guide for focus group discussion

Presentation

Present yourself, the project and the purpose of this FGD.Emphasize that all answers will be kept anonymous and no identifiers will be recorded.

Discussion

Phase 1
To determine which are the most significant interventions of the MVP in their eyes, and how do they see them develop in the future, and the benefits from them.
Q1 – As women and mothers, which are the most important project interventions for you, and why?
Q2 - In what way the (intervention mentioned in Q1) is an improvement of the past situation?
Q3 – Are there any interventions or parts of interventions that you think are implemented wrongly or are counter effective? Why?
Q4 – As women and mothers, which interventions you would like to see in the future and in what way they will constitute an improvement to your daily life?

Phase 2
To determine the extent of knowledge of mothers on diarrheal diseases: Their causes, treatment, and prevention.

Q5 – Did your child ever suffered from diarrhea?
What caused it?
How long he had it?
Did you go to the health center? Why (if yes or if no)
Q6 – Why do you think your children get diarrhea?
Q7 - (according to answers above, follow up to find out local traditions and believes) – are there any other things that you believe cause diarrhea?
Q8 – What do you do usually do when your child has diarrhea?
Q9 – According to local healers, what are the causes of diarrhea? How do they treat it?
Q10 – Do you think that there are other reasons for children getting sick with diarrhea?
Q11 – What needs to be done in order to avoid contracting diarrheal disease?
Q12 – Is there anything that you think the project needs to be doing in order to help avoid the contraction of diarrheal diseases?

FGD III – Community Health Workers

Duration: 1.5-2 hours

Objectives:

- To identify the extent of morbidity and mortality from diarrheal diseases in Rhuiira MVP.
- To determine the extent of the CHWs understanding of diarrheal diseases, their causes, treatment and prevention.
- To identify the level of knowledge on diarrheal diseases, causes, treatment and prevention on the household level as observed by CHWs.
- To identify current interventions to solve the problem and the proposed future interventions, as observed and proposed by CHWs.

Guide for focus group discussion

Presentation

Purpose of FGD:
Children who suffer or die from diarrhea are known either to HC, if the children come there for treatment, or to you as CHWs if you see them during your household visits. Deaths of children who had diarrhea, either as a primary symptom of a disease or as a secondary symptom of another disease will be almost exclusively known to you as CHWs since when a child arrives at a HC with diarrhea, he will usually not die as a result of the sickness.
The aim of this focus group is to use your help to gather information on the causes of diarrhea in households, the level of knowledge relating to causes of diarrhea, and to learn what you think CHWs contribute for prevention, treatment and education at household level on diarrheal diseases.

I would like to emphasize that this is not an examination; there are no correct or incorrect answers. The aim is to create a discussion from which your thoughts, knowledge and beliefs will be reordered in order to better understand the problem and its possible solutions.

I would like to emphasize that there will be no names used at this study, there will no means to trace information or quotes to specific people, so please feel free to say what you think, your opinion is greatly valued.

Questioner

Before we begin the discussion, I would like you to answer five questions on this form. These questions are there to try and collect numerical information on the extent of morbidity and mortality of children aged 5 or less in your catchment area. These forms are anonymous.

Form

1. **Name of Parish**

---

2. **How long have you been CHW for the project?**

---

3. **How many Households in your catchment area?**

---

4. **Do you know how many children aged 5 or less died in your catchment are during the time you worked for the MVP? (please write a number)**

Discussion

Phase 1

To determine the extent of the CHWs understanding of diarrheal diseases, their causes, treatment and prevention.

Q1 – When do you think a child is suffering from diarrhea?

Q2 – What are the causes of diarrheal diseases, and what are the contraction ways for children?

Q3 – What does one needs to do to treat diarrheal disease?

Q4 – Why do diarrheal diseases cause deaths?

Q5 – How can we prevent children from contracting diarrheal diseases?

Phase 2

To identify the level of knowledge on diarrheal diseases, causes, treatment and prevention on the household level as observed by CHWs.

Q6 – When it comes to the community, what do you think they believe are the primary causes of diarrheal disease? Are there any traditional believes (e.g. false teeth)?

Q7 – Do you think parents know and understand what causes their children to contract a diarrheal pathogen?

Q8 – What do you think are the primary causes of diarrhea on the household level?

Q9 – What do people do to treat diarrhea if you are not there to help? What are traditional solutions? Who administer them?

Q10 - What can you do as a CHW to help identifying, treating and preventing children from contracting diarrheal disease at the household level?

Phase 3

To identify current interventions to solve the problem and the proposed future interventions, as observed and proposed by CHWs

Q11 – What are your instructions when it comes to diarrheal diseases?

Q12 – What are the advices you give people when their child suffer from diarrhea?

Q13 – How do you conduct “verbal autopsy”? Are you asking if diarrhea was a symptom? Should you?

Q14 – Is there something more that you think you should be doing now or in the future in order to help households who have children suffering from diarrhea?

Q15 – Are you conducting any educational activities relating to diarrhea: causes, prevention and treatment? Elaborate? What can/should be added to your activities?

FGD IV – Traditional healers

Duration: 1.5 – 2 hours

Objectives

1. To identify the role of traditional healers in the society
2. To identify the knowledge of healers on the causes of diarrheal diseases, how they identify the causes behind each case and how they differentiate between them.
3. To learn of the methods used to treat diarrheal disease.

Guide for focus group discussion

Presentation

- Personal presentation and affiliation
- My background as an historian and archaeologist, and my interest in ancient cultures, heritage and their role in modern society.
- From the information received from community member, traditional healers and medicine play an important role in the community. Many people seek traditional medicine and advice before they make a decision to go to a health centers.
- I would like to have this discussion with you to understand how traditional healers perceive their own role in the community. I will ask you some questions in order to learn how you carry out your traditions. I would like to emphasize that this proceedings are anonymous. No names will be recorded, nor information that will identify you in person. This is for research purposes only.

Phase 1

To identify the role of traditional healers in the society

Background data

Q1 – how do you define yourself (herbalist, healer, magician, spiritualist, etc.)? Explain the difference.

Q2 – How long have you been practicing your profession?

Q3– Where did you learn your profession?

Q4 – How many patients each of you sees in a month?

Q5 – What kind of cases come to you?

Q6 – Which sickness is the most common?

Phase 2

To identify the knowledge of healers on the causes of diarrheal diseases

Q7 – What are the causes of diarrheal diseases?

Q8 – Does each cause results in a different diarrheal disease?

Q9 – How do you differentiate between each diarrheal disease (what are your methods of diagnosis)?

Phase 3

To learn of the methods used by traditional healers to treat diarrheal disease and their relation to health interventions in the MVP area.

Q10 – Do you have different treatments for each diarrheal disease? If yes, can you list the medicine for each disease?

Q11 – How do you prepare the medicine?

Q12 – How do you administer the medicine? How often it should be taken? (Dosage)

Q13 – Do you recommend something in addition to your medicine as treatment? (Food, other traditional or modern medicine, referral to HC)

Q14 – How long does it take to heal each disease?

Q16 – what happens if after that time the patient is not healed? What do you do or recommend?

Q 17 – What is the meaning and importance of traditional medicine? Is it different from modern medicine? How?

FGD V – Local Leaders (LC1)

Expected duration: 1.5 – 2 hours

Objectives:

1. To identify and rank by importance the intervention introduced by the project.
2. To identify the present impact of the interventions on the village and villagers.
3. To assess how they perceive the future benefits from the solutions.
4. To identify future goals and needs of the community

Presentation

Present yourself and affiliation.

In this meeting I would like to catch the perspective of community leaders on the importance of project interventions, their contribution to the community andtheir impact in terms of changes they produced in the villages.

I would also like to get your perspective on what you think is still a challenge to the MVP and/or which applied interventions are for any reason not adequate in your opinion and how they can be improved.

Finally I would like your perspective on how you hope your future will improve thanks to project interventions, and which future intervention you would like to see in your area

Phase 1

To identify and rank by importance the intervention introduced by the project.

Q1 – Please list all the project interventions in your area.

Q2 – From this list, can you discuss, and rank the interventions by their importance for your community.

Phase 2

To identify the present impact of the interventions on the village and villagers (use ranking)

Q3 – Can you describe how this intervention (read from list produced from phase 1) has changed the village and the life of the community? Compare to how it was before.

Q4 – According to you, which interventions are not very beneficial? Are there interventions that are causing problems or harm? What are you not happy with?

Phase 3

To assess how they perceive the future benefits from the solutions.

Q5 – Can you discuss and tell how you think your future will be improved by the interventions (read from ranking list)?

Q6 – Is there anything that can be added or done differently with current interventions that will result in future benefits?

Phase 4

To identify future goals and needs of the community

Q7 – Can you discuss and come up with new interventions that are needed in the area to improve the lives of the community and individuals?

Appendix E - QUESTIONNAIRE GUIDE FOR HOUSHOLD VISITS[114]

Name of Community:…… Date of Interview:……..

Name of Interviewer:……. Respondent's position in household:…..……

Interview Starts (Time):…… Interview Ends (Time):……

SOCIO-DEMOGRAPHIC BACKGROUND

Household Characteristics

How many people are in this house?……..

How many households are in this house?.....

How many people are in your household?.....

	Household Members (description) – NO NAMES	Age (years)	In household for the whole season?	Education 1. Read &Write 2. Can't Read &Write	Highest Educational level achieved	Still in School	Major Employment	Minor Employment
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								
11								

[114] Partially adapted from a structured questionnaire prepared by Mr. Razak Seidu for his PhD research on diarrheal diseases in Ghana, and used here with his permission.

GENERAL FOLLOW UP OF CHILD

1. During the month of December your child visited the HC, what was the problem?
2. What in your opinion caused the problem?
3. What treatment did the child receive?
4. How long did it take for him to recover?
5. Did he suffer from the same symptoms since?
6. Did you seek any other treatment before or after visiting the HC?

ASSESSMENT OF MVP INTERVENTIONS ON HH LEVEL

1. How did you benefit from project intervention in general and on the household level?
2. What would you like to see in the future as project interventions?
3. How will your life change (what will you be doing differently on the household level with desired future project interventions?

Housing Characteristics

1. What type of housing unit/s does this household occupy (Observe)?
2. How many rooms are in this house?
3. How many rooms are used for sleeping in this house?

Water Sources

1. What water facilities/sources are used by the household in the rainy season and dry season?

Water Collection

1. What are you using to collect water, and how many times do you collect water per day?
2. What distance do you have to cover to the water source in the **wet season**?
3. What distance do you have to cover to the water source in the **dry season**?
4. How much time do you spend to fetch water from the source in the **dry season**?
5. How much time do you spend to fetch water from the source in the **wet season**?
6. Do you cover/close this container when transporting the water? How?
7. Do you use the container for anything else? What?

Water Storage

1. Do you store water in the HH? How?

2. How do you fetch the water from this container?
3. If scooped out, do you use the scooper for anything else? What?
4. Do you do anything to your water before drinking? What? *(Wet season/dry season)*
5. If no, why? *Wet season/dry season*

Health and Hygiene

1. How often do members of the household use soap when bathing?
2. How often do the children use soap when bathing?
3. Do members of the household use sponge when bathing? Who?
4. How many sponges you use? Do you share? Who shares?

Hand Washing

1. When do you think hand washing is necessary?
2. When would you use soap in addition to water for hand washing?

Hygiene Behaviour

1. Do you eat outside? Where?
2. Would you say there is always enough water for hand washing before eating on the farm?
3. Do you send soap to the farm? What is it used for?
4. Are there any babies in this household?
5. Do you use nappies for the babies? What kind (bought, cloths…)?
6. When you change the nappy, how do you clean the baby?
7. Where are the feces from the nappies thrown away?
8. How often do you wash your hands after changing the baby?
9. Do you always have the means to wash your hands after changing the baby? Do you always have soap?

Food Hygiene

1. Where do you store your left over food? How do you store it?
2. Do you handle your left over food before eating it? How?
3. When does the household clean its utensils after cooking and eating? (Breakfast, lunch dinner)

Sanitation

1. Do you have a toilet facility? (if the answer is no) What do you do?
2. Does everyone in the household use the household toilet? Specify if not.
3. Do you always have water to wash your hands after toilet?
4. Do you use soap in addition to water when washing? Always?
5. Do the children always have water for hand washing after toilet (Check with children if any)?
6. Do they use soap in addition to water for hand washing (Check with children if any)? Always?

Disease Occurrence

1. What would you say are the common diseases affecting members of your household (Adults, children, babies)

Observe during and after interview

- Toilets
- Kitchen
- Water
- Soap
- Compound
- Children behavior
- Adults Behavior

Appendix F – Symptom/Diagnosis of Children Suffering From Diarrhea, Ruhiira MVP[115]

No.	Symptoms/Diagnosis	Malaria Smear	Treatment
1	Malaria Acute Diarrhea	Negative	Albendazole ORS
2	Malaria Acute Diarrhea Pneumonia	Negative	ORS Benzylpenicilloyl-Polylysine
3	Malaria Acute Diarrhea	Negative	ORS
4	Malaria Acute Diarrhea Acute Respiratory Infection	Negative	Not specified
5	Pneumonia Acute Diarrhea	Negative	Penicillin G, Procaine Paracetamol Salbutamol ORS
6	Malaria Acute Diarrhea	Negative	Albendazole Vitamin A
7	Malaria Acute Diarrhea	Negative	ORS
8	Acute Diarrhea	Negative	ORS
9	Acute Upper Respiratory Infection Diarrhea	Negative	Paracetamol Sulfamethoxazole/Trimethoprim Vitamin A
10	Malaria Acute Diarrhea Otitis Media	Negative	Benzylpenicilloyl-Polylysine Vitamin A Albendazole Paracetamol Quinine
11	Malaria Acute Diarrhea	Negative	Sulfamethoxazole/Trimethoprim ORS
12	Malaria Acute Respiratory Infection	Negative	Albendazole Paracetamol Sulfamethoxazole/Trimethoprim
13	Acute Diarrhea	Negative	ORS Vitamin A
14	Malaria Acute Diarrhea	Negative	Vitamin A Albendazole Paracetamol
15	Malaria Acute Diarrhea	Negative	Vitamin A ORS
16	Malaria Acute Diarrhea	Negative	Vitamin A ORS
17	Malaria Acute Diarrhea	Negative	ORS
18	Acute Diarrhea	Negative	ORS
19	Gastroenteritis (Stool for OVA and Cysts – positive)	Negative	ORS Metronidazole

[115] The information is a summary of all children under 5 years old visiting a specific HC in one particular month.

	Malaria		Vitamin A Sulfamethoxazole/Trimethoprim Paracetamol
20	Malaria Acute Diarrhea	Negative	Vitamin A ORS
21	Malaria Acute Diarrhea	Negative	Sulfamethoxazole/Trimethoprim Vitamin A Paracetamol
22	Acute Diarrhea	Negative	Sulfamethoxazole/Trimethoprim Vitamin A ORS
23	Acute Diarrhea	Negative	ORS
24	Acute Diarrhea	Negative	Not specified
25	Acute Upper Respiratory Infection Diarrhea	Negative	Vitamin A Amoxicillin ORS Sulfamethoxazole/Trimethoprim
26	Malaria Diarrhea	Positive	Albendazole Quinine Paracetamol
27	Acute Upper Respiratory Infection Malaria Diarrhea	Negative	Albendazole Paracetamol Sulfamethoxazole/Trimethoprim
28	Acute Diarrhea	Negative	Not specified

Appendix G - Ethical Guidelines

Millennium Villages Data Use Consent Statement

BACKGROUND

As stipulated by the Millennium Villages Data Sharing Policy, data collected as part of the Millennium Research Villages Project (MRVP) will be made available exclusively to the scientists and researchers that are involved in this project for a limited time usually not exceeding one year from measurement. After this period, the data will be made publicly available.

In preparation to the release to scientists and researchers working in the project of different MV data sets, it is imperative that the principal guidelines set by IRB and the Millennium Villages Project are clear in terms of confidentiality issues, data sharing, and professional conduct expected from scientists and researchers working in the project. All persons collecting or viewing data collected from the Millennium Villages project must take the IRB Human Subjects course and pass the IRB exam TCOO15 (use of human subjects, which is available online at https://www.rascal.columbia.edu/) and have approval through Columbia University IRB board.
This document's intent is to highlight and make these principal guidelines clear and to obtain a written reply of consent to abide by these guidelines.

CONFIDENTIALITY AND PRIVACY OF RESPONDENTS

As per the IRB protocols and guidelines, scientists and researchers working with human subjects have a moral responsibility to protect the confidentiality and privacy of respondents. As part of the preparation of the data set, several steps have been taken by the Millennium Villages Secretariat to ensure that the identity of research subjects is not disclosed. For instance, direct identifiers were eliminated from the data set and new household and personal identifier numbers were assigned to respondents.

The identity of a person or establishment must be kept confidential. Any intentional identification or disclosure of this information directly violates the assurances given to the providers of such information.

In compliance with the above stated goals, users of the Millennium Villages Research Project data agree the following:

1. To use the Millennium Villages dataset solely for statistical analysis, planning and reporting of aggregated information and not for investigation of special individuals or organizations. If identification is necessary, a formal request will need to be sent to the

MRVP director, who may authorize in writing the use of such information.

2. To make no use of the identity of any person or establishment discovered inadvertently. If an identity is discovered inadvertently, the scientist or researcher must contact the MRVP director immediately to notify such discovery.

3. To produce no links among MRVP datasets or among MRVP data sets and other data sets that could identify individuals or organizations.

4. To use the MRVP datasets internally for a limited time not exceeding 1 year from measurement, and not to redistribute for free or sell those datasets to other individuals, institutions and/or organizations.

BIBLIOGRAPHIC CITATION

The MRVP further asks that any articles, conference papers, theses, dissertations, reports, books or any other publications that employ data provided by the MVRP reference the bibliographic citation in accord with recommended citation procedures. For example, data could be cited as follows:

> The Earth Institute at Columbia University, Millennium Villages Research Project. *Sauri Socioeconomic Survey: Annual Demographic File*, 2005 [Computer file]. MVSESISauri05. New York, NY: the Earth Institute at Columbia University [producer], 2005. The Earth Institute at Columbia University [distributor], 2005-12-20.

In addition to reference the bibliographic citation, the data user must acknowledge that donors bear no responsibility for use of the data or for interpretations or inferences based upon such uses.

FORMAL CONSENT

Please acknowledge your agreement to comply with the above-mentioned requirements and give your assurance that the use of statistical data obtained from the MVRP will conform to widely-accepted standards of practice and legal restrictions that are intended to protect the confidentiality of research subjects.

Millennium Villages Confidentiality Statement

I am aware that I am working with data that concerns human participants and that I may personally know some of the human participants in this study. I am aware that any disclosure of the data's contents could cause harm to these participants. I will only discuss the data with which I am working for purposes related to the work I am assigned by the Millennium Villages Project Staff and I will not discuss or disclose any information related to this data outside of work or for purposes other than completing my assigned tasks.

In addition, I am aware that premature disclosure of the data may lead to irreparable harm to the investigators of this protocol or their sponsors.

I will protect the confidentiality of the data with which I am working.

0104
2005

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OUR REF
YOUR REF
DATE 06 NOVEMBER 2008

Earth Institute at Columbia University
2910 Broadway
New York, New York 10025
USA

Approval from the Norwegian University of Life Science Ethics Board – Research application submitted by Shai Divon

The research will be conducted in accordance with UMB Ethical Guidelines and Norwegian Ethical Guidelines for social research, humanities, law and theology (NESH http://www.etikkom.no/retningslinjer/NESHretningslinjer).

The research is designed to be beneficial to the people involved in that it is designed to identify residual causes of diarrhea in the area. This builds on work already being done in Ruhiira. Therefore, the main intended result of the work is to further contribute to the reduction of child mortality in the area. All of the results will be made publically available after the completion of the research (within one year).

The research will cause no harm to the people involved. None of the information collected can be used in a way that can compromise individuals that have participated. In the case of any interviews conducted, anonymity will be assured. No names of local people will be included in the study. The only names that may be included are those of people working in their official capacity that have given their prior consent. The research has no invasive components.

The study poses no risk to either the people or the local environment. No experiments will be conducted, no foreign substances will be introduced and nothing will be removed from the area.

The topic of the research is not one identified with social stigma. There is no reason to assume that people seen talking with the researcher will in any way be socially labeled or ostracized for their participation in this research.

All people involved in the research will be informed of the purpose of the work and asked whether or not they are willing to participate (informed consent). If children are included, both the child and their parents/guardians will be informed of the purpose of the work and asked whether or not they are willing to participate.

Shai has taken a UMB course that includes the topic of research ethics. He has successfully completed Columbia University's 'Human Subject Training Course' (6 Nov 2008).

Deborah Oughton
Administrative Head, UMB Ethics Board

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