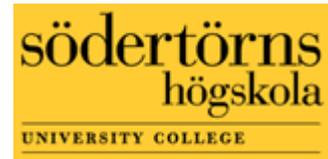


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# Women, Water, and Perceptions of Risk

- a case study made in Babati, Tanzania 2008



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**“If you could tomorrow morning make water clean in the world,  
you would have done, in one fell swoop,  
the best thing you could have done for improving human health by  
improving environmental quality.”**

- *William C. Clark, speech, April 1988*

## ABSTRACT

More than 1 billion people in developing countries lack access to safe water and sanitation. Drinking water in these countries is often collected from unsafe sources outside the home. Even piped well water in the developing world can be unsafe due to inadequately maintained pipes, low pressure, intermittent delivery, lack of chlorination, and clandestine connections. Furthermore, drinking water often becomes contaminated after collection, either during transport or during storage in the home. Improvements in water supply, hygiene education and safe storage can reduce the spread of waterborne diseases, such as diarrhoea. However it is not an easy task to combat unsafe drinking water, and several factors have to be taken into account. Correct management of water at the household level is a vital factor in reducing contamination of water in areas where water is not available in the home, and often has to be transported for long distances before storage.

It is often a woman's responsibility to collect and store water. The aim of this study is to provide an understanding of women's knowledge and perceptions of the risks associated with drinking water and waterborne diseases in Babati, Tanzania. Furthermore, the study sets out to investigate the methods utilized at the household-level to prevent waterborne diseases. Interviews were the key method to collecting primary data and the results present findings from 20 women in two villages in Babati. All of the respondents had access to community water pipes but none had taps in their household. Among the respondents who treated their water, the most common method of treatment was boiling. The study shows that there is a link between lived experience, perceptions of risk, and the way water is managed in the household.

Key words: Tanzania, perceptions of risk, waterborne diseases, sanitation, storage of water.

# TABLE OF CONTENTS

<b><u>1. INTRODUCTION.....</u></b>	<b><u>1</u></b>
1.1. BACKGROUND.....	1
1.2. PURPOSE OF THE STUDY:.....	3
AIM: .....	3
OBJECTIVES: .....	3
1.3. METHOD .....	4
<b><u>2. LITERATURE REVIEW .....</u></b>	<b><u>4</u></b>
2.1. WATER AND ECONOMIC DEVELOPMENT .....	5
2.2. WOMEN IN RURAL AREAS.....	6
2.3. STORAGE OF COLLECTED WATER .....	7
2.4. WATER TREATMENT AT THE HOUSEHOLD LEVEL.....	8
2.5. HYGIENE .....	9
2.6. INFORMATION AND PARTICIPATION .....	11
<b><u>3. THEORETICAL FRAMEWORK .....</u></b>	<b><u>11</u></b>
3.1. PERCEPTION OF RISK .....	11
3.2. BEHAVIOUR CHANGE.....	15
<b><u>4. METHODOLOGY .....</u></b>	<b><u>19</u></b>
4.1. DESCRIPTION OF THE STUDY AREA .....	19
4.2. FIELD WORK .....	20
4.3. CRITICAL ANALYSIS .....	22
4.4. LITERATURE .....	23
<b><u>5. ANALYSIS AND RESULTS .....</u></b>	<b><u>23</u></b>
5.1. WATER ROUTINES .....	24
5.2. CHANGES IN BEHAVIOUR.....	25
5.3. STORAGE.....	27
5.4. TREATMENT .....	28
5.5. INFORMATION .....	30
5.6. PERCEPTIONS OF RISK .....	31
5.7. CHILDREN'S SAFETY .....	32
<b><u>6. DISCUSSION AND CONCLUSIONS.....</u></b>	<b><u>33</u></b>
<b><u>REFERENCES .....</u></b>	<b><u>38</u></b>
<b><u>APPENDIX 1. ....</u></b>	<b><u>41</u></b>

# 1. Introduction

## 1.1. Background

Clean and safe water is a vital resource for human life. More than 1 billion people in developing countries lack access to safe water and sanitation (UNICEF, 2008). Drinking water quality is an issue of concern for human health, but risks arise from infectious agents, toxic chemicals and radiological hazards (World Health Organization, 2005). Many people lack access to safe water in the household, and are forced to collect water from unsafe water sources outside the household where water quality often is poor (Mintz *et al*, 1995). Inadequate water and sanitation affect human health, and especially the health of children. Improvements in water supply and sanitation have historically been documented to benefit health and improve life expectancy (Checkley *et al*, 2004).

The most common disease caused by unsafe drinking water is diarrhoea, which remains a leading cause of illness and death in the developing world (Mintz *et al*, 1995). Basic hygiene related diseases, like diarrhoea, kill around 2.2 million people every year (Sobsey, 2002). Infant mortality is high in many developing countries, where around 90% of the people who die from diarrhoeal diseases are children under the age of five. The diarrhoeal disease is often attributed to unsafe water supply, as well as inadequate hygiene and sanitation (World Health Organization, 2005). Experience highlights the value of preventing approaches spanning from water resource to consumer. Improved water supply, improved sanitation and hygiene interventions can make a huge difference in reducing diarrhoea morbidity (World Health Organization, 2005). Diarrhoea can arise from several things, for example malaria. The disease is also transmitted through food and through the air, which means that the disease can not entirely be attributed to water, and lack of sanitation and hygiene (Pruss *et al*, 2002). This makes it difficult to make a diagnosis. However, infectious diarrhoea is probably the largest contributor to diseases related to poor water quality, sanitation and hygiene.

In first world countries, death and disease due to poor water supply and sanitation are generally restricted to occasional outbreaks affecting vulnerable subpopulations. In developing countries, much less progress in water and sanitation has been attained generally (Checkley *et al*, 2004). It is often the poorest groups which face the most serious environmental hazards and have the least possibility of avoiding them and receiving treatment to limit their impact on health (Austin and van Vuuren, 2001). This also means that diseases related to water, and lack of sanitation and hygiene on a much larger scale affect the poorer member of society (Pruss *et al*, 2002). Urban movements are putting severe strains on the need of water supply and sanitation services especially in developing countries. Clean water and sanitation are one of the most basic services to maintain health, and lack

of these services is the main issue of many of African's current health, environmental, social, economic and political problems. Significant improvements were made during the International Drinking Water Supply and Sanitation Decade (1981-1990); unfortunately, the progress did stagnate after that period. More people in Africa were without adequate services in the beginning of the 21st century than in 1990 (Austin and van Vuuren, 2001). According to Pruss (2002), the burden of disease from water, sanitation and hygiene can be up to 240 times higher in developing regions than in a developed region. In the beginning of 2000, World Health Organisation (WHO) made a study of water supply in 91 countries which showed that only 14% of the rural population had access to sufficient and safe water. Another finding was that the daily per capita consumption of water in these countries was 13 litres, which can be compared with the WHO recommendation of 23 litres (Sikitiko and Kapile, 2003). Millions of people in the developing world still lack access to safe water despite several policy and institutional changes, as well as programmes to improve water supply services.

Women's knowledge and perceptions are highly important when dealing with issues concerning waterborne diseases. Women also have a significant role for the children's safety and play a major role in areas where safe water is not available in the house. Women are typically responsible for collecting and storing water, as well as for treating the water at home (Watts, 2004). This study includes an on-the-spot investigation in Babati, Tanzania, and aims at an examination of women's knowledge and perceptions of risks associated with drinking water and waterborne diseases in Babati, 2008. Furthermore the purpose is to examine the methods used on a household-level to prevent waterborne diseases.

Africa has the poorest water and sanitation coverage of all regions in the world (Tibaijuka, 2007). Many water supply policies and programmes in Tanzania have passed without much success (Sikitiko and Kapile, 2003). The sustainability of water services and systems often depends on many factors, such as the economy (Smet *et al*, 1999), and Tanzania is one of the poorest countries in the world (Sanctuary *et al*, 2005). In many parts of the developing world, and Tanzania is no exception, drinking water is often collected from unsafe sources outside the home and is then held in household storage vessels. Drinking water may be contaminated at the source or during storage (Mintz *et al*, 1995). Interventions in hygiene, sanitation and water supply can reduce diseases related to bad water (World Health Organization, 2002). Universal access to safe water and sanitation has for decades been promoted as an essential step in reducing diseases. Unfortunately, "universal access" in these issues remains elusive (Sobsey, 2002). By using methods to treat the water, reductions in household diarrhoeal diseases of 6-90% have been observed. The large gap

between the percentages depends on the technology and the exposed population and local conditions.

Implementation of new methods and strategies often need to go hand in hand with education, socio-cultural acceptance, changing people's beliefs and behaviours and achieving sustainability and affordability in the provision of safe water (Sobsey, 2002). However, improving of source water quality alone does not always decrease diseases. Drinking water also becomes contaminated after collection, either during transport or storage in the home. Improvements in source water quality are also generally an expensive, long-term and centralized process (Mintz *et al*, 1995). Low-cost interventions at the household and community level can have a huge positive impact on improving household stored water and reducing the risk of diarrheal disease and death. An inexpensive strategy available to improve household drinking water is disinfection where water is collected (point-of-use disinfection) and storage in vessels designed to prevent contamination (safe storage) (Mintz *et al*, 1995). During the last years several water storage and collection systems have been developed to reduce diseases. A variety of physical and chemical treatment methods to improve the water quality have been tested and implemented in developed and developing countries (Sobsey, 2002).

## 1.2. Purpose of the study:

### Aim:

The aim of this study is to provide an understanding of women's knowledge and perceptions of the risks associated with drinking water and waterborne diseases in Babati, Tanzania. Furthermore, this study aims to examine the methods used on a household-level to prevent waterborne diseases in Babati.

### Objectives:

1. To investigate women's daily routines associated with water: e.g. walking distances, time use on water, water sources and amounts of water used in the households.
2. To examine hygiene behaviours, storage and treatment of water on a household level.
3. To investigate knowledge and information available about health and water.
4. To investigate whether there are differences in perceptions of risks among the women.
5. To determine women's perceptions of children and their risks associated with drinking water.

### 1.3. Method

To address the objectives, this study is based on both primary and secondary sources. Using interviews as a key method to collect primary data, the study focuses on women's knowledge and perceptions of risks when handling water. Secondary sources include literature from earlier researches on the same topics. The results present findings from 20 women in two villages outside Babati town. To get a better understanding of the water-quality in Babati and the situation of waterborne diseases in the town and in the rural areas, interviews were also made with a few official persons that could provide good background knowledge to this study. However, women in the rural areas make up the main category of respondents for this study according to its aim and result findings.

## 2. Literature review

Researchers working with unsafe drinking water and related issues have been undertaking research from different perspectives attempting to explain the problem. The literature review below will explain the water issue from different aspects which remain necessary to illustrate this complex topic.

It is a problem in underestimation of people served by unsafe water. Often the assumptions of safe water do not take into consideration important well-documented problems, this leads to the fact that current numbers of people using unsafe water are probably low. One big problem is the so called protected or improved water sources, such as boreholes and treated urban supplies, the fact is that this water can still be unsafe and cause diseases (Sobsey, 2002). Sometimes the water systems deliver from unprotected and contaminated sources with no treatment while still classified as improved and safe. Another problem is contamination of water during distribution. Many communities do have protected or improved water sources where water is collected or when it leaves a treatment plant. But there are factors that lead to contaminated water when it reaches the consumer's tap or collection point, substandard water distribution systems, intermittent water pressure due to power outages and other disruptions, and illegal connections to the distribution system do often in the end lead to unsafe water (Sobsey, 2002). This part of the essay outlines a brief introduction to several factors that in different ways are of importance for promotion of safe drinking water.

Good methods for safe water should be safe, effective, socio-culturally acceptable and affordable. Simple, acceptable, and low-cost interventions at the household and community level have been

evaluated to dramatically improve the quality of stored water and reduce risks of diarrhoeal disease and death. According to WHO's report "Managing Water in the Home: Accelerated Health Gains from Improved Water Supply" (2002), methods with these characteristics are now available (Sobsey, 2002).

There are lots of factors that need to be considered when planning for and dealing with safe water sources. Factors like increasing populations, urban growth and expansion, peri-urban settlement etc affect the water in terms like increasing pollutant transport into ground and surface water due to deforestation, global climate change, recurrent disastrous weather events and increasing coverage of the earth's surface with impervious materials (Sobsey, 2002).

## 2.1. Water and economic development

According to Sanctuary *et al* (2005), investments in improved water and sanitation will contribute to economic growth and eradicate poverty in countries where water challenges occur. Among the poor countries, those with access to clean water and sanitation experience greater economic growth. Stockholm International Water Institute (SIWI) states that investing in water is good business due to increased production and productivity within economic sectors, and meeting the Millennium Development Goal on water supply and sanitation will result in economic benefits. SIWI further argues that water issues should be a public and private investment strategy that also allows individuals and households to explore new livelihood opportunities and businesses to reach new markets with increased production and productivity. Improved water is a question about people's health. Improving health not only provides immediate economic benefits, it also safeguards future economic gains. According to Sanctuary *et al* (2005), strong leadership and commitment from government, civil society and business leaders and opinion makers are all necessary to take action.

Dr Gaare (pers. comm., 2008), at the local hospital in Babati, states that the biggest threat in issues related to poor water quality and sanitation in Babati and Tanzania is the economy. A big part of the population is living under the amount of 1 US dollar daily, and people under such poor conditions are fighting to survive every day. Dr Gaare argues that this is the biggest threat for the individual as well as the community and country in their activities. He further means that there is no possibility for development and improvements without money.

## 2.2. Women in rural areas

In areas where safe water is not available in the house, women play a major role in the domestic water management. In general, women are responsible for collecting and storing water. Women are also especially at risk when washing laundry and handling water in other activities (Watts, 2004). All the activities have considerable risk for contamination (even if the water comes from treated, piped sources). Correct hygiene and storage of water can protect water-related diseases, and it is a close link between safe water and sanitation in health issues (Watts, 2004). Therefore, a greater understanding of women's water management and hygiene behaviours and local constraints need to be achieved. There are constraints facing rural women in adopting protective behaviours linked to hygiene, water and sanitation. When constraints need to be identified it is always important to listen to local knowledge in implementation of strategies (Cifuentes *et al*, 2005). This knowledge need to be incorporated into health promotion, including behaviour change. It is unrealistic to expect women to change behaviour unless water quality, drainage and sanitation are upgraded (Watts, 2004). Another problem is women's marginalized role in rural areas. Empowering women is a key issue in rural development (Martinez *et al*, 2008).

Many activities in rural areas in the developing world are highly gendered (Lopez-Carlos and Zahidi, 2005). 4 out of every 10 women are unemployed and women who are employed are often employed in the lowest paid category as domestic workers. Most women in rural Africa are also responsible for unpaid activities like preparing of meals, child care and odd jobs (Joke, 2007). It is in general the women who ensure the supply of firewood and the woman who does the family laundry and makes sure there it is water in the house (Fred-Mensah, 2003). The women and their children often walk long distances to collect firewood and water and carry it back home (Fred-Mensah, 2003). For women who beside the unpaid tasks have full-time income jobs, like agricultural work and food production, the working hours make up a large part of their everyday life. Today the key division of labour is between reproductive and productive work (Lopez-Carlos and Zahidi, 2005). Women who enter the workforce and get paid are increasing, but the number of women at home responsible for domestic tasks are not decreasing (Claassens, 2007).

Sub-Saharan Africa makes a reality picture of how water and sanitation has a very significant impact on the poor people. In rural areas, women spend up to 6 hours a day to collect water. This time can be seen as lost time for productivity: time that could be spent on more productive activities. More than half of Africa's economic growth shortfalls have been explained statistically by disease burden, demography and geography, rather than the traditional macro-economic policy and

political governance (Claassens, 2007). Among the world's poorest countries, of which Tanzania is one, it is shown that those with access to improved water and sanitation services experience higher economic growth (Sanctuary *et al*, 2005).

### 2.3. Storage of collected water

Good storage vessels designs can work as a practical and inexpensive method to prevent diseases due to unsafe drinking water (Mintz *et al*, 1995). According to Sobsey (2002, p. 9), regardless of whether or not collected water is of acceptable quality, it often becomes contaminated during transport and storage due to unhygienic storage and handling practices. Drinking-water collected outside the home may also be stored in vessels that are already contaminated. In these cases the original quality of the water has little impact in reducing the number of waterborne diseases. In general, the contamination levels are substantially higher in household water containers than in water sources taps (Sobsey, 2002). Furthermore, the risk for contamination of the water is increasing if the water is transferred from one vessel to another, for example collected in one vessel and kept for storage in another (Morgan, 1990).

The use of containers which the water is collected in is of vast importance, and the design of a vessel may determine the risk of contamination during storage. Containers with narrow opening for filling and dispensing devices such as sprouts or taps are shown to protect the water during storage and household use, rather than using for example an open bucket into which hands can be inserted (Mintz *et al*, 1995). Some containers are designed for safe storage where the water can be directly treated by the physical method of solar radiation and then directly stored and dispensed for household use. These improved containers are also often designed with a label containing educational on their cleaning and use (ibid, 1995).

Depending on the design of the vessel, water can be stored for a longer or shorter time period. Earlier studies have shown that in some vessels the water becomes contaminated already after 1-2 days while more improved vessels can store the water for an entire month without contamination. For longer safe storage a tightly fitting lid and a narrow opening is vital. The Centre for Disease Control and Prevention (CDC) has together with the Pan American Health Organization (PAHO) proposed design criteria's for safe storage. Among other criteria, a safe vessel should be constructed of translucent high-density polyethylene plastic or similar material that is durable, and lightweight. It is further important with criteria's such as no oxidizing, easy to clean, inexpensive, and ability to be produced locally. It should also hold an appropriate standard volume (e.g., 20 L), and it should have only one small opening with a strong, tightly fitting cover and at the same time allow air to

enter as water is extracted. Another important criterion is that the vessel should have volume indicators and illustrations of safe water handling practices displayed on the outside of the vessel (Mintz *et al*, 1995, pp. 3-7). However, safe water storage alone can not make the water potable when the source water quality is poor, but it can be used as a method to preserve water quality after treatment (ibid, 1995 pp. 2-5).

## 2.4. Water treatment at the household level

Poor people in Africa spend in general more than a third of their income on the treatment of water-related diseases (including malaria) (Sanctuary *et al*, 2005). Mainly the physical methods appear to be accessible, simple and economical for use, and some of these systems have been promising to be both efficiently, sustainable and economical (Quick *et al*, 2002). The most widespread methods with these characteristics are boiling, different types of solar disinfection, chlorination combined with storage in an appropriate vessel. Boiling is a widespread method to treat the water. However, it is still a risk after the boiled water is cooled, it can then easily be contaminated again, especially if it is transferred to another storage container. Chemical disinfectants are a practical alternative to boiling. Only the least expensive disinfectants are suitable for households in the developing world where chlorine is most commonly used for water treatment use (Mintz *et al*, 1995, p. 2). Treatment with chlorine has shown a 62% reduction in diarrhoeal disease (Pruss *et al*, 2002).

According to Mintz *et al* (1995, p. 2), the traditional measure to boil the water is an economically and environmentally unsustainable method. It takes a kilogram of firewood to bring a litre of water to boil for a minute, and a person needs a minimum of 2 litres of drinking water every day. There are alternatives to fuel wood such as kerosene and other fossil fuels, but these ones are expensive and are also environmental unsustainable in the long term. An alternative could be solar powered methods, that are practical, sustainable and inexpensive, but not enough developed yet (ibid, p. 2).

Methods to improve the quality of water include both physical and chemical treatment. Physical treatment include boiling, heating (fuel and solar), settling, filtering, exposing to the UV radiation in sunlight, and UV disinfection with lamps (Sobsey, 2002, p. 16). Chemical treatments include coagulation-flocculation and precipitation, adsorption, ion exchange and chemical germicidal agents (primary chlorine). Chemical treatment is sometimes inaccessible in rural areas or it can not be bought for a reasonable cost, it might also require relatively complex and expensive systems and procedures to treat the water (Quick *et al*, 2002). Most technologies have not been well studied for their ability to reduce diarrheal and other waterborne diseases on a household level. The most studied methods include chlorination, storage in a safe container and solar disinfection. None of the

treatment technologies have been tested in combination with another, all of them independently. Combinations of different types of treatment are recommended as next step in the development, evaluation and implementation on a household level (Quick *et al*, 2002).

It is important to remember that treated community drinking water of high quality may still be contributing significantly to community diarrhoeal illness. It has been shown that the risk of diarrhoeal diseases from the categorized as safe community water were significantly decreased by further treatment of the water at household level (Sobsey, 2002). Recent studies have shown that household water treatment can reduce morbidity by about 50 % and lead to disease reductions of more than 70 % (Bloomfield and van der Voorden, 2007, pp. 8-9).

## 2.5. Hygiene

Some studies have shown that the combination of improved hygiene and sanitation are more important than safe water alone in reducing diarrhoeal and other waterborne diseases (Sobsey, 2002, p. 12). Similarly, some studies state that safe water alone is unlikely to result in reduction of waterborne diseases. On the other hand, recent studies have shown that only safe water interventions clearly document significant reductions in diarrhoeal disease. However, compared to what either intervention can do alone, it is clear that the combined roles of safe water, hygiene and sanitation are likely to lead to the greatest number of reduction in waterborne diseases (ibid, pp. 12-13).

More than 5000 children under the age of 5 die every day from diseases related to unsafe water, bad sanitation and because of lack in hygiene practices (Bloomfield and van der Voorden, 2007). Access to clean water and sanitation has for decades been lifted up as the essential step in reducing diseases related to bad water and poor sanitation. Water from wells does not always significantly protect against diarrhoea (Knight *et al*, 1992). According to *Stockholm Water Front* (2007), past programmes in water and sanitation issues have often been undertaken without integration of hygiene promotion. This is now believed to be a key mistake, as hygiene can prevent the spread of infectious disease. Hygiene interventions can furthermore prevent diseases at a fraction of cost of other interventions (Bloomfield and van der Voorden, 2007). Therefore, hygiene interventions is a cost effective promotion and recent studies showing that correct handwashing can reduce diarrhoeal diseases with up to 42-47 % (ibid, 2007, pp.8-9). It is clear that the responsibility for implementing hygiene measures must be shared by the public and community to be effective and sustainable (Bloomfield and van der Voorden, 2007). The home and the community are the environments where the human activities occur, and this is important to remember in promoting better hygiene practices.

Most people associate hygiene with simple handwashing, but the truth is that hygiene includes so much more than just handwashing. The list below shows a wider picture of what hygiene includes (ibid, 2007, p. 9):

- Hand hygiene and personal hygiene;
- Food hygiene (cooking, storing, preventing cross contamination);
- Ensuring safe water at the point of use;
- Safe disposal of faeces (both human and animal);
- General hygiene (laundry, surfaces, toilets, bath, sinks);
- Disposal of solid waste;
- Control of wastewater and rainwater;
- Observation of high risk situations;
- Care of those who are infected;
- Care of those who are more vulnerable to infection.

Hygiene issues should be viewed holistically from the point of view of the family (Bloomfield and van der Voorden, 2007). One problem here is that advice on household water treatment and storage is often given separately from hygiene practices (and often from different agencies). This can result in that the community has little concept about how infectious diseases are actually spread and no clear relation is made between treatment, storage and hygiene to prevent diseases. This makes it difficult for hygiene practices to be adapted in the holistic view of prevention of diseases, and there is a need of hygiene promotion programmes where a holistic view is approached. According to International Scientific Forum on Home Hygiene (IFH), hygiene promotion programmes work best if they focus on a small number of activities where practices are incorporated in stages. In corporate hygiene strategies into daily life of communities is a challenge. National, international and non-governmental agencies need to persuade to invest in hygiene promotion. Furthermore, proper infrastructure at national, district and local levels is needed to establish active and coordinated programmes. Education and motivation at community and family level are also important to achieve successful programmes. Improvements can only be reached by combining local knowledge, needs and constraints with an understanding of the means to prevent diseases through hygiene practices (Bloomfield and van der Voorden, 2007).

## 2.6. Information and participation

Successful implementation of household treatment strategies require focused educational campaigns (Mintz *et al*, 1995). Programs designed to support community participation, education and other efforts to achieve sustainability and acceptance is seen to be an important factor in use of technologies to treat and safely store household water. Successful implementation and sustainable use of technologies are unlikely to be fully achieved when socio-cultural, behavioural and economic components are not taken into account (Quick *et al*, 2002). Greater efforts to reach out with information about household water treatment and safe storage and their benefits and advantages are crucial to reduce the number of diseases. Efficient introduction of improved water treatment and storage at the household level is likely to increase personal and community knowledge and awareness of the importance of water hygiene and sanitation. In the provision of safe water it is of vast importance to deal with education, socio-cultural acceptance, changing people's beliefs and behaviours and achieving sustainability and affordability.

Information on exposure and risk is generally only available at the community or regional level although actual exposure occurs at the household and individual level (Pruss *et al*, 2002). However, community education about the causes and prevention of waterborne diseases and proper use of the intervention is one of the main elements to reduce mortality (Quick *et al*, 2002). Participation of all levels is also necessary to achieve sustainability, particularly at the community level. Experience from Tanzania shows that since independence (about 45 years), only a few stakeholders have been involved in formulation of national water policies and programmes (Sikitiko, 2003).

## 3. Theoretical framework

### 3.1. Perception of risk

The phenomenon of risk and the role it plays in contemporary social life and subjectivities have been one of the most discussed areas in social and cultural theory. There are various types of risk that have been examined and different ways of limiting the effects of risk. The three major theoretical perspectives include 1) influential perspective on risk- adopts a cultural anthropological approach, 2) sociological examination on risk and the role of risk in society, and 3) the ways in which the state and governments work together to govern populations via risk discourses and strategies (Lupton, 2000, p. 1). Little attention has been taken to the broader social, cultural and historical context of risk. Deborah Lupton, professor in Cultural Studies and director of the Centre for Cultural Risk Research, is looking at risk in a sociocultural perspective. Lupton means that risk

can not be explained in isolation from its social, cultural and historical contexts (Lupton, 2000, chap. 1).

Psychometric researchers have found out that lay people are more likely not to perceive something as risky if information related to it is available and easily recalled. On the other hand, people tend to overestimate risk related to circumstances where it can be easily imagined as happening to oneself (Lupton, 2000, pp. 2-7). Risks that for one person are perceived as being closer are also shown to be of higher concern for that person. Risks that are common and less serious are shown to be underestimated, while on the other hand risks that are seen to be rare but memorable tend to be overestimated. Risks that are new or imposed are shown to be more likely to happen than those perceived as familiar or voluntary, the latter are also often seen to be more acceptable (Lupton, 2000, chap. 1).

It has been reported that media attention increases concern of risk compared with disasters related to risks that do not receive the same attention, even if this rarely occurs. It is also a difference in perception of risk whether the dangers are seen to occur in a cluster or an equivalent number of events that happen over a longer period of time, where the latter is considered as less serious (Lupton, 1999, chap. 5). Consequences of catastrophes that occur immediately arouse more concern than those that are delayed. Members of less powerful social groups are shown to be more concerned about risks than members of powerful social groups, and women and non-whites also tend to consider risks higher. (Lupton, 1999, chap. 5).

There are several perceptions of what risk actually is. Some researchers argue that 'actual risk' exists, but they can only ever be interpreted as perceptions. Other argues that definitions of risk are 'real' and 'correct'. Obviously, how humans see and understand the world is different; humans construct their own beliefs and engage in behaviours outside the cultural and political frameworks (Lupton, 1999, pp. 17-25). Studies on this often show that individuals are represented as atomized and self-interested, behaving in respond to their beliefs and perceptions of risks. In some studies it seems important to examine the ways which in underlying cultural structures, hierarchies and categories serve to define risk knowledge and practices. Accepted norms and social rules concerning behaviours are often taken into consideration in this type of studies (Lupton, 1999, chap. 2).

The importance of identifying realities, meanings and understandings related to risks has been examined of some researchers within poststructuralist theory. These researchers are mainly interested in change and flux in social structures and meanings, as well as the relationship between

power and knowledge (Lupton, 1999, chap. 2). The 'lived experience' is vital and how individuals experience their world in relationship with meanings and knowledge. These researchers examine how risks differ from locale to locale and how specific actors within a certain sociocultural group construct their risk understandings as part of interaction with others. They argue that social structures shape the perceptions of risks; it is not only drawn from the social environment but also how social actors influence their environments. The poststructuralist theory explores processes which mediate people's responses to other people and to objects and events; what people measure, identify and manage as risks are always constituted via pre-existing knowledge and discourses. According to Lupton (1999, chap. 2), reproduction of meanings and knowledge is created through social interaction and pre-existing realities, and then meanings and perceptions of risk can change.

In some cases, it has been shown that not until something has been tested and proven by scientists to be a risk, first then do people become concerned about the risk factors (Lupton, 1999, chap. 2). For example one study on risk associated with high levels of micro-organisms in the water supply; even if the micro-organisms had occurred in the water supply before scientists examined the issue, it was only after the water authority had begun testing for the micro-organisms that they became identified and consumers started to be concerned over the problem. This may show that it is rarely lay people who play a significant role in the level of public debates in risk objects. 'Expert' knowledge is often mediated through mass media and these debates often occur around acceptable levels and what consequences of hazard might be (Lupton, 1999, chap. 2).

On the other hand, for social constructionists risk is a part of the people's world views rather than the judgement from scientist and experts. In this view, risk patterns do change over time and space, and the cultural differences determine in which a certain phenomenon is identified (Lupton, 1999, chap. 2). From a constructionist point of view, perceptions of risk often differ between actors depending on different locations. What is identified as risk in one historical or cultural context may not be the same in another place or context. This results in different knowledge and understanding and the development of these (ibid, chap. 2).

A risk can be understood as a part of an object where perceptions and cultural perspectives are central. If so, the distinction between 'real' risk and 'false' risk is irrelevant because both perspectives are describing some form of risk, and both the 'false' and 'real' risk is here leading to some form of action (Lupton, 1999 chap. 2). Instead of examining if the risk is more accurate or less biased, it is important to look at the ways in which these understandings are constructed and acted (ibid, chap. 2). In a constructionist view the important issues include among other: the statements that are used to construct knowledge about risk and look at the historical context and

sociocultural settings, rules that prescribe certain ways of talking about risk, types of subjects that are constructed through risk discourses, how knowledge does acquire authority and how new risk discourses of risk emerge and supplanting others and the effects of this for risk knowledge and subjects of risk (ibid, p. 33).

Mary Douglas, cultural anthropologist, has studied sociocultural analyses of risk and 'cultural/symbolic' perspectives of risk. Douglas has been seeking to understand why some dangers are identified as 'risk' while others are not. Her explanations mainly deal with social deviance and achieved social order, and the importance for social groups, organizations or societies to maintain boundaries between Self and Other (Lupton, 1999, chap. 3). Douglas argues that culture is of great importance when discussing risk and perceptions. According to Douglas, social influences shape perceptions of risk and which risks that get attention, she also argues that it is hard to maintain that perceptions of risk is private. She claims that concerns are rather cultural than individual and that individuals do not try to make independent choices, especially about political issues. The cultural background stands for assumptions. People do engage in activities that they perceive as being 'risky' and Douglas explains this in terms with "A refusal to take sound hygienic advice is not to be attributed to weakness of understanding. It is a preference. To account for preferences there is only cultural theory" (Lupton, 1999 p. 37). According to Douglas, it is important not to see lay responses to risk as biased just because they differ from the expert knowledge, instead it should be acknowledged in a cultural context of use and value. Douglas even states that notions of politics are linked to risk, particularly when dealing with accountability, responsibility and blame. Risk is a selective process where some risks are ignored or downplayed while others get high attention (ibid, chap. 3).

Douglas points at the politics and how risks are politicized. From a particular culture with shared values and concerns, certain risks may get attention while others do not. As Douglas argues that certain reasons for why some risk get more attention than others is related to the culture, Douglas also states that knowledge about risk can only be mediated through sociocultural processes, and she claims that risk is a socially constructed interpretation and response to the 'real' risks that objectively exist (Lupton, 1999, chap. 3). Douglas is making a comparison of the human body and the community which it is a part of. She looks at the relationship between the two, how the flow of phenomena goes between the both bodies to examine how boundaries between 'inside' and 'outside' are constructed and politicised. She means that just as the human body is having boundaries between inside and outside, the notion of societies is having form, external boundaries, margins and internal structure (ibid, chap. 3). The body's boundaries can represent any boundaries which are

threatened or precarious. From this perspective, risk can be translated into notions of the body and boundaries and how to deal with the threats (Lupton, 1999). It is about the bodily control as an expression of social control, if social controls over boundaries are relaxed, so are controls over the individuals body and perceptions of risk. Douglas argues that being at risk is being threatened by risks imposed upon oneself by other actors and entails being in places in the role of victim, rather than bringing risk upon oneself through one's own actions (ibid, chap. 3).

### 3.2. Behaviour change

How does behaviour change occur? The question does not only have one answer, there are probably as many answers as there are diverse populations and cultures. Several well known theories are used on how behaviour change is believed to occur. Below, the Stages of Change theory will be presented and explained as one of the major theories in behaviour change (Denison, 2002). The theory aims at explaining motivational readiness to change behaviour (Arbor, 2009). Behavioural change theories have been used in issues related to poor water quality and the importance of changes in hygiene behaviours (Denison, 2002).

The Stages of Change Theory (SCT) was developed by psychologists in 1982. The theory did first appear in a study that compared smokers in therapy and self-changers along a behaviour change continuum. The theory has been used in different contexts and studies where behavioural change needs to be examined, for example in water and hand hygiene studies (Denison, 2002).

The SCT claims that a person's needs at a particular point can be shown in a process divided into different stages that he or she is going through to change a behaviour. The SCT include four original components or stages: precontemplation, contemplation, action and maintenance (Denison, 2002). The theory has changed over time and a fifth stage called 'preparation for action' has been added, and also ten processes that help predict and motivate individual movement across stages. In other words, transition between the stages of change are effected by a set of independent variables, these are the processes of change (Arbor, 2009). As the processes are the independent variables that people need to apply, or be engaged in, to move from one stage to another, these processes have also become to be an important source for intervention programmes (Arbor, 2009). When the theory was first developed, the stages were seen to occur in a linear process, but now the five stages are considered to be a cyclical process that varies for each individual. Below, the stages and processes will be described more in detail.

**Stage 1 Precontemplation:** An individual has a problem; the problem might or might not be recognized by the individual. He or she has no intention of changing behaviour to deal with the problem (Arbor, 2009).

**Processes:** Rising of consciousness due to increased information (for example media campaigns), knowledge, feedback and confrontation. This will lead to increased awareness about the causes, consequences and cures (Denison, 2002).

- Dramatic relief includes techniques that can move people emotionally (role playing, psychodrama, grieving, media campaigns), these initially produces increased emotional experiences, that result in reduced affect if appropriate action can be taken (Arbor, 2009).

- Environmental re-evaluation explains how one's problem affects the social environment. It combines both affective and cognitive assessments of how the habits of the individual affect oneself and surroundings. Re-assessments might include empathy training, documentaries and family interventions (Arbor, 2009).

**Stage 2 Contemplation:** The problem is recognized by the individual. The individual is not only aware of the problem but is also seriously thinking about changing behaviour (Arbor, 2009).

**Processes:** Feelings regarding behaviour are assessed and social liberation requires an increase in social opportunities or alternatives. People who are relatively deprived or oppressed are extra relevant, increased opportunities can be produced due to appropriate policies, empowerment procedures and advocacy (Denison, 2002).

- Self re-evaluation includes assessments of one's self-image whether a particular habit is healthy or unhealthy. Value clarification, healthy role models, and imagery are methods that can move an individual towards behaviour change (Denison, 2002).

**Stage 3 Preparation for Action:** The individual is preparing to change behaviour within the next month (Arbor, 2009).

**Processes:** Commitment or belief in ability change (Denison, 2002), unhealthy habits are removed and prompts for healthier alternatives are added through stimulus control (Arbor, 2009).

**Stage 4 Action:** Consistent change in behaviour is enacted for less than six months (Denison, 2002).

**Processes:** Helping relationships can be needed in behaviour change where there is a risk to relapse, support of change might be necessary. Caring, trust, openness and acceptance are of importance (Denison, 2002).

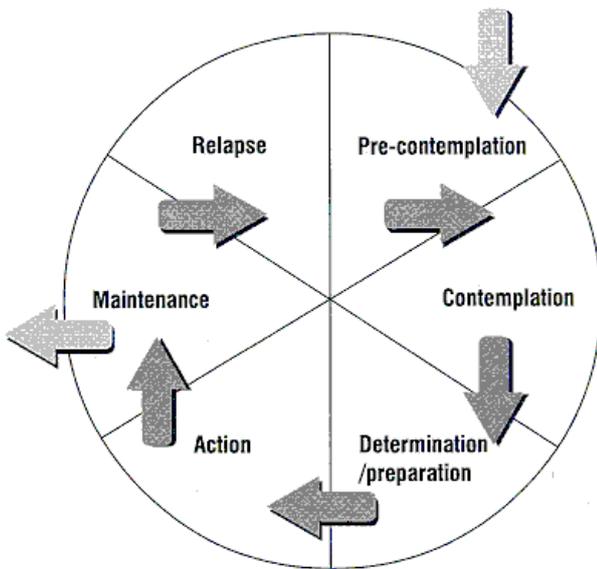
- Substitutes for problem behaviours are often necessary, counter conditioning requires the learning of healthier behaviours, for example: fat free food can be a substitute to fat food, or nicotine replacement can substitute for cigarettes (Denison, 2002).

- Reinforcement management can include the use of punishments and provides consequences for taking steps in a particular direction. On the other hand, self-changers can rely on rewards much more than punishments (Denison, 2002).

- The last step in the process is about the belief that one can change behaviour and the commitment and recommitment to act on that belief. Self-liberation can be enhanced through lots of different factors depending on individual, for example to have multiple rather than single choices, New Year's resolutions and public testimonies (Arbor, 2009).

**Stage 5 Maintenance:** new behaviour is maintained for six months or more (Denison, 2002).

Behaviour changes due to smoking, weight control, mammography screening and more recently researches in HIV/AIDS have been explored using SCT. As mentioned before, the theory has even been used in handwashing research for the importance of behavioural change to reduce diseases through poor water quality (Denison, 2002).



*Stages of change model.*

Critiques against SCT have argued that the theory focuses on the individual without assessing the role that structural and environmental issues may have on a person's ability to enact behaviour change. The theory provides a descriptive rather than a causative explanation of behaviour and this leads to that the relationship between stages is not always clear. The theory has also been criticized as a limitation that the stages in the theory may not be suitable for characterizing every population and culture (Denison, 2002).

Many behavioural theories argue that risk information alone is not enough to change behaviours (Kreuter and Strecher, 1996). Health Risk Appraisal (HRA) is a health education tool from promoting individual behaviour change. HRA collects epidemiologic risk factor information from its users, the mortality risks are calculated and it provides the individuals with feedback about these risks. Despite the facts that HRA is one of the most widely used tools in behavioural change, reviews have found little evidence for HRA's efficiency in changing individual behaviour. One explanation for this failure has been that HRA does not provide individuals with necessary recommended information to manage to make changes in their behaviour. HRA gives no consideration to psychosocial and other factors which mediate individual behaviour change, and some researchers mean that its feedback should not be expected to do more than transmit information or alter health beliefs (Kreuter and Strecher, 1996).

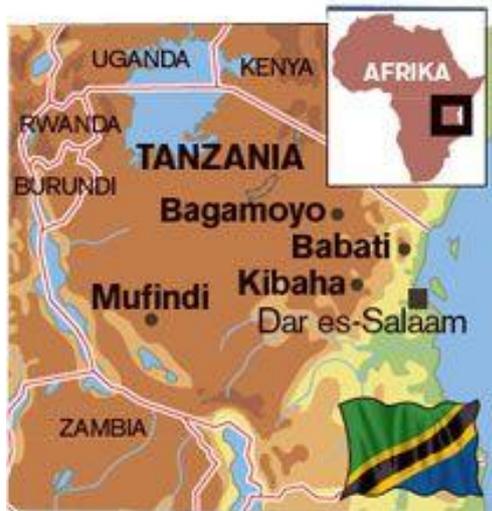
As most of the theories on behavioural change, SCT is focused on changing addictive behaviours. Despite this, the theory has been used on behavioural changes that are rather based on a cultural behaviour (Prochaska *et al*, 1992).

As mentioned before, it is now well-documented that proper hand hygiene reduces infections related to water and sanitation. According to Trunnell and White (2005), most research on hand hygiene has so far focused on the specific needs of health care providers, and it is therefore of importance to reach a larger variation of target groups, and therefore a theoretically based approach is needed to be equally applicable on all different target groups (Trunnell and White, 2005). SCT is used as a powerful tool both for educators and the targeted participants to help them to move through the stages towards actual behaviour and maintenance. The model shows how best to help individuals become aware of the need of change, to contemplate and prepare for change and to act and maintain that change. The model can explain why some education-based programs might not be successful when trying to encourage hand hygiene compliance; if programmes do not address the issue of the psychological preparedness to change, beliefs in the ability to change or the relevance of actually changing behaviour, parts of the propose of the programmes might failure (Trunnell and White, 2005).

## **4. Methodology**

### **4.1. Description of the study area**

The field study for this thesis was made in Babati, which is located in north central Tanzania and is the Manyara Regional Capital. It is a small, but booming town. In Babati, like in several other cities in developing countries like Tanzania, access to clean water is a problem. Most of the infrastructure in Babati town is from the 1950's, and one of many problems is the pipes in the water pumps that need to be replaced with new ones for safer water. Unfortunately, the economy constrains this development (Gaare 2008, pers. comm.). According to Julius (2008, pers. comm.), the sanitation in Babati town is better organised than in the rural areas. However, to prevent waterborne diseases the water should be treated before it is used for drinking, both in Babati town and in the rural areas. Children in Babati run a big risk of being sick from unsafe water and should for that reason only drink treated water (Gaare 2008, pers. comm.). Rural town water supplies in Babati and surroundings are in general poorly organised, which also can be reflected in this study where none of the respondents had access to piped water in the household.



*Map of Tanzania*

#### 4.2. Field work

Södertörn University College has for several years arranged field courses in Babati, Tanzania. The course is a volunteer opportunity for third year students studying 'Environment and Development' and/or 'Global studies'. The aim of the trip is mainly, for each individual, to collect data for a bachelor thesis. The trip for this study took place in Babati during three weeks with start in the middle of February 2008. Out of these three weeks, eight days were reserved for field studies during which each individual, with help from field assistants, collected data.

In this study, interviews were the main method used for collection of primary data. However, an interview is not just an interview; there are questions on experience and behaviour, opinions and values, feelings, needs, background data etc. Questions may address the past, present or future (Mikkelsen, 2005). Individual interviews were undertaken with an opportunity sample of purposely selected respondents to obtain representative information. The main category of respondents in this study, women, were determined in advance. Women with children under the age of five were of extra interest for this study because of the link between children and diarrhoea. Studies have shown that about 90% of diseases from water, sanitation and hygiene occurs in children younger than 5 years old (Pruss *et al*, 2002). Anyhow, the respondents were in large determined by availability. Interviewing a number of women on the same topic quickly revealed a range of opinions, attitudes and strategies. The interviews took place in two villages; Nakwa and Matufa, located about, 10 and 40 minutes, respectively, by car from Babati town.

Interviews have also been carried out with four persons with specific knowledge about the situation in Babati and waterborne diseases, these ones include: one doctor and one nurse at the children

division at the hospital in Babati town, one researcher within the topic of waterborne diseases with good knowledge of these issues and the situation in Babati, and one employee at Babati Urban Water and Sewerage Authority (BAWASA) who could provide information about the water supply in Babati town and surroundings. The data collection from these interviews serve background information in this study rather than being part of the result chapter, though the aim of these interviews was to get more background data before beginning with the interviews with women in rural areas. No translators were needed in these interviews since the respondents' English was good enough to carry out an interview.

There are different types of interviews. Interviews enable the researcher to survey a representative sample, while some interviews also ensuring anonymity and privacy for those who wished. Semi-structured interviews were used in the interviews with the doctor, nurse, researcher and the employee at BAWASA. These types of interviews are more conversational than for example questionnaires, where the questions are strictly predetermined before the interview. Semi-structured interviews are though still controlled and structured (Mikkelsen, 2005). Only some of the questions and topics were determined in advance, while many questions were formulated during the interview, and irrelevant questions could be dropped. The predetermined topics in these interviews can be found in Appendix 1.

Already after the first interviews, some questions had to be formulated differently, others had to be removed and new questions had to be added. Semi-structured interviews were also used in the first 10 interviews with the women in the rural areas. The semi-structured interviews were not just a substitute for the structured interviews, but they were rather a complement with in-depth information. The basic idea was to start a conversation with the women about water management and risks linked to their drinking-water. The interviews were conducted informally and the questions were mixed with discussion. Topics and issues to be covered were predetermined, while sequence and wording of questions was decided during the interviews. In these types of interviews, the outline increases the comprehensiveness of the data and makes data collection systematic for each respondent (Mikkelsen, 2005). The interviews remained fairly conversational and situational.

After the first 10 interviews with women, the days set aside for field work started to run out. Therefore, with the aim to have time to double the number of interviews, the most relevant questions for the study were picked out from the interview form. 10 more interviews could be managed after this, and the type of interviews was changed from semi-structured to more structured interviews. Here, the exact wording and sequence of questions were determined in advance. All respondents were asked the same basic questions in the same order. The majority of the questions

were open-ended and the interviews were planned to take no more than 10 minutes each. The interviews contained questions about personal details (age, number and age of children, location of household), daily routines concerning water collection, household water, treatment and storage – beliefs and behaviours, hygiene, and access to information.

### 4.3. Critical analysis

Different types of interviews have both strengths and weaknesses. One weakness when using semi-structured interviews can be the possibility for the interviewer's flexibility in sequence and wording that may result in substantially different responses from different perspectives (Mikkelsen, 2005). When using structured interviews, data can be easily compared and aggregated since all the respondents are asked the same questions. On the other hand, these types of interviews give little flexibility in relating the interview to particular individuals and circumstances; it can constrain and limit naturalness and relevance of questions and answers (Mikkelsen, 2005).

Before the trip to Babati, the plan was to manage both group interviews and individual interviews. The idea was even to make interviews with women at places where they fetch water. Unfortunately, it appeared that this idea was difficult to implement, due to limited time and lack of knowledge of what time of the day women normally fetch their water and where the water points were located. However, a few interviews were made by water points, but the vast majority of the interviews took place in the households. No group interviews were carried out. Group interviews could have been opening up for discussions between women, and new ideas and feelings could have been shared. On the other hand, group interviews can result in negative influences where only the strongest personalities may present their opinions.

According to Mikkelsen (2005), nothing can fully substitute for conducting an interview in the indigenous language. English-Swahili translators have been necessary during all the interviews with the women in the two rural areas. There are several risks when translators are used; information may be lost and there is a greater risk for misunderstandings than if the indigenous language is used. It should also be noticed that English was neither the translator's, nor the researcher's indigenous language. Therefore, one of the most important parts of the field work was, as soon as the interview was finished, to go through all the questions and answers together with the field assistant to avoid possible misunderstandings or gaps in the data.

Another limitation with this study is the small number of respondents due to the limited time. Limited access to a translator and sometimes difficulties in finding transport to the field-study area

were other limitations. More interviews could obviously have given a more reliable picture of women's perceptions and knowledge of risks linked to drinking-water.

#### 4.4. Literature

As a compliment and in support of the primary data, secondary sources in term of earlier studies on the same topic were used. Key studies used as secondary sources include reports focused on women in rural areas in developing countries, waterborne diseases and studies of how to on a household level prevent waterborne diseases. Internet has been used as a main tool both to find books, articles and even relevant information from a few organisations. When non-published material has been used, it stands from well known and trustable organisations such as Swedish International Development Cooperation Agency (Sida), World Health Organisation (WHO) and The United Nations Children's Fund (UNICEF). The theoretical framework was worked out based on the relevant literature, and in the analysis secondary data is compared with results from the primary data.

### 5. Analysis and results

This study resulted in a number of key findings that in this part of the essay will be presented and analysed. 20 women participated in the study. The respondents were in the ages 16-24, where the mean age of the sample was 20.

It is vital to add that the water quality from the wells were not tested in the study and is therefore unknown. However, even if the quality of water from wells was good, correct management of the water *after* collection is of vast importance to prevent waterborne diseases due to the high contamination risk during transport and storage in home. Plate 1 shows one of the water wells in the village Matufa, which some of the respondents collected their water from. The water well in the picture symbolizes what a typical water well in the study area looked like.



*Plate 1. Water well in Matufa.*

### 5.1. Water routines

None of the respondents had access to piped water in the household, but all of the respondents, 20 women, had access to community piped water. Some of the respondents had to walk long distances to reach the closest water well. As a result of the long distance to walk, 2 of the respondents stated that they sometimes collected their drinking water from a surface source; the nearby river. The remaining 18 women stated that they always collected water from a well. Fetching water is often a time consuming activity, and some of the respondents in this study spent around 40 minutes by foot one way to reach a water well. The women with such long walking distances stated that the walk often was necessary to do at least twice every day. Other respondents had closer distance to the water well with a minimum of 10 minutes one way. These respondents with less time to walk often fetched water 3-4 times daily. In general, the respondents who had less distance to nearest water well also seemed to consume more water per person in the household compared to those who lived further away. There were also shown to be differences in storage of the water depending on walking distance. The ones who had to walk less often consumed most or all of the stored water in the home before fetching more, while the remaining seemed to be more concerned about always having an amount of water as a reserve in the household. Collecting water is not only time consuming but also a heavy activity. The majority of the women fetched water in 20 litres buckets which after filled up were carried back home, often in hot climate. All of the women with children in the household stated that the children are an important part in helping the mother with activities such as fetching water.

## 5.2. Changes in behaviour

Change in hygiene behaviour can be of vast importance to reach reduction in waterborne diseases. Changes in handling of water at the household level, as well as hygiene behaviours, have to occur for safer drinking water. Behavioural change is often closely linked to information and beliefs. Trunnell and White (2005) argue that some education-based programs might not be successful when trying to encourage hand hygiene compliance because of lack in addressing the issue of the psychological preparedness to change, beliefs in the ability to change or the relevance of actually changing behaviour. They further state that one explanation for failure has been that individuals are not always provided with necessary recommended information to manage to change their behaviour (Trunnell and White, 2005). However, many behavioural theories argue that risk information alone is not enough to change behaviours (Kreuter and Strecher, 1996). Makundi (pers. comm., 2008) argues that traditions play an important role in the water related issues in many developing countries. Makundi means that it might be difficult to change behaviour or method from something that have been used for generations, such as physical and chemical methods for safe drinking water. Makundi further means that it is for many people completely foreign to boil the water or use chemicals.

If the respondents would be analyzed due to the Stage of Change theory, around 50 % would probably fit in to the first step in the theory; *precontemplation*. This stage is symbolized of an individual that has a behaviour that should be changed; the problem might be or might not be recognized by the individual. Many of the respondents did not see any risks at all with their behaviours related to how they stored and not treated the water before drinking. This stage of the theory also includes a few processes of importance, these processes are about rising consciousness due to increased information (for example media campaigns), knowledge, feedback and confrontation that will lead to increased awareness about the causes, consequences and cures. A further process, *environmental re-evaluation*, is also vital in explaining how one's problem affects the social environment. It combines both affective and cognitive assessments of how the habits of the individual affect oneself and surroundings.

One line of critique against the Stages of Change theory is that the theory focuses on the individual without assessing the role that structural and environmental issues may have on a person's ability to enact behaviour change. This critique can be related to and strengthened by this study. In this case it is probably the structures that are the constraints for behavioural change, rather than the individuals themselves. It is unrealistic to focus only on an individual's behaviour without consideration to their

surrounding environment and their conditions and ability to change a particular behaviour. Similarly, an individual should not be blamed for failure in behavioural change without assessing structural and environmental issues. Furthermore, the theory has also been criticized as a limitation that the stages in the theory may not be suitable for characterizing every population and culture (Denison, 2002). In the developing world, issues are often related to availability and money. Changing of behaviours that could be relevant in this study include hygiene interventions, treatment of water, and improvement in safe storage. All of these actions often demand more than just the willingness of change. Access to enough amounts of water, safe treatment methods, and correct storage vessels are prerequisites that are vital to achieve preferable change. To look at this one step further, information and knowledge of how to act for improvement is not a matter of course. Rural areas are often marginalized due to limited reach of information and instructions. It is also important to keep in mind that changing of cultural beliefs and traditions often takes both time and effort.

However, all respondents in this study stated that hygiene is an important factor in their daily life and most of them stated that they used a relatively big amount of their fetched water for hygiene. The majority stated hygiene as extra important after using the toilet and before preparing food. Some of the respondents even stated that they use soap and others stated that they heat the water before hygiene using. During the dry season, water can become a scarcity and it might be a question of priority of use. There might not be enough water to use for proper hygiene behaviours. It is important to remember that fetching water is for many a both time consuming and heavy activity. Many of the respondents had to walk long distances to fetch their water, often several times every day, and often under demanding conditions.

Those respondents who had changed their behaviour from not treating the water to be more careful and aware about risks might have gone through several changes that are shown in the Stage of Change theory, for example: raising of consciousness due to increased information, increased emotional experiences that result in reduced affect if appropriate action can be taken, environmental re-evaluation that explains how one's problem affects the social environment, awareness of the problem and thinking about changing behaviour, self-evaluation which includes assessments of one's self-image whether a particular habit is healthy or unhealthy, commitment or belief in ability changes, and the last step in the process that is about the belief that one can change behaviour and the commitment and recommitment to act on that belief.

### 5.3. Storage

70 % of the respondents said that they only used the vessel for fetching water, while the remaining 30 % used the vessel for laundry, washing and hygiene. All of the latter stated that the vessel is carefully cleaned before used for fetching water. The respondents were asked how they stored the water, and most of them stated that they always used a tight lid that covers the vessel.



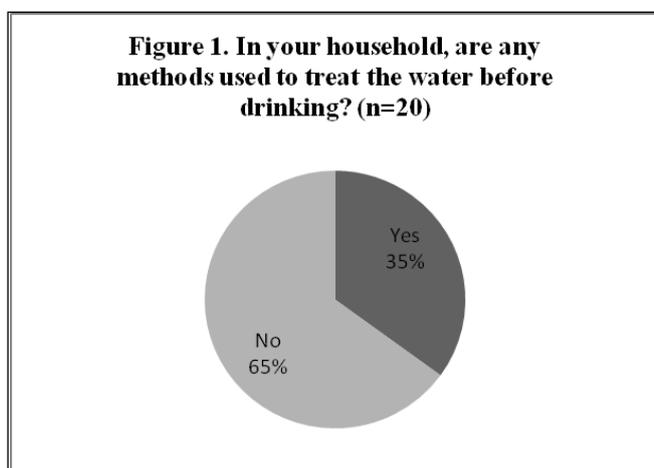
*Plate 2. Water vessels.*

The majority of the respondents in this study stored the water in a narrow mouthed plastic vessel (see white ones in plate 2), which is safer than an open bucket. Some of them also collected the water in the same vessel. The majority collected water in a simple open bucket, into which hands could be inserted (see coloured ones in plate 2). The second most common for storage was a plastic vessel with narrow opening and with a plastic tap. Covering the vessel with a tight fitting lid is of importance to prevent contamination of the water. 4 of the respondents did not cover the stored water at all, and none of these 4 treated the water before drinking. Contamination of water is quickly increasing when the water is stored at the household without any cover. Of the remaining 16 respondents that covered the water with a lid, the majority did fetch and stored the water in the same vessel. 5 out of the 20 respondents changed to another vessel after fetching the water.

Differences were noted as to how long time the respondents stored the water in the household. Some of the women did fetch water several times every day and never stored the water for more than 1 day. On the other hand, one respondent stated that the water normally is stored in the household for 2-3 weeks. Overall, the most common answer was that the water is stored between 3-5 days, but often for longer during the dry season.

## 5.4. Treatment

Household treatment can often provide benefits to the population more quickly than it will take to design, install and deliver piped community water supplies in the households (Sobsey, 2002). As all respondents had access to community water pipes, the water quality was probably improved compared to for example surface sources, such as the nearby river. However, it is important to remember that even if the water quality was improved, there are a lot of other factors that have to be taken into consideration to make sure that the water is safe for drinking. According to Makundi (pers. comm., 2008), all the water in rural areas in Babati, even the piped water, should be treated before drinking.

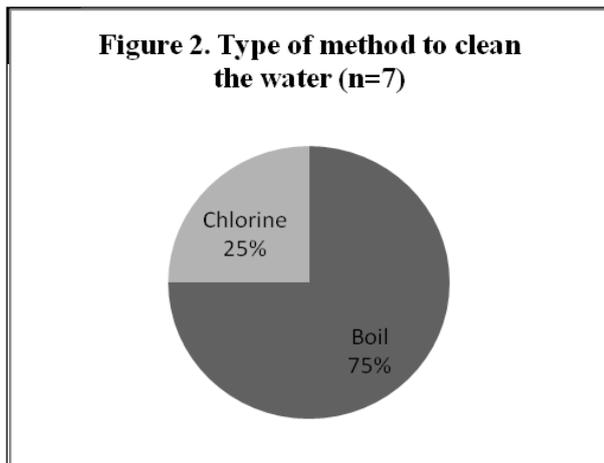


35 % of the women stated that they treated their drinking water, while the remaining 65 % stated that they did not do anything with the water before drinking it (see figure 1). All of the respondents who treated their water did that every day.

Only one of the respondents stated that she always boiled the water just before drinking it.

If the water got cooled and was not used at that time, she boiled the water again before next time drinking water was needed. This is an important action in prevention of diseases. All of the other respondents who treated the water did only boil the water once and then kept it for storage until consumption.

In the interviews it was discussed if the respondents knew how to prevent diarrhoea. The vast majority (90 %) stated that they knew how to do it, and the answers were the same for every individual: boiling the water.



Out of the respondents who stated that they used some sort of treatment for their drinking water, figure 2 shows that 25 % did use chlorine tablets while the remaining of the respondents boiled the water. The question why a particular method was used for treating the water before drinking was asked to all the respondents who stated that they treated their water. 1 out of 7 did answer “prevents diarrhoea”, 4 of the respondents said “cleans the water”, and 2 said “the water is contaminated and needs treatment”.

All of the respondents who treated the water mentioned that they take that action because of knowledge that has been created in the neighbourhood. First when they had heard that someone in their social network had become ill as a result of contaminated water, they started to be concerned about treating the water.

From some theoretical perspectives, all knowledge about risk is bound to knowledge in a sociocultural context that is generated in relation to scientists or other experts or lay people's knowledge. This knowledge is never value-free but rather the real way of seeing. Therefore, a risk is always a part of the network of social interaction and the formulation of meaning. 80% of the respondents who did not treat their water stated that they had been told that the water was of good quality. The information was perceived to come from people with correct knowledge and information, such as organisations or the leader of the village. One of the visits to the study area resulted in a meeting with the village leader and some issues were discussed where the leader stated the opposite, that the water should not be used for drinking water before treatment.

According to Gaare (pers. comm., 2008), chlorine tablets for water treatment are available to buy at the local markets in Babati. Gaare argued that the price was affordable for everyone. Despite this, only 2 of the respondents stated that they use chlorine tablets as a method to clean the water, and they further argued that the tablets are easily accessible and they did not perceive the price as a constrain for use.

## 5.5. Information

A public Health Centre is located in Babati where educated persons, e.g. nurses, work with health and diseases. Information is available at the Health Centre and the staff should be able to answer questions about health and give recommendations (Makhundi, pers. comm., 2008).

**Table 1. Where have you got, or where can you get information about the water quality and risks associated with water? (Multiple responses) (n=20)**

Description	Frequency
Neighbours	7
Organizations/village leader	6
No information	6
Health officer	3
Hospital	2
Media	1

Table 1 shows where the respondents stated that they can get information about their water and health risks. The most common answer was “neighbours”, where also a few further told that they treated the water because of stories from neighbours where untreated water has been used for drinking and resulted in sickness. 2 out of 20 respondents stated that they had got information from hospital; these respondents did get the information when they personally visited the hospital because they had stomach pains or similar problems, and were then told that all water should be treated. All of the 6 respondents that said “no information is available” did not treat the water, and some of them did not see any risks with their drinking water.

It is interesting to notice that despite the fact that many of the respondents perceived risks with their water and seemed aware of the problems that untreated water can cause, only 7 out of the 20 respondents actually treated their water. 15 out of 20 said that they knew how to prevent diarrhoea, and all of these argued that boiling the water before drinking was the answer. A few of these 15 did not perceive any risk with their drinking water, did not treat it, but stated that they can be sure to prevent diarrhoea if they boil the water. This might be understood as diarrhoea was not being perceived as a risk.

In rural areas, problems linked to information for the local population is often the access to these

places, such as Health Centres. There is often a lack of transportation, time and money. It is also important to remember that people might not be aware of these kinds of Health Centres existence or where they are located. Therefore, information should instead come from these places to the rural areas to give information, instructions and advices. Makundi (pers. comm., 2008) stated that there are campaigns in Babati where staff from for example the local Health Centre visit households in rural areas to inform about health risks related to water, and show safe storage, treating of water and related issues. Gaare (pers. comm., 2008) argued that a greater part of the population in Babati was informed about risks related to water as a result of increasing numbers of campaigns and media. 6 out of 20 respondents in this study had got information from someone who came to the household to demonstrate and give information related to drinking water and health. Makundi (pers. comm., 2008) means that a lot of health and disease information is given in both primary and secondary school. This further leads to the question about education. Everybody does not have access to education, it may not be a nearby school in the area or it might be financial or other reasons that are placed like obstacles for education. It is an issue about reaching information to the ones who most need it.

## 5.6. Perceptions of risk

Many of the respondents collected water from the same well, and it is therefore interesting to notice that their perceptions about risks and water quality were different.

**Table 2. Risks with drinking water associated with waterborne diseases. (Multiple responses) (n=20)**

<b>Description</b>	<b>Percent</b>
No risks	50
Stomach ache	40
Cholera	25
Diarrhoea	25
Water amoeba	5

Table 2 shows the great number of 50 % of the women which did not see any risks at all with their drinking water. The table even shows that only 25 % of the women mentioned diarrhoea as a risk linked to the water. A greater number, 40%, mentioned stomach ache. It is important to look critically at this point and remember that people do perceive risk differently. Stomach ache might in

some cases be translated and understood as diarrhoea. It may also be understood that stomach ache is seen as a less serious risk than diarrhoea. Among the respondents who mentioned diarrhoea and stomach ache as a risk, the majority did not perceive it as a big problem or a threat to the health, they rather perceived it as something less likely to happen and many of the women argued that “if it happened it would just be a temporary pain with no further consequences”.

Lupton (2000) means that the 'lived experience' is vital when talking about risks, as well as how individuals experience their world in relationship with meanings and knowledge. 25 % of the respondents mentioned that they had lived experience of disease from water and another 10 % had experienced neighbours or friends that had been ill, probably as a result of poor quality drinking water. This can further be linked to the risk theory and the fact that social structures shape perceptions of risks. Researchers have examined how risks differ from locale to locale and how specific actors within a certain sociocultural group construct their risk understandings as part of interaction with others (Lupton, 2000). It may be the fact that the risks associated with waterborne diseases are downplayed locally at the places where these risks are close to the persons. At the same time, in the developed world these risks (that mainly occur in the developing world) get attention and are highly concerned to be serious risks.

Gaare (pers. comm., 2008) thinks that the biggest problem concerning knowledge related to water issues, in Tanzania, is the link between water and diarrhoea, and maybe particularly lack of understanding of the seriousness of the impacts that unsafe water can cause. Gaare stated that the overall biggest problem related to water is that the health problem is not taken seriously enough. Gaare did not doubt that the knowledge exists, but is rather absent in government policy. There are policies and programmes on both a local and a national level, but Gaare argued that very little is actually happening.

## 5.7. Children's safety

13 out of the 20 women had children under the age of 5 in their household. It is well documented that children under the age of 5 are in a greater risk of becoming victims of diarrhoeal diseases, which often are related to poor water quality. Therefore, it may be extra important to consider careful managing of water in these households. The mother of the child was in all households the one who was responsible to collect, store and treat the water in the household. According to this; the women play a major role for the children's health.

All of the respondents who treated the water (35 %) before drinking also stated that treatment is

extra important for the children's health. According to doctor Makhundi (pers. comm., 2008), the infant mortality in Babati is high mainly as a result of high levels of diarrhoea. Makhundi argues that after malaria as number one, diarrhoea is the most common disease related to water, and malaria often causes diarrhoea. Doctor Gaare (pers. comm., 2008) argues that the infant mortality in Babati is decreasing, probably as a result of increased knowledge among the locals how to protect oneself against malaria, and also as a result of campaigns in preventing waterborne diseases. However, the infant mortality in the area still remains a huge problem. The majority of the women seemed to be concerned about the fact that children run a greater risk when drinking untreated water. On the other hand, just a few women stated that these risks were perceived as serious enough to actually make sure that the water is treated. As discussions about children and water took place, it was often stated by the women something similar with: "if and when the children drink untreated water they might get stomachache". A few of the women stated that they store the water at a place where the children can not reach it to make sure that they only did drink treated water. However, the vast majority said that the children could drink of the collected water at the household whenever they wanted, treated or not. In many cases there was not any obvious link between the women's perceptions of how important it was for the children to only drink treated water, and the actions they actually made when it came to be aware of that the children only were allowed to drink treated water. A greater number stated the importance of only treated water for the children than the number of the respondents who stated that the children only were served treated water.

## **6. Discussion and Conclusions**

Results obtained from this study indicate that there is a link between lived experience and the manner in which risks are perceived and managed. The respondents who to a greater degree seemed to perceive their drinking water as a risk if it was left untreated, had acquired this perception through lived experience or stories from neighbours, where a member of the community's sickness was attributed to poor water quality. All of these respondents also mentioned that they did not treat their water prior to themselves or a relative becoming sick. This shows how a change in behaviour did not appear until lived experience became a reality. For these respondents, the importance of treating their water did not become obvious until they were in hospital at the point of sickness.

Local conditions and the surrounding environment play a big role in water issues discussed in this essay. If the respondents had access to quick, cheap and easy methods that were proven to provide them with safe water, the number of respondents who treated their water might have been larger. Boiling is sometimes perceived as an easy and reliable method of water treatment. Boiling the water, however, requires burning much wood for fuel and is actually time consuming.

To be assured of the quality of the water, it should be boiled again after cooled down if used at another time. In rural households in developing countries, the size of the family is often large and one person should drink a minimum of 2 litres of water daily (Mintz *et al*, 1995, p. 2). The problem becomes even more complicated when adding walking distances to the nearest water source, economy constraints and the fact that everyday life for many people revolves around survival. Collecting and managing water is an important daily activity for many rural poor, often women, and they also have many other daily activities that require management. An alternative to boiling could be solar powered methods. According to Mintz *et al* (1995, p. 2), these methods seem to be practical, sustainable and inexpensive, but unfortunately, implementation on a large-scale still requires much development. Chlorine tablets could also be used as a quicker and easier alternative to boiling. As the tablets, according to Gaare (2008), were easily available at a low price in the local market in Babati it is interesting to notice that only 2 respondents used the tablets to clean their water. Maybe the tablets despite the low price were not affordable for all individuals, or perhaps the tablets were not as accessible as Gaare (2008) believed. On the other hand it is possible that the tablets were poorly promoted, and that the respondents were unaware of their easy availability.

Personal hygiene was discussed with the women during the interviews, as it is shown that the combined roles of hygiene, safe water and effective sanitation are likely to lead to the greatest reduction in waterborne diseases. To ask questions about personal hygiene and the amount of water used for hygiene was perceived to be a delicate topic of conversation. Not surprisingly, all respondents recognized that hygiene is an important factor, and all stated that hand washing after using the toilet was the most obvious and important hygiene behaviour. Many of the respondents also highlighted the importance of hand washing before preparing food. However, for improvements in correct hygiene promotion, a significant supply of water is needed. In many areas, especially during the dry season, water is a scarce commodity. Water is a necessity in many daily activities such as drinking, cooking, laundry, crop irrigation, personal hygiene etc. If water is scarce and has to be transported long walking distances prior to use, one can easily understand that the use of water for personal hygiene is not a priority. Adequate personal hygiene can prevent waterborne diseases, but constraints such as the availability of water and priorities in water use also have to be considered. Improvements in personal hygiene among the rural poor cannot be expected without first examining the local water supply and amounts of water available.

Changing peoples' behaviour is often a process involving several factors. The findings from this

study point at the importance in changing peoples' behaviour *before* someone gets sick. There should be more information highlighting the importance of treating the water with emphasis on minimizing risks associated with waterborne diseases. However, reliable and accurate information is not always enough. Many of the respondents were well informed, and aware of the risks. Despite this, only a few women implemented regular, approved methods for safer drinking water at the household level.

This study has also shown that the respondents had obtained their information from different sources, which differ in content. Among the respondents who used the same water well, perceptions did differ about whether the water was safe for drinking before treatment. Interestingly, some respondents had heard from perceived reliable sources, such as organizations and the village leader, that the water was safe for drinking. On the other hand, some respondents had received contradictory information from the same sources. The problem becomes more complicated when opinions about water quality differ, making it difficult to know which sources are reliable.

It must be remembered that all participants in this study had access to community piped water, but the water quality was not tested in this study. Therefore, it can not be taken for sure that the water was of poor quality, and it is unknown in this study if risks associated with waterborne diseases occurred when drinking the water at the point where it leaves the well. However, a few of the 20 respondents stated that they had received information, mainly through the hospital, that the water in these community pipes required treatment prior to consumption. The picture is more complicated, however, as it has been well documented that water often becomes contaminated during transport, storage and poor hygiene behaviours (Sobsey, 2002). This is a further reason why water collected from pipes or wells needs treatment and careful management at the household level to reduce contamination. The majority of respondents were aware of the importance to use a lid when transporting as well as during storage of the water. Most of them also stated that the vessel was used exclusively for water. These are important factors in reducing the contamination of water.

Out of those respondents who did see risks with their water and associated it with disease, only a few actually treated their water before drinking it. On the other hand, the remaining half of the respondents perceived no risk at all with their water, and therefore did not use any method to treat the water. Only 35 % of the respondents used effective methods to treat their water before drinking, while as many as 50 % perceived some kind of disease-associated risk with drinking the water. The vast majority (90%) stated that they were sure of preventing diarrhoea by boiling

the water, but only a few perceived the disease serious enough to actually use the method. These findings tell us that highlighting the risks with special focus on the importance of treating the water is necessary to achieve a decline in disease incidence. It is obvious from this study that a misunderstanding appear of the serious negative impacts that unsafe water can have on the human health. Respondents who had children under the age of 5 in their household showed an overall greater concern regarding the manner in which they handled water in the household. This is vital in light of the fact that children under the age of 5 stand the greatest risk of becoming victims of diarrhoeal diseases, which are often associated with unsafe drinking water. It is often the women who are responsible for activities linked to water usage in the household, and therefore they too play an important role for their children's safety.

In the interviews with Dr Gaare and Dr Makhundi, both argued that information campaigns do exist in the area where the aim is to reach out to the local community and informing them of the risks associated with contaminated water, as well as the methods that could be used at the household level to prevent diseases. 6 out of 20 respondents in this study had obtained their information from somebody who had come to the household to demonstrate and give information related to drinking water and health. Based on the small number of respondents in this study it is difficult to make any conclusive comment about how well these campaigns worked and to what extent they reached the local community. However, it is a positive finding that 6 of the respondents had been visited by organizations, which shows a degree of success for these kinds of campaigns in the area. Only 3 out of the 6 respondents who had actually been visited in their households were found to treat their water. The remaining 3 stated that they had heard from other sources such as local organizations, that the water in the wells was safe, and they did therefore not take any action in treating the water. One of the respondents mentioned that information was obtained via the media, but it is vital to recognise that many of these people were living under conditions without access to television, newspaper or other media sources. Therefore, information has to reach the community through other sources where everyone can receive the benefits. This could be for example: meetings in the local community and visits to households where information is shared and demonstrated. To make it possible for the locals to implement safe and easy methods in the home it is important that information and instructions are relayed face-to-face. It is unrealistic to expect significant improvements through only placing instructions on labels, for example on vessels, since many people in the developing world can not read. It is also important that information reaches those who are responsible for the daily cleaning activities, in this case most often the woman in the household. The importance of this problem needs to be highlighted and viewed with the greatest of seriousness. People in these communities

have traditional methods of handling their water, and it is not always easy to convert to new and unfamiliar methods.

It is not an easy task to combat poor drinking water in the developing world, and several different factors have to be taken into account. Correct managing of the water in the household is a vital factor to reduce contamination of water in areas where water taps in the household are not available and where water often have to be transported long distances and stored at the home. The respondents' daily routines did differ in form of distance to walk to fetch water, time used on water activities, and amounts of water used in the households. Some of the respondents had to walk up to 40 minutes one way to fetch water, while others had shorter distances and could fetch water several times every day. There was a big gap between for how long the respondents stored the water at home. The women in this study stored the water at home from one day to three weeks. In general, the respondents who had less distance to their nearest well also seemed to consume more water per person in the household, compared to those who had to walk 40 minutes one way to reach a water source. It was also shown to be differences in storage of the water depending on walking distance. Those who had to walk a shorter distance often consumed most or all of the stored water in the home before fetching more, while the respondents with long walking distances seemed to be more concerned about always having an amount of water as a reserve in the household. The majority of the respondents mentioned that they used a covering lid when storing the water and also when transporting the water from the water point to the household. Often the water was stored at home for more than one day which increased the risk of contamination even if the water was safe at the point of collection. Treatment, good personal hygiene and safe storage are factors that need to be implemented together, since no factor alone is enough to prevent disease.

## REFERENCES

### Published articles:

Austin A, van Vuuren F. (2001). Sanitation, Public Health and the Environment: Looking beyond current technologies, *Journal of the South African Institution of Civil Engineering*, 43 (1): 29-43.

Bloomfield S, van der Voorden C. (2007). Holistic Hygiene for Human Health, *Stockholm Water Front*, 4: 8-9.

Checkley W, Gilman R, Black R, Epstein L, Cabrera L, Sterling C, Moulton L. (2004). Effect of water and sanitation on childhood health in a poor Peruvian peri-urban community, *The Lancet*, 363: 112-118.

Cifuentes, E. and Rodriguez, S. (2005). Urban Sprawl, Water Insecurity, and Enteric Diseases in Children from Mexico City, *EcoHealth*, 2: 70-75.

Claassens, A. (2007). Women and Land, Draft document for discussion at the PFOTA Workshop.

Denison J. (2002). Behavior Change – A Summary of Four Major Theories, *Family Health International*.

Fred-Mensah, B. K. (2003). Looking up for the victims: Land Scarcity and Women's Role in Food Provisioning in the Ghana-Togo Border Area, *Research Review*. 19 (2): 35-48.

Joke, K. M. (2007). Perception of Home Garden Potentials Among Women in Edo South Ecological Zone, Nigeria, *Gender and Behaviour*. 5 (1): 1042-1052.

Kreuter W M. and Strecher J V. (1996). Do tailored behavior change messages enhance the effectiveness of health risk appraisal? Results from a randomized trial. *Health Education Research*, 11 (1): 97-105.

Knight S, Toodayan W, Caique W, Kyi W, Barnes A, Desmarchelier P. (1992). Risk Factors for the Transmission of Diarrhoea in Children: A Case-Control Study in Rural Malaysia, *International Journal of Epidemiology*, 21(4): 812-818.

Lopez-Carlos, A. and Zahidi, S. (2005). Women's Empowerment: Measuring the Global Gender Gap, *World Economic Forum*.

Martinez J, Mboup G, Sliuzas R, Stein A. (2008). Trends in urban and slum indicators across developing world cities, 1990-2003. *Habit International*, 32: 86-108.

Mintz E, Reiff F, Tauxe R. (1995). Safe water treatment and storage in the home: A practical new strategy to prevent waterborne disease, *The Journal of the American Medical Association*, 273 (12): 948-953.

Prochaska J, DiClemente C, Norcross J. (1992). In search of how people change. Applications to addictive behaviors. *The American Psychologist*, 47 (9): 1102- 1114.

Pruss A, Kay D, Fewtrell L, Bartram J. (2002). Estimating the Burden of Disease from Water,

Sanitation, and Hygiene at a Global Level, *Environmental Health Perspectives*, 110(5): 537-542.

Quick R, Kimura A, Thevos A, Tembo M, Shamputa I, Hutwagner L, Mintz E. (2002). Diarrhea Prevention Through Household-Level Water Disinfection and Safe Storage in Zambia, *The American Society of Tropical Medicine and Hygiene*, 66(5): 584-589.

Sanctuary M, Tropp H, Haller L. (2005). Making Water a Part of Economic Development, The Economic Benefits of Improved Water Management and Services, *Stockholm International Water Institute*.

Sikitiko, H. Kapile. (2003). In Search of the Best Options: The Dynamics of Water Supply Policies and Programmes in Tanzania, *Department of Programmes, the Mwalimu Nyerere Foundation, Tanzania*.

Smet J, Shordt K, Ikumi P, Nginya P. (1999). *HESAWA, Health through Sanitation and Water*, Swedish International Development Cooperation Agency, Stockholm.

Sobsey, M D. (2002). Managing Water in the Home: Accelerated Health Gains from Improved Water Supply, Department of Protection of the Human Environment, World Health Organization.

Tibaijuka, A. (2007). UN-HABITAT Pushes for Better Global Sanitation Access, *Stockholm Water Front*, 3: 16-18.

Trunnell E, and White Jr L. (2005). Using Behavior Change Theories to Enhance Hand Hygiene Behavior, *Education for Health*, 18 (1): 80-84.

Von Munch, E. and Mayumbelo, KMK. (2007). Methodology to compare costs of sanitation options for low-income peri-urban areas in Lusaka, Zambia. *Water SA*, 33 (5): 593-602.

Watts, S. (2004). Women, Water Management, and Health. *Emerging Infectious Diseases*, 10 (11): 2025-2026.

### Books:

Lupton, D. (1999). *Risk*, Routledge, New York.

Lupton, D. (2000). *Risk and Sociocultural Theory, New Directions and Perspectives*. Cambridge University Press, Cambridge.

Mikkelsen, B. (2005). *Methods for Development Work and Research: A New Guide for Practitioners*, Sage Publications, Denmark, 103-115.

Morgan P. (1990). *Rural Water Supplies and Sanitation*. Blair Research Laboratory & Ministry of Health, Harare. Distributor: MacMillan.

Web sources:

**WHO**

World Health Organization, Water, Sanitation and Hygiene Links to Health.  
[http://www.who.int/water\\_sanitation\\_health/factsfigures2005.pdf](http://www.who.int/water_sanitation_health/factsfigures2005.pdf)

Accessed 8 March 2008.

**Center for Health Communications Research**

Arbor, A. (no date). Health Behavior Theories (on-line),  
[http://chcr.umich.edu/how\\_we\\_do\\_it/health\\_theories/healththeories5/chcr\\_document\\_view](http://chcr.umich.edu/how_we_do_it/health_theories/healththeories5/chcr_document_view)

Accessed 12 February 2009.

**UNICEF**

<http://www.unicef.org/wash/>

Accessed 02 March 2008.

Figure and Plates:

**Front page picture:** Retrieved on April 29, 2009 from

<http://static.travelmuse.com/docs/artwork/destination-page/tanzania-page-kongwa-women-with-water-full.jpg>

**Stages of change model:** Retrieved on April 04, 2009 from

<http://www.drugtext.org/library/books/methadone/Resources/motivation-cycle.gif>

**Plate 1. Water well in Matufa:** Taken in March 2008 in Babati, Tanzania.

**Plate 2. Different types of water vessels:** Mintz E, Reiff F, Tauxe R. (1995). Safe water treatment and storage in the home: A practical new strategy to prevent waterborne disease, *The Journal of the American Medical Association*, 273 (12): 948-953.

**Map of Tanzania:** Retrieved on May 20, 2009 from

[http://gfx.aftonbladet-cdn.se/multimedia/dynamic/00504/karta-tanzania\\_504617b.jpg](http://gfx.aftonbladet-cdn.se/multimedia/dynamic/00504/karta-tanzania_504617b.jpg)

## **Appendix 1.**

Topics used in interviews with **Dr. Makundi, Dr. Gaare and Nurse at Babati hospital.**

- Waterborne diseases and the situation in Babati.
- Obstacles for development in improved water systems, preventing of diseases etc.
- Information about waterborne diseases t the local community.
- Perceptions of risks among the local community and knowledge about diseases.
- Infant mortality and the situation in Babati.
- Ongoing projects for improved water and sanitation?
- Methods on the household level to prevent diseases through poor quality drinking water.  
Importance of hygiene.

Topics used in the interview with Julius at **BAWASA.**

- About BAWASA and their main tasks.
- Water quality in Babati.
- Projects for improved water and sanitation.
- Constraints for development.