Chapter 1- Introduction

More than 150 years ago, John Snow established that cholera was spread through water or food contaminated by human faeces. Also in the late 19th century, Chicago was plagued by both cholera and typhoid epidemics. The links between dysfunctional sewerage systems, subsequent drinking water contamination, and these enteric disorders were recognized back then. More than a century later, these risk factors are still responsible for 28% of all deaths in children under 5, up to 50% of malnutrition, and addressing them could prevent up to 10% of the entire global burden of disease (Paunio and Acharya, 2007; Prüss-Üstün et al, 2008). These issues of water supply, sanitation, and hygiene (WSH) represent the most significant components of global environmental health (EH), problems of which are directly associated with an estimated 23% of all deaths, and 36% in the 0-14yrs age group (Listorti and Doumani, 2001).

At least 2.5 billion people worldwide remain without access to even basic sanitation facilities, with another 884 million using unsafe water sources (UNICEF, 2009). Perhaps the most obvious result of the WSH statistics is infectious diarrhoea, representing the third leading cause of death in low-income countries (WHO, 2008c). Poor sanitary conditions, along with the accompanying diarrhoea and intestinal parasites, have a strong association with malnutrition in children (Lechtig & Doyle, 1996; Rice et al, 2000). Having said that, very little in the health sphere exists in isolation: impacts of one determinant of health will undoubtedly affect another, whether directly or indirectly. In this way, effects of

improper WSH spread to other sectors, including economics, education, and social structure.

With the WSH risk factors and their consequences known, along with approaches (technical, social) available to at least partially address them, why then are the global figures (particularly of sanitation coverage) so dismal? One likely explanation lies in the relative [dis]interest of decision-makers and stakeholders in truly investing adequately in long-term interventions to address WSH and related issues. This is suggested by figures in global aid allocation, for one. For example, in 2004, HIV/AIDS caused just over 2 million deaths worldwide, malaria just under a million, and diarrhoeal diseases almost 2.2 million. Looking at the total aid money allocated to the same categories from 2004-6, the ranking is reversed: nearly USD 2.3 billion towards HIV/AIDS, nearly USD 750 million to malaria, and a mere 250 million towards sanitation (OECD database and Prüss-Üstün et al, 2008, cited in WaterAid, 2009).

The traditional focus of combating WSH related illness has been on promoting and providing water and sanitation infrastructure; it is relatively recent that a shift has been made towards incorporating hygiene and associated behaviour changes into interventions (Kolsky, 1993; Varley et al, 1998). Hygiene education and behaviours such as handwashing have impacts not only on diarrhoea in children, but on non-enteric pathologies such as pneumonia and impetigo (Luby et al, 2005b) as well. Achieving health gains through sanitation and hygiene, however, has proved more challenging than water supply, although the three are inextricably linked.

Players in WSH have long recognized the importance of instilling a feeling of "ownership" in recipient communities, and the latter are encouraged to participate in various aspects ranging from suggesting water point locations, to operation and maintenance, and even sanitation promotion. While important, these do not guarantee the sustainability of the interventions. Approaches worldwide thus far seem to generalize what is observed, particularly with regards to the human element, and try to fit individual scenarios to models.

Although it is accepted that any policy, programme, or project will have impacts on health, it is relatively recently that formal efforts are being made to document and assess these health impacts explicitly. Health impact assessment (HIA) aims to define, estimate, and manage impacts of activities on the health of a defined population (Scott-Samuel, 1998; ECHP/WHO-ROE, 1999; Kemm, 1999; Kreiger et al, 2003). Although there is no single accepted methodology for the HIA process, it relies much on other, older, types of impact assessments. Since health impacts of existing projects are the best indicators of the performance of future ones (Birley and Peralta, 1992), retrospective impact assessments of programmes form the evidence base for use in planning future ones. Ongoing findings can also be integrated into existing projects, which is more cost-effective than setting up new ones for different, but ultimately connected, targets.

Most HIAs have been conducted on larger development projects, or on policies, mainly in developed countries or multi/international organisations. The traditional indicators are either difficult to data on (epidemiological or quantitative), or are of too qualitative a nature to be acceptable to donors and

other stakeholders. Furthermore, few account for behavioural factors. In the case of WSH, impacts of sanitation and hygiene are much more intimately linked with human behaviour than water supply. This complicates the issue even further, as the need to address the human element of health involves a host of other complex and interrelated determinants. Recent attempts have been made to address some of the challenges with quantifying the impacts of water and sanitation interventions ((Prüss-Üstün et al, 2004; Fewtrell et al, 2007). While the methods are more suited for decision-making in policy and large-scale development initiatives, the time and capacity required render them largely out of the scope of many smaller, individual players (e.g. NGOs).

NGOs are assuming a growing role in development, and help relieve the strain on developing countries' budgets by providing development, expertise, and infrastructure/services. This means that maximising the impacts of their interventions saves time and efforts in the long term, and for all stakeholders involved. Most importantly, this inevitably translates back to population health. However, the donor agendas unavoidably affect the scope of the programmes themselves, including planning and M&E requirements (Carter et al, 1999). The preference for rapid, quantitative change usually means the indicators used by implementing agencies end up reflecting short-term changes in specific risk factors, i.e. "hardware" indicators (Ball and Ball, 1991). These are not necessarily representative of the true impacts on populations in the longer term, for one thing because most true health impacts take time to manifest.

For these reasons (among others), there is a need to be able to extract situation-specific indicators of health in recipient communities. To make the idea of HIA agreeable to NGOs operating in resource-constrained settings, the methods used must be relatively uncomplicated, and able to be integrated into the NGOs' existing budgetary and human resource capacities.

This research (conducted from the end of August 2006 to June/July 2008) is concerned with the indicators of health impacts of a UK-based NGO's water and sanitation programme on two rural communities in Thyolo District, southern Malawi. To the author's knowledge, this is the first research of its type to be conducted in such an interdisciplinary, comprehensive, and community-based manner on water, sanitation, and hygiene programmes. The water and sanitation programme ended in 2004, and involved installation of handpumps, training in pump maintenance and simple repair, and health and hygiene education. Malawi, a landlocked country in southeast Africa, is ranked as one of the poorest countries in the world, with over 65% of its population living below the national poverty line (WHO, 2007). In addition to examining indicators of health impact of the WSH programme on the communities, the research aimed to address the following needs of NGO WSH interventions:

a) Need for feasible ways to assess programme's impact on population health, in a manner as representative as possible for that particular setting;

b) Need for uncomplicated (and not resource-intensive) methods to extract health-related indicators, including proxy indicators, from recipient populations for use in planning, M&E, assessment;

c) Need to be able to use these indicators at all stages of the intervention (planning, M&E);

The thesis is structured as follows: Chapters 2 provides an introduction to Malawi, the magnitude and health impacts of WSH issues globally and in Malawi, and complexities in isolating causal factors in some of the most common (and serious) public health issues. The aim in this chapter, apart from introducing the issues in general, is to illustrate just how interrelated public health is, and how difficult it would be, even in the best of resource settings, to measure definitively and quantitatively health impact of *any* intervention. Chapter 3 introduces development projects in general, and considerations in their monitoring and evaluation. Health impact assessment, with its potentials and pitfalls, is also introduced. Associated considerations are discussed in the context of water supply, sanitation, and hygiene programmes, with a further focus on Malawi and developing countries in general. The methods used in this research are presented in Chapter 4, and the results and discussions in Chapter 5 and 6. Final conclusions and recommendations for future work are offered in Chapter 7.

Chapter 2- Introduction to Malawi and Water, Sanitation & Health

2.1 Malawi: Country overview

This chapter introduces public health issues of global importance related to water supply, sanitation, and hygiene, with a focus on the situation in Malawi. Initially, Malawi as a country is introduced, with discussion of the general development indicators. Thereafter, the discussion shifts to the burden of specific environmental and public health considerations related to water supply and sanitation, and the multifactorial components of the associated health impacts.

2.1.1 Geography

Malawi is a landlocked country in southeast Africa, bordered by the United Republic of Tanzania to the north, the Republic of Zambia to the north and northwest, and the People's Republic of Mozambique to the east, south and southwest (Fig. 2.1). Of the country's total area of 118,484 km^2, 94,276 km^2 is land area, with the remainder largely made up of Lake Malawi along the eastern border with Mozambique (NSO, 2005).

Malawi is divided into three regions: the Northern Region (6 districts), Central Region (9 districts), and Southern Region (13 districts). Fig. 2.2 provides a breakdown of Malawi into its Districts, with Thyolo District, where this research was conducted, highlighted in red. Also, since this research was focused on Thyolo District, statistics for Thyolo will from this point on be discussed alongside those of

Malawi as a whole. Each district is further subdivided into traditional authorities, each of which is presided over by a chief. Villages, headed by village headmen, are the smallest administrative units within each traditional authority (NSO, 2005).

Fig. 2.1 Map of Malawi

(http://www.reliefweb.int/rw/fullMaps_Af.nsf/luFullMap/0A325B5C7879FAC5C125732300372036/$File/rw_REF_mwi070706.jpg?OpenElement)

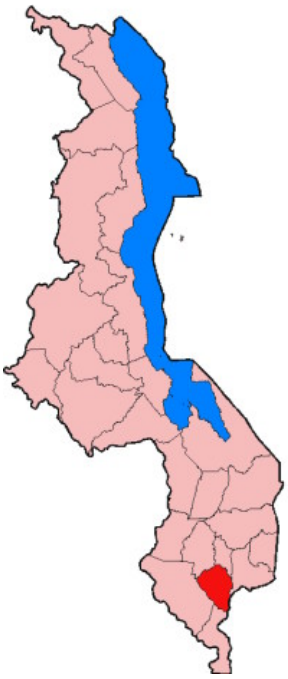


Fig. 2.2 Map of Malawi; Thyolo District (the focus of this thesis) in red

(http://commons.wikimedia.org/wiki/Image:MW-Thyolo.png)

2.1.2 Population and economy

Malawi is ranked as one of the poorest countries in the world, with a per capita GNP of USD 650 in 2006. Over 80% of the population of 12.9 million is rural, with a heavy dependency on agriculture for their livelihood. In 2006, more than 65% of Malawians lived below the national poverty line, and 42% below the international poverty line of USD1/day (WHO, 2007).

Agriculture forms the basis of Malawi's economy, accounting for over 70% of the country's export revenue. Tea, coffee and sugar form the bulk of the export commodities. Maize represents by far the principle food crop grown in Malawi, and is the staple diet for the rural population (NSO, 2005).

2.1.3 Education

Table 2.1 below shows the 2004 estimates for level of educational attainment in Malawi as a whole and for Thyolo District (data from NSO, 2005). Primary school education is free for Malawians, with fees having been abolished in 1994.

Table 2.1 Educational attainment in Malawi and Thyolo District (adapted from NSO, 2005)

	No Education	Primary 1-4	Primary 5-8	Secondary or above	Missing	Total
Urban (Malawi)	9.68	26.47	30.91	32.62	0.36	100.05
Rural (Malawi)	28.37	39.90	23.84	7.58	0.35	100.05
Thyolo District	25.15	43.47	22.73	8.32	0.24	99.91

2.1.4 Health and associated indicators

For 2006, the life expectancy at birth for both sexes in Malawi was estimated at 50 years (WHO, 2008a), largely contributed to by the nation's widespread poverty, high HIV/AIDS prevalence and high child mortality rates. It is important to keep in mind however, that the *healthy* life expectancy is only 35 years (WHO, 2008a). Fig. 2.3 below shows the causes of mortality in all age groups in Malawi for 2002 (WHO, 2006). The pathologies that are related to environmental factors are in bold text in the figure, in order to illustrate the relative burden of these.

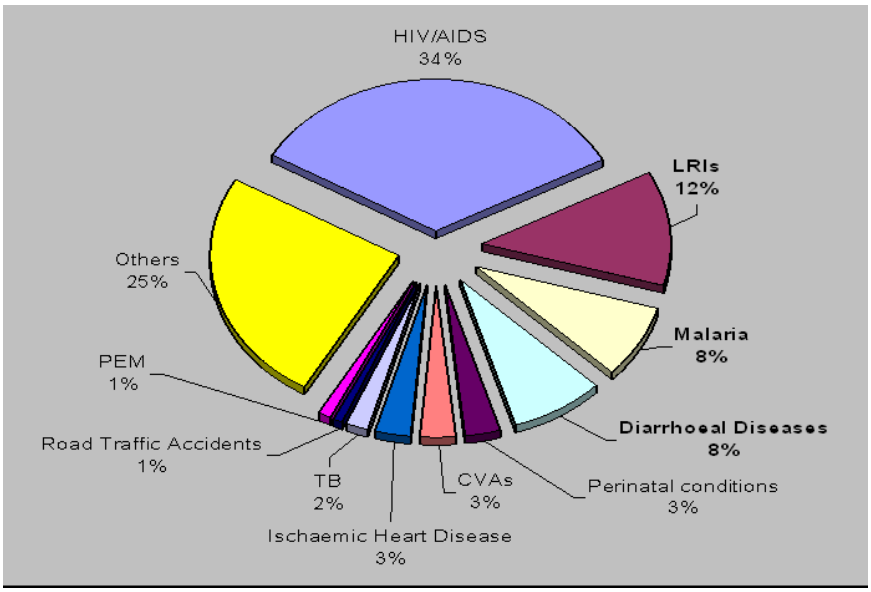


Fig. 2.3 Causes of Mortality in All Age Groups (%) in Malawi, 2002 [WHO 2006]

[note: LRI=lower respiratory infection, PEM= protein energy malnutrition, TB= tuberculosis, CVA= cerebrovascular accident]

Based on 2004 national health statistics and regional exposures, the World Health Organisation estimated the environmental burden of disease at 27% of the total burden per year, with 68,000 deaths annually attributed to environmental health risk factors (WHO, 2007). Table 2.2 provides a further breakdown of the measurable health impacts from three major environmental health factors, and illustrate just how significant the health impact of poor water, sanitation, hygiene, and air quality are.

Table 2.2 Burden of disease in 2002 from two major environmental health risk factors in Malawi (WHO, 2007)

Risk Factor	Deaths	DALYs/1,000/year
WSH	17,100	47
Indoor air pollution	13,300	36
Outdoor air pollution (mainly urban)	600	0.7

2.1.4.1 HIV/AIDS

At least 14% of Malawi's population is HIV+, with prevalence rates higher in the Southern Region for both men (15%) and women (20%). Similarly, and in line with the global picture, prevalence is higher in urban areas for both genders, and in all three Regions (NSO, 2005). As with most other health indicators (e.g. under-5 mortality, section 2.1.4.3.1), Thyolo District has a higher prevalence of HIV than the national average for both men and women (18.6% and 23.1% respectively). In this thesis, HIV refers to infection with HIV-1, as this is the predominant form of the virus in the region.

HIV/AIDS has become a mandatory consideration in just about every economic, social, and health indicator for development in Malawi. This century has seen it overtake malaria as the major cause of death in the country (Bowie, 2006). HIV/AIDS has become the chief risk factor in the diagnosis and management of both infectious and non-infectious respiratory and diarrhoeal diseases, and malignancies (particularly Kaposi's sarcoma). Atypical African Kaposi's sarcoma (KS) is associated with AIDS, and represents the most common malignancy diagnosed in

medical wards in Malawi (Gordon and Graham, 2006), accounting for 52% and 28% of cancers in men and women respectively between 1994-1998 (Banda et al, 2001).

Infection with HIV increases susceptibility to, and worsens outcomes of, other infectious and non-infectious conditions. This is a grave interaction in a country like Malawi, where infectious diseases account for most of the population's morbidity and mortality. Recent studies have shown an increased prevalence and severity of malaria in HIV+ individuals, an association that grows stronger with increased immunosuppression. In Uganda, Whitworth et al (2000) found that, compared to HIV- subjects, HIV+ patients had odds ratios of clinical malaria of 1.2, 3.4, and 6 for CD4+ counts of ≥5000/μL, 200-499/ μL, and <200/ μL respectively. Based on this and another study, also in Uganda, Korenromp et al (2005) estimate that HIV infection led to increases in adult malaria prevalences of 1.2, 3, and 5 times for the aforementioned CD4+ levels. They further estimate that, in Malawi, HIV infection results in increases of 3.5% and 13.3% in malaria incidences and deaths, respectively.

2.1.4.2 Maternal health in Malawi

Malawi has one of the world's highest maternal mortality rate, estimated at 1,800/100,000. For the 12 years or so before the 2004 Malawi Demographic and Health Survey (MDHS), around one in five deaths in women were maternity-related (NSO, 2005).

2.1.4.2.1 Anaemia in pregnant women

The 2004 MDHS reports a 12.1% prevalence of [any] anaemia in pregnancy. However, this was based on self-reported information of complications in women who gave birth in the five years preceding the survey, and not on actual clinical measurements. If values in the MDHS for Blantyre District are compared to a study which actually conducted Hb measurements in pregnant women in urban and rural Blantyre (van den Broek et al, 2000), the problem becomes clearer: the MDHS reports anaemia in 10.6% of pregnant women in Blantyre District, whereas van den Broek et al (2000) found anaemia (defined as Hb<11g/dL) in over 60% of pregnant women in rural and urban Blantyre. This discrepancy can likely be extended to estimates throughout Malawi, where access to/uptake of health services is low overall, and diagnoses often made without laboratory confirmation.

The aetiology of anaemia in pregnant women is complex, and is contributed to by several factors, including infection with HIV and malaria, and nutritional deficiencies (iron, vitamin B12/folate). Verhoeff (2000) found vitamin A deficiency in nearly two thirds of pregnant women studied; one in five of these women had severe deficiency. Similarly, over 88% of the women were anaemic; however, only half of these were iron deficient, supporting a multifactorial aetiology of anaemia. Dietary factors are likely contributors to anaemia in the pregnant and >5 age groups, with the staple food being a maize porridge (*nsima*) with groundnuts and cabbage/pumpkin leaves (seasonal). Bioavailability of dietary iron is probably not adequate. At the same time, these groups are more vulnerable to infection, certain forms of which themselves contribute to anaemia.

2.1.4.2.2 HIV in pregnancy

HIV infection has been associated with higher prevalence of malaria parasitaemia in HIV+ pregnant women compared to their HIV- counterparts (Verhoeff et al, 1999). Estimates of HIV infection in pregnancy are high, with one study in southern Malawi (Verhoeff et al, 1999) reporting an HIV prevalence of 25.6% in pregnant women.

2.1.4.3 Children's health in Malawi

2.1.4.3.1 Under-5 mortality

A summary of neonatal (1st month after birth), infant (between birth and 1st birthday), childhood (between 1st and 5th birthday) and overall under-5 mortality rates is given below for Malawi and Thyolo District.

Table 2.3 Childhood mortality rates (per 1000) for the 10 years preceding the 2004 survey (NSO, 2005)

	Neonatal Mortality	Infant Mortality	Child Mortality	<5 Mortality
Urban (Malawi)	22	60	60	116
Rural (Malawi)	39	98	74	164
Thyolo District	43	119	77	187

Thyolo District has among the highest childhood mortality rates in Malawi, with the second highest infant mortality and third highest childhood mortality rates of the districts sampled in the 2004 MDHS. The following sections discuss major causes of child morbidity/mortality in the country.

Acute respiratory infections (mainly pneumonia), malaria, and diarrhoeal diseases are high on the list of causes of under-5 deaths in Malawi, and this is illustrated in the chart below using data from the WHO's estimates for the period 2000-2003 (WHO, 2006).

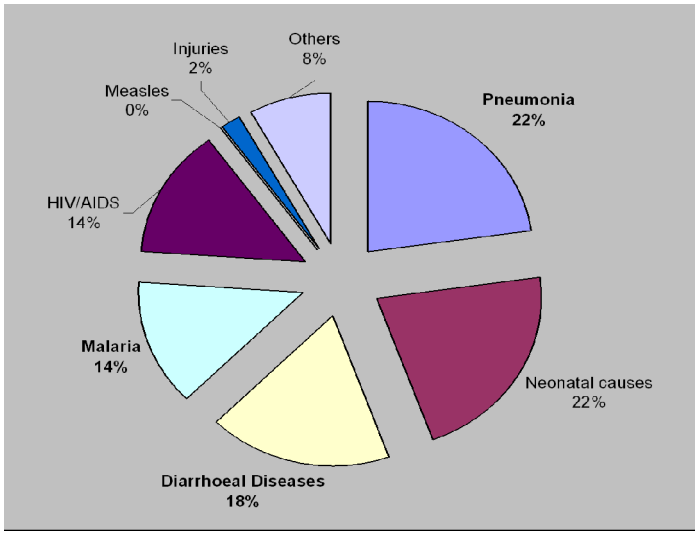


Fig.2.4 Top causes of under-5 mortality (%) in Malawi, 2002-3 (WHO, 2006)

Children in rural areas of Malawi have much higher rates than their urban counterparts for diarrhoeal diseases, fever episodes, and ARI symptoms (NSO, 2005). However, it must be remembered that the overwhelming majority of the population is rural, and perceptions of illness (particularly diarrhoea) are often subjective, so these estimates may not be entirely representative. Figures for Thyolo District are well above the national estimates for both rural and urban populations, as seen in Table 2.4 below.

Table 2.4 Children <5 with ARI symptoms, fever, & diarrhoea in the two weeks preceding the 2004 survey (NSO, 2005)

	Children with ARI symptoms (%)	Children with fever (%)	Children with diarrhoea (%)
National	18.81	37.15	22.25
Urban	11.3	29.9	17.5
Rural	20	38.3	23
Thyolo District	21.9	47.3	27.4

2.1.4.3.2 Acute respiratory infections (ARIs)

Respiratory diseases are most common in children aged 1-3 months and during the cold season (Vaahtera et al, 2000). It should be noted that there may be an overlap in symptoms between ARIs (mainly pneumonia) and malaria, and so where the figures for pneumonia are based solely on clinical criteria, they may be distorted by this clinical overlap. Pneumonia remains the leading cause of morbidity and mortality in both HIV- and HIV+ children in Malawi. Biological determinants of bacterial respiratory diseases in children include protein-energy malnutrition, low birth weight, micronutrient (particularly vitamin A and zinc) deficiencies, presence of viral respiratory infections, and HIV infection (Gordon and Graham, 2006).

There is probably a link with the household use of fossil fuels, although no studies were found detailing specifically the extent of this association in Malawi. Mishra (2003) describes an increase in ARIs associated with biomass fuel use in young children in Zimbabwe, and the conditions (and effects) are probably very similar, particularly in rural Malawi where there is nearly universal use of biofuels (Table 2.5). Kilabuko and Nakai (2007) also found an increased risk of acute respiratory infections in Tanzanian children in households using biofuels. Other studies from developing countries suggest that children in households using solid fuels are 2-3

times (after adjusting for other confounding factors) as likely to experience severe ARIs than those in using other sources of fuel for energy (Smith et al, 2000).

Table 2.5 Type of fuel used for cooking in Malawian households (adapted from NSO, 2005)

	National	Urban	Rural
Electricity	2	10.6	0.3
Kerosene	0.1	0.2	0
Charcoal	8.5	41.4	2
Firewood/straw	89.2	47.1	97.5
Dung	0.1	0	0.1
Total	99.9	99.3	99.9

These and other (including behavioural and social) determinants of respiratory and other diseases in children will be further discussed within section 2.5.

2.1.4.3.3 Diarrhoea and malaria

Both diarrhoea and malaria are most prevalent in children aged 6-12 months, and during the rainy season. This age group may coincide with waning of protective maternal antibodies after about 6 months of age, and/or introduction of complementary foods (assuming guidelines on infant feeding are practiced). These factors provide a continual challenge to the child's underdeveloped immune system, and a peaking of clinical infection may represent the body's response in fighting the pathogens (in case of actual infection) while the immune system adapts and develops its own resistance.

Malaria ranks among the biggest killers of children in Malawi, and the most important cause of fever in this (and older) population. The burden of this disease is huge nationally and globally, causing an estimated 500 million infections worldwide and 1-2 million deaths, mainly in children in sub-Saharan Africa. It accounts for an estimated 14% of under-5 deaths in Malawi (WHO, 2006), although the exact figure may be influenced by the fact that many cases go unreported due to lack of uptake of health facilities, diagnoses are frequently made clinically (especially in rural areas), and verbal autopsies common.

It is also likely that other diseases are misdiagnosed as malaria, due to lack of diagnostic, financial, and human resources for definitive diagnosis, as well as the sheer volume of cases. In fact, one study (Mallewa et al, 2007) conducted post-mortem examinations on brain tissue from children whose deaths were attributed to cerebral malaria (26), suspected meningitis (1), and clinically diagnosed rabies (2). Six of these tested positive for the rabies virus, most notably three (11.5%) of the 26 initially diagnosed with cerebral malaria. This study was conducted at Queen Elizabeth Central Hospital (QECH), a tertiary referral centre attached to the College of Medicine in Blantyre; being also a research facility, QECH would have more resources at its disposal than most other health facilities in the country. Other important diseases potentially misdiagnosed as malaria include typhoid and acute manifestations of other diseases, including human African trypanosomiasis (HAT). In the case of HAT, a study (Chisi et al, 2007) on clinical presentation of the disease in Nkotakota in Central Malawi revealed that the majority of patients ultimately diagnosed with HAT had previously been repeatedly treated for malaria, despite none having evidence of concomitant malaria in the study.

2.1.4.3.4 Anaemia in children

Anaemia in children under 5 is highly prevalent in Malawi, and shows an association with birth order and the interval with older siblings (NSO, 2005). The highest rates of anaemia in children is seen in Southern Region, with Thyolo District having the highest prevalence (Table 2.6) of severe anaemia (defined as haemoglobin <7 g/dL) in children aged 6-59 months (NSO, 2005).

Table 2.6 Anaemia in under-5s in Malawi, by location (adapted from NSO, 2005)

	Any anaemia (%)	Mild anaemia (haemoglobin 10-10.9 g/dL)	Moderate anaemia (haemoglobin 7-9.9 g/dL)	Severe anaemia (haemoglobin <7 g/dL)
National	73.2	26.4	42	4.8
Urban	65.4	22.8	40.8	1.8
Rural	74.1	26.8	42.1	5.2
Thyolo District	70	22.2	40	7.9

Severe anaemia is most prevalent in the 10-11 month age group, possibly reflecting the effects of changes in feeding practices or the increase in infections after the loss of protective maternal antibodies as the body adapts its own immune response. Most likely though, it is a combination of many of these factors, and as with other health problems, cannot reliably be attributed to a single aetiology. Malaria and other parasitic infections (particularly hookworm) likely play a role in childhood anaemia, with the latter more prevalent in older children.

Malnutrition (here used to mean undernutrition) contributes to susceptibility to, duration, severity, and prognosis of virtually any disease. In particular, micronutrient/mineral deficiencies (particularly iron, zinc and Vitamin A) have been

shown to be related to poor outcomes from respiratory and diarrhoeal diseases (Semba, 1999; Black, 2003) and in some studies, susceptibility to and morbidity of malaria (Shankar et all, 1999; Caulfield et al, 2004). Chronic and persistent infection, particularly with malaria, hookworm, and HIV are all associated with anaemia of various severity.

There are several genetic factors associated with childhood anaemia, namely inherited haemoglobinopathies associated with anaemia, including sickle-cell anaemia (SCA), thallasaemias, and glucose-6-phosphate dehydrogenase (G6PD) deficiency. Studies in children in rural southern Malawi have reported relatively low prevalences of around 2.5% for HbSS, the genotype responsible for sickle-cell disease (Brabin et al, 2004; Calis et al, 2008). G6PD deficiency (the most common enzyme deficiency globally), like SCA and thallasaemias, parallels malaria distribution geographically. It is still prevalent in areas where malaria is no longer endemic; for example, high prevalence of this enzymopathy is still found in Bahrain, where *P. falciparum* malaria was endemic until 1970 (Al-Arrayed et al, 2003). G6PD is crucial in protecting red blood cells from oxidative damage (and subsequent haemolysis) by stressors such as certain drugs (including aspirin, some antibiotics and antimalarials) or infection (e.g. bacterial pneumonia) (Tugwell, 1973).

Estimates of G6PD deficiency allele prevalence in children in rural southern Malawi vary from 11% (Calis et al, 2008) to over 25% (Brabin et al, 2004), although, it does not appear to manifest as clinically significant (Broadhead, 2008, pers comm). Still, the condition has been associated with severe anaemia in both male and female

Malawian children, with adjusted odds ratios of 2.2 and 4.1 respectively (Calis et al, 2008).

2.1.4.4 Health care and health-seeking behaviour

The healthcare system in Malawi is decentralised, with primary health care centres in rural and urban areas managed by their respective Districts Hospitals. A system is in place to refer cases, which cannot be handled in the health care centres, to the District Hospitals, and if necessary, main tertiary facilities such as QECH.

Traditional healers are a popular source of healthcare for Malawians, particularly in rural areas. Reasons for this vary, but likely include the difficulty in accessing healthcare services (transport cost/availability, distance, etc.), disenchantment with public health services, and traditional beliefs regarding health issues and treatments. Traditional healers therefore represent a culturally acceptable and accessible source of healthcare in Malawi and throughout Africa (Courtright, 1995).

An example from the 2004 MDHS is the proportion of children, shown in Table 2.7 under 5 with fever and symptoms of acute respiratory infections (cough with short, rapid breathing), who were taken to a healthcare centre/provider (excluding traditional healer, pharmacy, shop).

Table 2.7 Proportion of <5s with diarrhoea, fever and ARI symptoms taken to a healthcare provider (data from NSO, 2005)

	Percent (%) of symptomatic children taken to healthcare provider	
	Fever & ARI symptoms	Diarrhoea
National	19.6	36.4
Urban	22.6	38.7
Rural	19.3	36.2
Thyolo District	23.6	53.2

The maximum figures reported from any District for fever/ARI and diarrhoea were 28.2% and 53.2% (Thyolo) respectively (NSO, 2005). However, the 2004 MDHS did not collect data on the order in which different providers were consulted and associated reasons, e.g. if traditional healers were visited before mainstream facilities such as clinics/health centres. This would have provided valuable information on the behavioural aspects related to health, especially since it is already established that traditional healers are perceived to be an important source of healthcare throughout Africa.

There is a low utilisation of government health facilities for fever and respiratory symptoms, and most likely other health problems as well. This could be due to reluctance to seek medical attention for various reasons, preference for traditional healers, or simply a poor understanding of the potential severity of these conditions (especially ARIs). Evidence of all these was found in the villages where the research was conducted, and will be discussed in within section 5.4.2 in the results and discussion chapter.

2.2 Burden of diseases from inadequate water supply, sanitation, and hygiene (WSH)

A water supply of sufficient quality and quantity, safe disposal of human excreta, and adequate hygiene practices are essential to breaking the transmission of pathogens associated with the faecal-oral pathway. Perhaps the most obvious result of these is infectious diarrhoea, which kills up to two million children annually (WHO, 2002). In addition, the *morbidity* associated with infections associated with poor WSH is tremendous and must not be underestimated. There is a negative impact on the quality of life of communities, and the wider impacts of these diseases span into the economic development of entire nations. For example, iron deficiency anaemia is an important consequence of (particularly intestinal) parasitic infections, lowers energy levels and productivity, and hence impacts wages and output (Thomas and Frankenberg, 2002). To put the situation in perspective, more people suffer from the largely preventable consequences of poor water and sanitation supply than are affected by terrorism, war, and weapons of mass destruction combined (Bartram et al, 2005).

In an effort to quantify the morbidity associated with illness worldwide, the Global Burden of Disease Project introduced a separate quantitative measurement: the disability adjusted life year (DALY). The DALY considers the effects of early death and years lived with disability from disease, combined with a weighted average of disease severity. This provides more information than the traditionally used mortality rates, which may not capture the true socioeconomic effects of diseases that are not always fatal, and acknowledges that such conditions have a substantial

impact on populations and development. For example, schistosomiasis kills about 15,000 people worldwide, but over 200 million people are infected. Of these, about 20 million suffer chronic and severe manifestation of the disease (WHO, 2002). The morbidity associated with this disease is tremendous, resulting in long-term debility and subsequent loss of productivity in a portion of those infected.

Although the DALY provides a better idea of the overall burdens of different illnesses, there is some controversy about the weighting given to some of the diseases. For example, King et al (2005) conducted a systematic review of data from 135 studies on disability and morbidity associated with schistosomiasis, and subsequently came up with a weighting for this disease that was up to 30 times that used by the WHO. Table 2.8 below summarises estimates, from the World Health Organisation's World Health Report for 2002, of the global burden for some of the main diseases associated with inadequate WSH.

Table 2.8 Global burden of disease from WSH-related diseases, 2001 (based on data from WHO, 2002)

Disease	Number of deaths (% of total deaths)	DALYs (% of total DALYs)
Diarrhoeal diseases	2,001,000 (3.5)	62,451,000 (4.3)
Schistosomiasis	15,000 (0)	1,760,000 (0.1)
Intestinal nematode infections	12,000 (0)	4,706,000 (0.3)
Trachoma	0	3,997,000 (0.3)

For Malawi specifically, WHO (2004) reports the following disease burden for WSH-related conditions.

Table 2.9 Estimated burden of select WSH-related disease in Malawi, 2002 (adapted from data in www.who.int/evidence/bod)

Disease	Estimated total deaths	Estimated total DALYs
Diarrhoea	19,500	632,000
Malaria	20,000	734,000
Schistosomiasis	800	34,000
Lymphatic filariasis	…	39,000
Intestinal nematode infestations	100	16,000
Trachoma	…	34,000
PEM	2,600	142,000

2.2.1 Diseases associated with inadequate WSH

Diseases related to WSH can be broadly classified into faecal-oral (bacterial and non-bacterial), vector-borne, and helminthic (water and soil-based). It is important to remember at this point that:

1) Many of the helminthic infections are inextricably linked to **both** water and sanitation (except perhaps Dracunculiasis) in that they are excreted in faeces (or urine in the case of *S. haematobium*) to an intermediate/definitive host in a water supply. The transmission pathways further involve community behavioural issues together with water and sanitation infrastructure.

2) Transmission of many infections involves animals, either as hosts or through their faeces. Thus, although improved sanitation may reduce the (often substantial) contribution of human excreta to the cycle, there remain the issues of animal faeces (e.g. *Campylobacter*, *Yersinia* and *Cryptosporidium* sp.) and

environmental habitat (e.g. *Bulinus sp.* and *Biomphalaria sp.* in the cases of *S. haematobium* and *S. mansoni*, respectively) (Cairncross and Feachem, 1983).

3) Where transmission occurs with animals in series (e.g. taeniasis), efforts to improve disposal of human excreta will likely impact the cycle of infection. However, when transmission of zoonoses occurs by animals in parallel (e.g. salmonellosis), efforts to improve disposal of human excreta will have no impact on animal-human transmission (Bradley and Feachem, 1978).

2.2.1.1 Faecal-oral diseases

Bacterial diseases transmitted via human and animal excreta can be transmitted directly from person to person, or via more extended pathway. For example, vegetables and other crops, and water sources, can be contaminated with faecal matter as a result of application of manure (animal or human) as fertiliser.

Cholera is perhaps the most well known bacterial disease associated with poor water and sanitation. Diarrhoea due to *V. cholerae* is normally mild and self-limiting in immunocompetent hosts. Cholera is seen most frequently in populations using unsafe water sources (Schroeder and Wuertz, 2003) either due to poverty, or in combination with natural disasters or armed conflict (e.g. Baghdad in 2007). Looking at the annual WHO statistics for reported cholera cases, it is all too clear that the largest outbreaks, and most fatalities, occur in populations already crippled by poverty or conflict, and thus the least able to cope are the hardest hit by the consequences. In 1999, over 80 % of cases and 95% of cholera deaths were in sub-

Saharan Africa. The southern region of Malawi has seen yearly cholera outbreaks since 1997 (Zachariah et al, 2002), many of these in the crowded slums around the main cities. In 1999, the country reported over 26,500 cholera cases and 648 deaths (WHO, 2008b).

Apart from cholera, several other pathogenic bacteria associated with WSH are notable for their public health significance in developing countries. *Salmonella typhi* causes typhoid fever, which has a much higher incidence worldwide than cholera, results in about 60 times as many deaths (Schroeder and Wuertz, 2003), and is associated with faecal-oral contamination of water and food.

Shigella sp. is the most common causative agent for bacillary dysentery, and four species of *Shigella* are most commonly isolated from clinical cases: *S. dysenteriae* (Group A), *S. flexneri* (Group B), *S. boydii* (Group C), and *S. sonnei* (Group D). At both ends of the spectrum, disease caused by *S. sonnei* tends to be milder and shorter-lasting, while that of *S. flexneri* is more severe. Disease caused by the other two is of varying severity, and *S. dysenteriae* is often associated with epidemic dysentery. Major epidemics of *S. dysenteriae* have been documented in East Africa since 1991 (Percival et al, 2004). There is general consensus in the literature that outbreaks of dysentery in developed countries tends to be a result of impaired drinking water quality, such as the *S. sonnei* outbreaks in the US (Black et al, 1978) and Scotland (Green et al, 1968) which were results of malfunctions/breakdowns along the water treatment-distribution system, while in tropical countries where it is endemic epidemic dysentery is associated with water quantity and hygiene (Percival et al, 2004).

Other, non-bacterial pathogens can also be transmitted via the faecal-oral route, and include viruses (Hepatitis A, rotavirus, poliovirus), protozoa (e.g. *Giardia sp.*), and helminths (e.g. *Ascaris lumbricoides*). The viruses can further be subdivided into those causing gastrointestinal symptoms (e.g. rotaviruses) and those causing disease outside the gastrointestinal system (most importantly the hepatitis viruses and enteroviruses). Rotavirus alone is estimated to cause around 20% of infectious diarrhoea in developing countries (Heritage, 2003). Hepatitis A and the rarer Hepatitis E viruses are transmitted through faecal contamination of water or food. Faeces from patients with acute hepatitis A are highly infectious, although in most cases the disease is self-limiting, and a large proportion of people in developing countries have already been exposed in early childhood, with or without clinical symptoms. Hepatitis E, on the other hand, is of particular importance in pregnant women. Studies in Egypt, where Hepatitis E accounts for 20-40% of adult and paediatric cases hospitalised with acute viral hepatitis, have shown high prevalences of Hepatitis E antibodies in rural women (El-Zimaity et al, 1993; Divizia et al, 1999; Fix et al, 2000; Stoszek et al, 2006;). Mortality from fulminant hepatitis can be as high as 40% in pregnant women infected with Hepatitis E (Mast and Alter, 1992). Although no studies were found on Hepatitis E in Malawi, the risk factors are certainly present.

The most important and well known of the enteroviruses is the poliomyelitis virus. Although the main route of transmission is via water and contact with infected faeces, this virus can also be spread though the respiratory route. Vaccinating children is routine in Malawi, but crippling effects of the disease on older

generations are still clearly visible around the country. Other enteroviruses cause meningitis (ECHO viruses) and muscular complications (Coxackie viruses, notably Coxackie B viruses which cause serious cardiac complications) (Heritage, 2003).

Most of the faecal-oral pathogens can be spread from person to person through fomites or direct contact, and so personal and domestic hygiene play a substantial role in limiting their spread. This invariably involves improving water quantity together with sanitation and behavioural modification to facilitate improvements in hygiene.

2.2.1.2 Helminthic infections

The following sections introduce those helminthic (worm) infections of public health importance related to water, sanitation, and hygiene. These parasitic pathogens are of huge importance due to the impact they have on nutritional status, and their contribution to the cycles of anaemia, malnutrition, and infection.

2.2.1.2.1 Soil transmitted helminths

These include *Ascaris lumbricoides*, *Trichuris trichiura*, hookworm (*Ancylostoma duodenal* and *Necator americanus*), and *Stronglyloides stercoralis*.

One study (Randall et al, 2002) looked at infection patterns in adolescents and young adults in Karonga District, northern Malawi. Out of 501 students aged 9-16 from

four schools, hookworm was detected in 64%, *S. mansoni* in 27%, and *S. haematobium* in 20%. A summary of the findings is presented in Table 2.10.

Table 2.10 Helminthic infections in schoolchildren in Karonga study (adapted from data by Randall et al, 2002)

Species of infecting organism	Prevalence in schoolchildren aged 9-16 in study (%)
Hookworm	63.6
S. mansoni	27
S. haematobium	20.1
Ascaris lumbricoides	0.4
Trichuris trichiura	1.8
Taenia sp.	0.7
Strongyloides stercoralis	0.2
Any helminthic infection	76.2

Hookworm infection is perhaps the most important of these from a public health and development perspective. It is a major cause of anaemia worldwide, and as shown in the study discussed above, appears to be highly prevalent in Malawian children. The eggs of *A. deuodenale/N. americanus* are excreted in stool; thus improper sanitation allows these to be deposited in the soil and develop. The larvae enter the skin directly, and develop along the way to the intestine, where they latch onto the mucosa (Dasgupta, 2000). Each worm consumes about 0.03-0.06cc of blood per day, and so with persistent infection and reinfection the results are features of anaemia (from iron and folic acid/vitamin B12 deficiencies), growth retardation, and in severe

cases, visceral damage (e.g. cardiac). Even in seemingly asymptomatic cases, the effects may be insidious albeit detrimental. One study in Indonesia (Sakti et al, 1999), found that school children's function in six out of 14 tests on various functions on working memory was significantly affected by infection with hookworm, with greatest implications for reading comprehension and reasoning.

2.2.1.2.2 Water-based helminths

Schistosoma sp. and *Paragonimus westermani* are examples of water-based helminths. The former is the most important of these infections globally, due to the sheer scale of infection burden and the significant morbidity associated with chronic infection with the genitourinary and intestinal forms. It is one of Malawi's major public health issues, and probably one of the most difficult environmental health conditions to tackle.

2.2.1.3 Vector-related diseases associated with excreta

These mainly refer to diseases spread via mosquitoes and those carried by nuisance pests such as flies and cockroaches (e.g. trachoma and cholera). Both play a role in mechanical transmission, whereby the pathogens are carried on the surface of the insects and transferred to inanimate surfaces or the bodies of people they come into contact with.

Schistosoma sp. can also be classified in this section, since the larvae depend on an intermediate host (snails of genus *Bulinus* and *Biomphalaria* for *S. haematobium* and *S.*

mansoni respectively) in water systems to develop. Nevertheless, this was grouped into the water-based helminths above.

In Malawi, the main mosquito-borne diseases are malaria and lymphatic filariasis (*W. bancrofti*). The main vectors for lymphatic filariasis are Anopheline and Culicidine mosquitoes (Service, 1986). *Culex quinquefaciatus* is known to be an important vector for this disease in East Africa (Maxwell et al, 1990), and is associated with localized collections of polluted water (particularly that contaminated with organic matter), including puddles around pit latrines, storage containers, and the like (Service, 1986; Maxwell et al, 1990).

2.2.2 Impact of WSH-related diseases on children

Children unquestionably bear the brunt of the burden of repeat and chronic infection. Poor sanitary conditions, along with the accompanying diarrhoea and intestinal parasites, have a strong association with malnutrition in children (Lechtig and Doyle, 1996; Rice et al, 2000). Malnutrition stands both on the cause and the effect ends of the infection cycle, and has been cited as a root cause of at least 50% of under-5 child deaths in developing countries (Fewtrell et. al., 2007). It weakens the immune system, predisposing to disease, and increasing the severity and duration. Similarly, malnutrition can be a result of diarrhoea and intestinal parasites due to reduced food intake and nutrient absorption, and direct nutrient losses (Stephenson, 1999); for example, apart from interfering with digestion and nutrient absorption, a seemingly mild intestinal parasite infestation can consume ~10% of a child's total energy (Satterthwaite et al, 1996). Furthermore, about 50% of malnutrition is caused

by poor sanitation and repeat infections from unsafe water, sanitation and hygiene (Paunio and Acharya, 2007). A poor sanitary environment also contributes negatively to child growth and development by continuously challenging the child's immune system, diverting nutrients and energy from growth functions to supporting the immune response against infections (Solomon et al, 1993).

The percentage of children in Malawi that are stunted is estimated at 53% (WHO, 2007). This has severe implications for the future development of the country as a whole. The subsequent physical and cognitive effects of the consequences of inadequate water access and unsanitary environments on children carry on into their adult life, and hence quality of life and productivity. Many studies have established the links between malnutrition and the mental and social development of children in the short and long term. Children suffering malnutrition early in their lives have lower IQ scores, lower school achievement, and more behavioural problems later in life (Mendez and Adair, 1999; Grantham-McGregor and Fernald, 1997; Grantham-McGregor, 1995).

2.2.3 Quantitative estimates of improved WSH

Estimates of health changes through improving water supply, sanitation and hygiene worldwide are given in Table 2.11. Other studies have documented economic results of the same (Hutton, 2000; Hutton and Haller, 2004).

Table 2.11 Some quantitative estimates of impacts from improving WSH

Factor Improved	Comments	Disease reduced	Amount reduced	Reference
Sanitation	30 studies in Latin America, Africa, Asia	Diarrhoea morbidity	22% (median)	Esrey et al (1991)
	meta-analysis (2 studies used)	Diarrhoea	32%	Fewtrell et al (2005)
	global estimates	Schistosomiasis	Up to 77%	WHO/UNICEF (2000)
Hygiene	meta-analysis (11 studies)	Diarrhoea	33%	Esrey et al (1991)
Handwashing	With soap; review	Diarrhoea	43%	Curtis and Carincross (2003)
Water (supply)	meta-analysis (9 studies)	Diarrhoea	Up to 25%	Fewtrell et al (2005)
Water (quality)		Diarrhoea	Up to 47% (rural), 23% (urban/peri-urban)	Fewtrell et al (2005)

Regardless of the exact figures, there is universal consensus that access to water in adequate quantity and of adequate quality, sanitation, and behavioural changes are paramount in improving health status, and that improvement in water quantity and hygiene behaviour may be more important than improving water quality alone. The aforementioned points also highlight the magnitude of the behavioural component of WSH.

2.3 Water supply

Water plays several roles in the transmission of diseases. It can act as a direct medium by which pathogens are carried into the body (water-borne), is crucial for hygiene to remove pathogens from the skin (water-washed), and serves as a habitat for intermediate hosts in which pathogens develop and subsequently access the body (water-related, e.g. schistosomiasis). Still, over 884 million people lack access to a safe water source (UNICEF, 2009). There have been many epidemiological studies linking poor drinking water quality and the incidence of infectious diarrhoea (Hunter et al, 2003). Lechtig and Doyle (1996) conclude, based on data from 84 countries, that apart from adequate funds for food, the level of access to water is the best predictor of nutritional status. The following sections will deal with water quality issues by known points of contamination: sources, collection and transport, and storage and use (El Attar, 1982; Howard et al, 2003).

2.3.1 Water sources in Malawi

Communities obtain water from several sources, which are generally classified into protected and unprotected sources (Table 2.12). Protected sources have a mechanism to prevent contamination of the water by dirt/soil, leaves, insects, human and animal excreta, and debris. These include the more costly piped systems, which in developing countries are generally restricted to the wealthier few (Cairncross and Feachem, 1983). Groundwater from open wells (Ph. 2.1, 2.2) is an important source of water for communities worldwide, and in some cases may be the only source.

Table 2.12 Different water sources and protection status (modified from WHO/UNICEF, 2006)

Status	Source
Improved	Piped water into dwelling or yard
	Public tap or standpipe
	Borehole
	Protected hand-dug well
	Protected spring
	Rainwater collection
Unprotected	Hand-dug well (unprotected)
	Unprotected spring
	Tanker/truck
	Surface water (e.g. pond, stream, river)

About 64% of the Malawian population has access to a protected water source (Table 2.13). Table 2.13 below, with data from the 2004 Malawi Demographic and Health Survey, summarises the population's access to water in Malawi. It is not surprising to see the chasm between rural and urban figures, with 91% and 58% of urban and rural populations, respectively, with access to a protected water source (NSO, 2005).

Table 2.13 Access to water sources (%) in Malawi (adapted from NSO, 2005)

	National	Urban	Rural
Piped water into dwelling	2.9	14.1	0.6
Piped water into yard/plot	3.4	15.1	1
Public tap	13.7	45.2	7.4
Open well in yard/plot	2.4	1.9	2.5
Open public well	22.6	5.4	26.1
Protected well in yard/plot	4.9	2	5.5
Protected public well	38.6	14.7	43.4
Spring	2.6	0.1	3.2
River/stream	8	1.3	9.4
Pond/lake	0.4	0	0.5
Dam	0.2	0	0.3
Tanker truck	0.1	0	0.1
Total	99.8	99.8	100

A point to be made about piped water in Malawi is its often unreliable nature, with frequent lapses in service (up to several days, even weeks, from the author's experience) and variations in pipe pressure. This opens up the overburdened and under-maintained system to contamination when the pressure in the pipes is low, and poor maintenance of the system has resulted in damaged sections of pipes. The result in an increased likelihood of contaminated water being pumped into

households, and should be kept in mind when interpreting the figures in the above table.

The figures for improved water access may also be an underestimation, as there was no indication whether the water points were functional, or properly/consistently used. It is important to differentiate between drinking and non-drinking sources. Having access to a safe source does not necessarily solve the health problems associated with water. A "safe" water source, such as a borehole (Ph. 2.3, 2.4), may be used by a community for drinking, while another "unsafe" source (e.g. streams) may be used for washing clothes and utensils, or for bathing. This is especially true when collection times at safe sources are long due to, for example crowding or poorly functioning boreholes. Similarly, there may be a seasonal variation, where unprotected sources are used more during the dry season when the water yield from boreholes decreases as the groundwater level subsides. In such cases, exposure to *water-borne* diseases may be reduced, but not necessarily to *water-related* ones (e.g. schistosomiasis).

In addition, the water source itself may be contaminated despite being designated an "improved" source. Depending on the depth of the aquifer and soil characteristics, this can be due to livestock excreta or fertiliser use in the vicinity of the facility (Ph. 2.5). Owning livestock is common in Malawi, particularly in rural communities.

Ph. 2.1 Unprotected shallow well used by community in Mwitiwa Village, Thyolo (Aug.2007)

Ph.2.2 Natural spring in Mwitiwa Village (July 2007)

Ph. 2.3 Community borehole with Afridev pump in T/A Chimaliro, Thyolo District (May 2007)

Ph. 2.4 Protected shallow well with Malda pump in Mwitiwa Village, Thyolo (Sept. 2006)

Ph. 2.5 Borehole in Chikwawa, southern Malawi, with a pig and rooster in the stagnant soakaway (Sept. 2005)

2.3.2 Water collection & transport

Most communities in Malawi use containers of various types (usually metal or plastic) and sizes to collect water from a source and transport it home (often on their heads).

Ph. 2.6 Plastic and metal containers commonly used for water collection in Malawi (Sept. 2006)

Water contamination can occur when the containers are filled if the collection vessels are not properly cleaned, or during transport. For example, pathogens present on the walls of containers can contaminate the water drawn from a protected source, unless the former are properly cleaned before filling.

Hands are a common source of contamination during collection and transport. This can either be via transfer into the containers if they are used to wipe them, or if hands come into contact with the water during transport (finger dipping). In one study (Jabu, 2007) of source to point-of-use water quality in southern Malawi, *E. coli* (an indicator of faecal contamination) was found on over half of the hands of the women who collected water from boreholes in two rural villages. At the same time, at least 80% of samples from water stored in the households tested positive for *E. coli* and all tested positive for total coliforms. No *E. coli* or coliforms were detected in the water from the boreholes, pointing to post-collection contamination. This

phenomenon is widely recognised as a problem with water quality in Malawi (Lindskog and Lindskog, 1988) and worldwide (Genthe and Strauss, 1997).

2.3.3 Water storage and use

The manner in which water is stored and used in the households is an important consideration in any initiative aimed at improving water quality. Most households in Malawi store water at home; even those with piped connections, due to the unreliable and intermittent nature of this service. This presents another potential point of contamination, in addition to attracting disease-spreading vectors such as mosquitoes if the storage vessels are not properly covered. Some households store drinking water separately from non-drinking water. In these cases, behavioural patterns may differ in that the drinking water containers may be covered, while others may be left open water (author′s observations). If storage is short term (i.e. the water is used daily), this may not necessarily present a problem with regards to vector breeding, but does not address contamination.

Ph. 2.7 Water left uncovered in a house in Thyolo (Oct. 2006)

2.4 Sanitation

In combination with inadequate water supply, lack of access to adequate sanitation contributed to more than 2.4 million deaths worldwide in 2002, or just over 6% of the total (WHO/UNICEF, 2000; Fewtrell et al, 2007). Included in these figures are both direct (e.g. diarrhoeal diseases) and indirect (e.g. related PEM) impacts. In developing countries, human excreta (due to improper disposal facilities) constitute the most important source of water contamination (UNEP/UNICEF/WHO, 2002), with the most significant indicator playing a role being access to adequate sanitation (United Nations/World Water Assessment Programme, 2003). An example of this is India, where most rivers are highly polluted from the (inadequately treated) sewage load of cities (Jha, 2003). At least 2.5 billion people worldwide remain without access

to even the most basic sanitation facilities, i.e. simple pit latrine (UNICEF, 2009), and the effects of this are evident in the differences in figures for mortality and morbidity in developed and developing countries (Table 2.14). The dates for sanitation access (2000) in the table below were used simply because data for the other indicators is available for years around that.

Table 2.14 Improved sanitation coverage and select morbidity data for select countries

	Data from WHO (2008a)			Data from WHO (2004)		
	% population with access to improved sanitation (2000)	HALE (2003)	YLL due to communicable diseases (% of total, 2002)	DALY's lost to intestinal nematode infections (2002)	DALY's lost to schistosomiasis (2002)	DALY's lost to hookworm infection (2002)
Cuba	98	68	10	1	...	4
Algeria	92	61	50	244	210	38
S. Africa	57	44	77	97	203	37
Malawi	55	35	89	16	286	45
Burkina Faso	9	36	87	318	286	39

NB: DALY= disability-adjusted life years (per 100,000 population); YLL=years of life lost; HALE=healthy life expectancy

Sanitation is described by the WHO as 'at least adequate excreta disposal facilities that can effectively prevent human, animal and insect contact with excreta" (WHO, 1996). Before discussing the sanitation situation in Malawi, it is prudent to briefly introduce different types of sanitation facilities used worldwide and in Africa, where just 60% of the population (45% in rural areas and 84% in urban areas) have adequate access (WHO/UNICEF, 2000).

2.4.1 Types of sanitation facilities

There are many types of sanitation facilities used worldwide. Only two are described in any detail here, as the most commonly used in Malawi: basic pit latrines and ventilated improved pit (VIP) latrines.

2.4.1.1 Basic Pit Latrine

This is the most basic type, representing simply a hole dug in the ground with or without a concrete slab (sanitation platform, or Sanplat). When there is a concrete cover over the hole, the facility is classified as "improved", as in theory it prevents access by insect vectors to the wastes, and minimises human-excreta contact (Ph. 2.8). The term "in theory" is stressed on here, since it is up to the users to ensure than the facility is kept clean, and the hole in the slab is covered after use. This comes down to behavioural practices, and is discussed further in a separate section on hygiene. Depending on the quality of the structures and the nature of the soils, pit latrines are prone to collapse in the rainy season, and new ones have to be built every one or two years (Grimason et al, 2000).

Ph. 2.8 A traditional pit latrine in Thyolo District, with a concrete slap (Sanplat) and cover (Nov. 2006)

Ph. 2.9 A traditional pit latrine in Ndirande, one of Blantyre's poorest and most densely populated slums (June 2007)

2.4.1.2 Ventilated Improved Pit (VIP) Latrines

A diagram of a VIP latrine is shown in Fig.2.5 below.

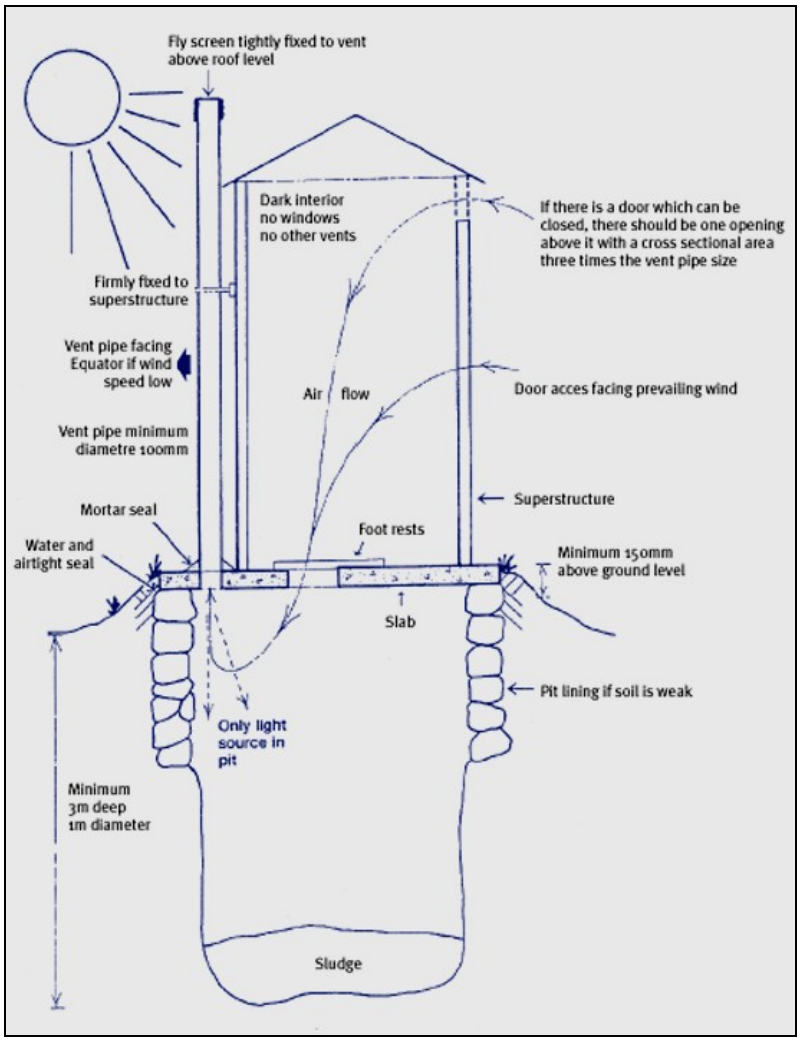


Fig. 2.5 Diagrammatic representation of a typical VIP latrine (WaterAid, 2008)

These latrines have the advantage of reducing odour and certain vectors (flies and mosquitoes) commonly associated with traditional pit latrines. Their design allows wind flow across a vent pipe over the pit, drawing air from the inside of the facility

and creating a downdraught of air through the squatting area, removing odours. The design also targets flies, in two ways. Female flies outside are attracted to the odours from the vent pipe, are prevented from flying down to lay eggs by the screen on the pipe. Those flies emerge from eggs deposited by flies entering the pit from the squat hole are instinctively attracted to the light at the top of the vent pipe, cannot escape, and eventually die and fall back into the pit (Cairncross and Feachem, 1983).

2.4.1.3 Other sanitation facilities

These include communal latrines, compost toilets, pour-flush toilets, vault toilets and cartage, and septic tanks. These are not common in Malawi; for example, less than 4% of the population uses flush toilets. Similarly, communal latrines can sometimes be seen in urban areas (public latrines), but the extent of their use is not known, particularly as they tend to be poorly maintained and unhygienic.

Another type of sanitation, ecological sanitation, is being encourage by several groups, and has been piloted in the country. However, it is a timely process, as the idea of handling human wastes and using them in agriculture is not easily accepted, and requires sustained sensitisation and awareness work to promote.

2.4.2 Sanitation situation in Malawi

In Malawi, the Ministry of Health (MoH) is responsible for sanitation and hygiene education. Almost 17% of the population have no access to any sanitation facilities

whatsoever (i.e. use "the bush/field"), 80% use a traditional pit latrine, 1.1% a VIP latrine, and only 3.4% use a flush toilet (NSO, 2005). Not surprisingly, the picture shows stark differences between urban and rural figures, as illustrated in Table 2.14 below.

Table 2.15 Access to sanitation (%) in Malawi (adapted from NSO, 2005)

	National	Urban	Rural
Flush toilet	3.4	16.2	0.8
Traditional pit latrine	79.4	76.1	80
VIP latrine	1.1	2.3	0.9
No facility/bush/field	16.1	5.2	18.2
Total	100	99.8	99.9

Nearly one in five Malawians are without any form of sanitation, exposing them to a host of health hazards described at the beginning of this section. It is important to draw attention to the term "traditional pit latrine", which usually refers to a hole in the ground which may or may not have a superstructure, or a concrete sanitation platform. The figures for sanitation may be misleading, as the data are based on surveys. They do not differentiate whether sanitation facilities were hygienic (surfaces free of faecal contamination) or properly used, as access to a sanitation facility does not translate into its proper use (Ph. 2.10). Therefore, the 80% reporting using a basic pit latrine does not necessarily translate into "safe" sanitation. Also, certain groups will often not use latrines at all (e.g. children <5), or for cultural reasons some adults will not use latrine used by other family members (e.g. mother/father-in-law). Finally, the figures represent a "snap shot" of the situation, as pit latrines are often seasonal, breaking down during heavy rains or wind, or due to poor construction (Grimason et al, 2000).

Malawi is one of the fastest urbanising countries in the region, with an urbanisation rate three times the world rate (GEO 3, 2004) and the implications are clearly evident when looking at the housing situation in Blantyre, the country's commercial capital: at least 40% of Blantyre is comprised of unplanned settlements.

Ph. 2.10 Soiled pit latrine with no cover, Southern Malawi (May 2007)

2.5 Hygiene and behavioural contributions to WSH related diseases

Three categories are referred to: personal, household, and environmental hygiene. Personal hygiene is further separated into general personal cleanliness and handwashing, because the latter in and of itself has been shown in studies to have its own separate effects on health, in particular diarrhoeal and respiratory diseases

(Ryan et al, 2001; Rabie, 2002). These subdivisions are necessary to put the social and behavioural issues in the spotlight when discussing the roles of hygiene and health education in infectious disease prevention.

2.5.1 Personal hygiene

Luby et al (2005b) examined the impact of hygiene education and handwashing with soap and water on diarrhoea, pneumonia, and impetigo in children in a community in Karachi, Pakistan, whose drinking water was heavily contaminated with faecal pathogens. In addition to regular visits to distribute soap to the study households, they provided intensive and continuous education and encouragement of handwashing to the mothers. The control households received health education in areas unrelated to hygiene and prevention of infectious diseases in children. The result was reductions of 53%, 50%, and 34% in diarrhoea, pneumonia, and impetigo respectively compared to the control households. The duration of diarrhoeal disease was also reduced, as well as a 26% reduction in hospitalisation of these children. Interestingly, education and handwashing with soap and water produced positive results for diarrhoea and pneumonia irrespective of the children′s nutritional status, and despite a poor quality water source.

Two things to bear in mind with studies of handwashing with soap are the economic (cost to households) and social (preferences for its use) factors. In communities already living below the national poverty lines, as are 65% of Malawians (WHO, 2007), the seemingly low cost of soap is unlikely to be high on the priority list of household expenditures. Similarly, even if soap is present, it may be preferentially

used for washing clothes or the rest of the body (Curtis, 2003). Social motivators such as wanting to appear/smell clean in order to eliminate visible or olfactory signs of "dirtiness" were demonstrated in two studies in Ghana and India (Curtis, 2001; Curtis et al, 2001). Most of the studies related to handwashing focused on soap as a cleansing agent; however, other things such as ash/sand or water are also used.

General personal cleanliness is used here to denote hygiene other than handwashing. Washing/bathing is an important means of reducing skin infections such as impetigo (Ph.2.11), and the more disabling blindness due to repeat ocular infections with *C. trachomatis*. The impact of facial cleanliness on trachoma is particularly noted, forming part of the WHO Alliance for the Global Elimination of Trachoma's (GET) SAFE strategy. The last two components, facial cleanliness and environmental measures, are dependent on sustained changes in personal and environmental hygiene to interrupt the transmission *C. trachomatis* via either person-to-person pathways or through autoinfection (Kuper et al, 2003). Clean faces, generally defined as "the absence of nasal and ocular secretions", are proposed to reduce the incidence of active trachoma by making the face less attractive to flies (Taylor et al, 1989).

Specific health issues related to water accessibility were discussed in section 2.3, but it is important to reiterate the role of having sufficient quantities of water to go with intensive and sustained education and hygiene promotion (Bosch et al, 2002; WHO/UNICEF, 2003), as the main direct benefits from increased water quantity are derived from its use in hygiene.

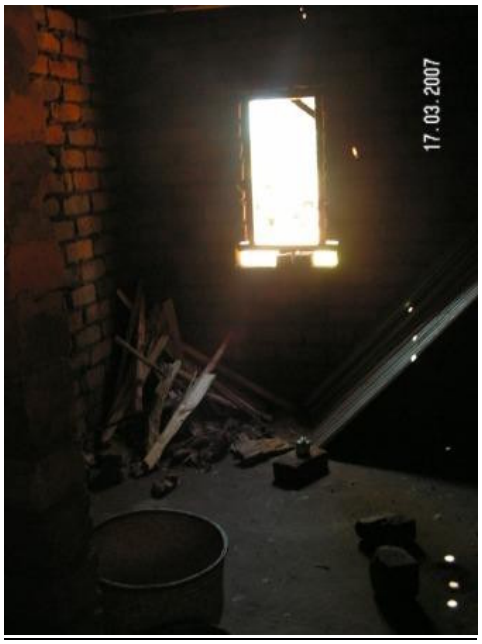
Ph. 2.11 Impetigo in a 2-year old in an orphanage in Ndirande, Malawi (Aug. 2007)

2.5.2 Household hygiene

Household hygiene here refers to the house itself (indoors) and the immediate surroundings. It is where young children spend a large portion of their time, whether in play (walking-age children) or accompanying their guardians (e.g. mothers) as they attend to chores. Air quality is an important issue here.

2.5.2.1 Indoor air quality

Indoor air pollution (IAP) is usually a result of the use of biofuels for cooking or from dust and related particulate matter. Associations with biomass use and ARIs in children, chronic obstructive pulmonary disease (COPD) and other respiratory conditions in women, and cataracts in women have been reported (Mishra et al, 1999; Smith, 2000). The impacts of these are compounded in homes with poor sunlight (Ph.1.12), where the natural effect of solar radiation is not present.



Ph. 2.12 A cooking area in a household in Katundu 3 Village, Thyolo (March 2007)

2.5.2.2 Other risk factors

Apart from IAP, the state of the house itself contributes to the health of its occupants. This can be in the form of uncleanliness attracting vectors, small children and toddlers exposed to disease via dirt and contaminants on the floors, or simply pathogen transfer through fomites. Household flies density, for example, was one of the risk factors associated with severe inflammatory trachoma in a study of Tanzanian children (Taylor et al, 1989). Animals in the house also present an exposure risk (Ph. 2.13).

Ph. 2.13 A goat that interrupted a FGD during the research in Thyolo (Nov. 2006)

2.5.3 Environmental hygiene

Evidence suggests that the implicated flies are attracted to faeces lying in soil, rather than in latrines (Emerson et al, 2000). Since flies and other vectors do not necessarily target human faeces exclusively, having animals close to the residences (Ph.2.14), as is common in Malawi and elsewhere, is problematic. Similarly, improper [non-excreta] waste disposal, for example by dumping in surface water sources, impacts public health by causing water/soil pollution or attracting disease vectors such as flies, rodents, and mosquitoes.

Ph. 2.14 Rural households often live in close proximity with livestock, and excreta from the latter are frequently found around the houses (Sept. 2005)

2.6 Summary

Chapter 2 has outlined some of the major health problems directly and indirectly related to environmental risk factors, globally and in Malawi. Most of these are inextricably linked to the faecal-oral transmission cycle of pathogens, and the subsequent impacts extend into virtually all indicators related to population development, from mortality and morbidity, to education and poverty reduction. Therefore, addressing this transmission cycle through improvements in water supply, sanitation access, and hygiene practices will have a positive impact on population health and sustainable development overall.

An important theme that has been apparent in this chapter is the existence of technical (e.g. water source, latrines) and behavioural factors in determining just how much one factor affects another. For example, proper use of improved sanitation facilities, or avoiding post-collection contamination of water from an improved source, play a crucial role in determining the health impacts of increasing access to these. It is also important to acknowledge the importance, when taking steps to improve the health of a given population, of taking into consideration local preferences in dealing with health, for example, utilisation of health-related infrastructure (e.g. health facilities, sanitation facilities); such considerations may range from physical location to confidence in the providers.

The complex nature of these problems, made even more complex by their inter-relatedness to other factors outwith the WSH sector (e.g. poverty, genetics), mean that untangling and quantifying causal relationships is extremely difficult even under the best of situations (from a financial and human resources point of view). Whether quantifying all indicators is actually desirable remains to be seen, and presents a whole new set of considerations, including time, funds, and capacity, among others. However, in order to improve public health indicators, in the case of this research indicators related to WSH, it is necessary to be able to map and predict the impact that interventions will have on these. These issues are introduced in Chapter 3.

Chapter 3- Sustainability and Health Impact Assessment in development projects

3.1 Development projects and population health

This chapter introduces development programmes and their potential impacts on population health, followed by discussion on the different ways in which their health impacts are assessed. Various models of impact assessment are introduced, and with further discussion on indicators of health impact and sustainability in development programmes in the water, sanitation, and hygiene sectors.

3.1.1 Development within the health sector

Some projects explicitly target improvement in some aspect(s) of health as the desired end result. In developing countries, particularly in the Sub-Sahara Africa (SSA) region, examples of some common health-oriented projects are:

- Prevention and/or treatment of communicable and/or vector-related diseases (e.g. HIV/AIDS, malaria, schistosomiasis, human African trypansomiasis, onchocerciasis). An example is Medecins Sans Frontiere's (MSF) programme to increase provision of antiretroviral therapy (ART) and management of AIDS-related opportunistic infections (OIs) in Malawi. Another is the Onchocerciasis Control Programme, where the Malawi Ministry of Health and Population (MHP, herein referred to as Ministry of Health, or MoH) oversees the yearly distribution of ivermectin to communities where the disease in endemic (including Thyolo).

- Maternal health and improving neonatal health and survival (e.g. Safe Motherhood's programmes in Malawi)

3.1.2 Development in other sectors

Even if an improvement in health status of the beneficiary population is not an identified outcome measure of a project or programme, almost any change brought about as a result of a policy, programme, or project will have an impact on health, for example nutrition status and food security (Birley and Peralta, 1992). Within these are programmes not necessarily within the health sector per se, but which target common contributors (in bold text below) to determinants of health, for example:

- Programmes to improve **water supply and sanitation** (alone or in combination): reducing mortality/morbidity from diarrhoeal diseases, intestinal helminths, etc.

- **Nutrition** and **food security**: either by distribution or increasing the capacity to acquire adequate quality and/or quantity of food (e.g. agriculture).

At the same time, seemingly unrelated programmes also have impacts on health, albeit through different mechanisms. For example:

- Mining and other resource development (particularly water), for example, the controversial uranium mining project in northern Malawi. Apart from

direct environmental and health concerns (e.g. from mine tailings), projects such as these involve significant migration of workers away from their families, and concerns here include transmission of HIV and other sexually transmitted diseases.

- Improvements in education sector. Encouraging school attendance by girls is especially significant, as they are more likely to default early from education. However, outcomes are also affected by sociocultural factors, such as early marriage and even availability of sanitation facilities in schools. Maternal education has been shown to influence child mortality (Cleland and Van Ginneken, 1988; Bicego and Boerma**,** 1993) possibly due to an association between level of education and household economic status, increased likelihood of a more educated mother having her children vaccinated, or increased ability to understand/process health education messages.

While the specific objectives of development projects depend on their area and scope of operation, it is acknowledged that to maximize the benefits they impart onto the recipient populations, participation of the latter in all stages (from planning onwards) is fundamental. This, along with its often ambiguous definitions, is discussed in context in section 3.3 dealing with sustainability and impacts of programmes. Since this research focused on WSH programmes, these will be the main point of reference, although the ideas and implications are applicable to many other areas of development.

3.2 Impacts of programmes on population health

Predicting and monitoring impacts of programmes on populations, particularly health impacts, is a complex issue. Projects will always have wide-reaching effects across sectors (health, social, economic, educational). However, multi-sectoral approaches to health improvement projects are not the norm, although such approaches are more cost-effective in the long run as costs are shared by multiple sectors and impacts magnified (Listorti and Doumani, 2001). Nevertheless, some of the larger multilateral groups have in recent years recognized the need for more integrated approaches to health, albeit specifically maternal and child health. This is seen, for example, through such initiatives as the Bamako Initiative in 1987, Integrated Management of Childhood Illnesses in 1992, and Accelerated Child Survival and Development in 2001 (UNICEF 2008). Similarly, USAID/HIP recently published a document on guidelines for integrating WSH improvements into HIV/AIDS programmes (USAID/HIP, 2008).

One example of the disjointed collaboration between sectors can be seen in the case of lead exposure. Efforts to reduce human exposure in the past decades have been only partially successful, very likely because approaches to this have been confined to single sectors (e.g. medicine, engineering, policy). Most notably, these have focused on exposure through leaded gasoline, whereas other routes have not received the same attention. For example, in Mexico City, human exposure through traditional pottery may in fact represent a (quantitatively) more important route of exposure for some than vehicle emissions, despite the latter being the focus of interventions (Listorti and Doumani, 2001). Similarly, one study in a group of school

children with elevated blood lead levels showed that chewing lead pencils accounted for the same level of lead exposure as walking to school near heavy traffic, with each accounting for about 40% of total exposure (Palazuelos, 1993).

It is not surprising then, that the use of multi-disciplinary indicators becomes uncommon, particularly when, as evident in Malawi, collaboration between sectors is weak (Anon, 2006). The efforts to emphasize health impacts, alongside other considerations, in both health-related and non-health programmes continues to gain momentum however; regardless of the motives being financial or truly out of concern for population health. The following sections introduce health impact assessment (HIA) as a developing tool worldwide, then focuses on its potential supporting role in targeting rural NGO WSH programmes in resource-limited settings such as Malawi.

3.2.1 Health impact assessment

Although it is accepted that virtually any policy, programme, or project will have an impact on health, acknowledging and attempting to document these explicitly is a relatively new school of thought. Health impact assessment (HIA) took off as a concept in the early 1990s with the explicit aims of defining, estimating, and managing impacts of policies, programmes, projects, and other activities on the health of a defined population (Scott-Samuel, 1998; ECHP/WHO-ROE, 1999; Kemm, 1999; Kreiger et al, 2003). Prior to that, in the 1970s and 1980s, health was represented within the context of environmental impact assessment (EIA), albeit in a somewhat cursory manner (Birley and Peralta, 1992; Elliston and Edwards, 1999;

Morgan, 2007). Even then, health impacts tended to be those related to environmental changes brought about by the activity, and in the context of risk assessment. An unavoidable result of this approach is simply transferring the issues associated with health (and their hidden costs) to other sectors to deal with (Birley and Lock, 1999).

In a study of 42 EIA papers in the US, Steinemann (2000) found that less than half mentioned health impacts at all. Those that did adopted a narrow analytical approach to the impacts, for example, using risk assessment to quantify potential carcinogenic effects of a single substance over a single generation. This is but one illustration of the subjective nature of EIA (among others); this point is elaborated on in the section dealing on the biomedical approach to HIA. Unfortunately, such narrow approaches to health mean that other, broader contributors to morbidity and mortality are overlooked and potential risks from interactions between these (including cumulative effects) are not addressed.

Although there is no single accepted methodology for the HIA process, it relies much on other, older, types of impact assessments (especially EIA). Like EIA, the stages of a prospective HIA are based on: screening, scoping, data (including baseline) collection and analysis, prediction of impacts, dissemination of findings and recommendations, and (in some cases) evaluation of the assessment itself. However, unlike EIA, a fundamental difference is that HIA is concerned with the means as well as the end (Banken, 2001). The similarities can be seen in the following graphical comparison of both processes (Box 3.1).

Box 3.1 EIA vs. HIA methods

Environmental Impact Assessment
(modified from Thomassen et al, 2003)

Screening: Project description; is EIA needed; at what stages?

Scoping: identify issues, set EIA terms of reference (TOR)

Impact assessment: prediction of impacts & their significance

Mitigation: identify methods to prevent, reduce, or compensate for adverse impacts

Report: prepare EIS for decision-making

Review: check quality of EIA report

Decision: accept or reject proposal

Follow up: monitor & manage impacts of project implementation (if approved)

Health Impact Assessment
(modified from Harris et al, 2007)

Screening: Project description; is HIA needed; at what stages?

Scoping: community profile, identify issues, set HIA

Assessment: prediction of health impacts & their significance; prioritise

Decision & recommentations: on acting on HIA's findings

Evaluation & Follow up: evaluate HIA process, develop impacts management plan of activity

The dependence of HIA on EIA and other, more established types of impact assessment (IA) is both cause for optimism and concern. There is already a wide array of expertise and literature on other forms of IA, and so the transition from health impact considerations as part of other IAs to becoming a separate field was relatively uncomplicated. However, with the close relation of HIA to other IAs comes the potential for effectively "reinventing" methodologies and approaches to IA. The HIA community itself is relatively well established in many parts of the world (e.g. Europe, Asia, Australasia), with networks along academic and electronic

fora; for example, electronic platforms exist for the International Association for Impact Assessment (IAIA)-Health, UK and Ireland HIA network (including separate sub-networks for Wales and Scotland), and the Asia Pacific HIA network (APHO, 2007; IAIA, 2008), among other national HIA groups in the United States, Canada, Finland, New Zealand, the Netherlands, and elsewhere.

With the large amount of information sharing, the problems of "recycling" of methods, case studies, and developing literature risk the HIA field developing in relative isolation, with variable levels of interaction with other IA communities (Morgan, 2003). A simple literature search for methods and tools for use in HIA leads to a multitude of results ranging from relatively short indicator checklists and surveys, to health matrices, to more complicated mathematical models (Franssen et al, 2002; Bos et al, 2003; Abdel Aziz, 2007; WHO-ROE, 2007).

At the same time as HIA is building its own identity, it is also developing as a sub-field within other IAs; this can be seen in the numerous guides being published on HIA, EHIA (environmental HIA), HIA within RIA (regulatory impact assessment), HIA within SEA (strategic environmental assessment) and others (Birley and Peralta, 1992; Birley, 1995; New Zealand Public Health Commission, 1998; Health Canada, 1999; Scott-Samuel et al, 2001; Hassan et al, 2005; Wright et al, 2005; Harris et al, 2007). While these are welcome additions to the growth of a relatively young field, the numbers and variety of publications are testimony to the flexible nature of HIA and other IAs, and the need to be able to adapt them to different situations.

3.2.1.1 Nature of HIA

HIAs can vary in complexity from a short desktop exercise, a rapid appraisal/overview, to a comprehensive, resource-intensive detailed study (Parry and Stevens, 2001). The approach employed and the scope of the HIA depend on the situation, desired outputs, time/resource availability, and even the level of interest or concern of the stakeholders (Franssen et al, 2002). Three types of HIAs are referred to in the literature: retrospective, prospective, or ongoing/concurrent (Kemm, 1999). While these distinctions set out the relative timelines of the assessments within interventions, separate chronological definitions of HIA can be misleading and confusing.

Ideally, HIA of a policy/programme is carried out before its commencement, even in the planning and proposal drafting stages, and assessments continued as far as possible into the life cycle of the intervention. In fact, if the purpose of the exercise in a programme or policy, according to the widely-adopted definitions, is to anticipate health impacts and develop ways with which to manage them, then by definition HIA should be prospective (Morgan, 2003). A concurrent HIA would in effect be a monitoring and evaluation exercise, with a retrospective HIA an "audit" or "lessons learned" mechanism.

Categorising HIA based on a programme/project's phases implies that there is some discretion about the point at which health impacts can be considered. If the purpose of HIA as set in its definition is accepted, then: an HIA is prospective in nature, and a "concurrent" HIA is "M&E", and the need for the term "retrospective" HIA is

negated. However, the health impacts of existing projects serve as the best indicator of the performance of future ones (Birley and Peralta, 1992). Therefore, it is important to document successes and failures of programmes for use in planning future ones; a retrospective HIA in effect becomes a tool for documenting "lessons learned". This is especially important for community-level programmes in resource-constrained settings, where the processes of planning and evaluating interventions operate within a much narrower scope than in countries with where HIA is developing most rapidly (and with less capacity limitations).

Also of importance, and to highlight the potential ambiguities in applying HIA, is the question: health impact on *who*? Many large projects (particularly those involving infrastructure development and environmental modification), those of international governmental organisations for example, have geographically wide-reaching impacts. Some examples of this are the intensive damming on the Euphrates River, international/regional toxic waste dumping, and oil/petrochemical projects. Are the health impact considerations to be limited to the project workers, as in the HIA conducted on the Chad–Cameroon petroleum development and pipeline project where the HIA was disproportionately targeted at the project's workers (Utzinger et al, 2005)? Are they to focus on the immediate community (and how to delineate the boundaries?) or a wider surrounding area; as for example, in the case of congestion at water points used by several villages? What about communities further "downstream", whose residents may be affected in the longer term by the programme? These are just some considerations which need to be further specified within the HIA field, but would need to be negotiated on an intervention-basis.

3.2.1.2 Approaches to HIA

Although the range of activities that are described as "health impact assessment" is vast, there have been two basic streams of thought in considering health impacts. The biomedical approach tries to adopt an evidence-based focus in its assessment, and highly favours the quantification of impacts (Mindell et al, 2001). The social sciences approach, on the other hand, is largely concerned with more qualitative input from the populations affected by the project/programme/policy (Kemm, 2004). In reality, the outcomes are often mixed in nature. The main approaches are introduced below.

3.2.1.2 .1 Biomedical Approach

Biomedical approaches to HIA are largely concerned with direct impacts of programmes on health (Morgan, 2003). Models within this line of thinking have been those most used with EIAs and EHIAs in development, be it for aid or for projects (Elliston and Edwards, 1999; Bos et al, 2005). They focus on translating identified health hazards (communicable and non-communicable diseases, injury, malnutrition, psycho-social illness, etc.) into health risks by using baseline and routine data, and strategising methods by which these risks can be managed. Routine data is that which is collected at regular defined intervals, and not for preset study/research purposes. These include, but are not limited to, information from healthcare centres (in/outpatient cases, health outcomes, disease prevention), census (demographics), exposure data (smoking, air pollution), and geographical data (locations of certain facilities/services). This type of data, where available and of

adequate quality, is practical both for creating a baseline health profile of the affected community and for forecasting (and monitoring) health impacts (Lock, 2000; Parry and Stevens, 2001).

The main challenges with the biomedical approaches are generally technical; for example, availability of epidemiological data, establishing causation, and statistical stability of data (Hansell and Aylin, 2003). Reliance on quantitative, epidemiological/toxicological data places most low-income population at a disadvantage, as the data required is usually unreliable at best, or simply not available (Birley, 2002). Indeed, the problems of availability of valid quantitative data, along with the tools to analyse them and subsequently translate the information into health impacts (Veerman et al, 2005) of the intervention are not always confined to resource-limited areas.

Furthermore, the confounding relationships between health status indicators, for example, malnutrition and infection, immune status and infection, and co-infections are astoundingly complex in the best of settings, and are virtually impossible (and impractical) to disentangle in resource-poor settings. The complexity of disease pathophysiologies, and the many contributors to (in this case) Malawi's most important health conditions were outlined in the previous Chapter. These are further complicated by the fact that diagnostics and follow-up in the country are usually inadequate outside of the few research-affiliated institutions, which are out of reach of most of the population.

Depending on the scope of the HIA, it may be more difficult to explain the findings in this and other highly quantitative models to persons in disciplines outside the health or sciences fields; a point which could have implications for how the HIA outputs would be used by decision-makers. Without the ability to translate (often) highly technical quantitative information into a form easily understood by policy/programme decision makers, HIA can easily become a tool for manipulating decision-making.

3.2.1.2 .2 Social Determinants Approaches

Social approaches to health are more qualitative in nature, and concerned with indirect effects of programmes/policies, and the attitudes and concerns of the affected populations. There is heavier reliance on qualitative data, utilising a multitude of methods to gather information. Consultation with the affected communities is the central theme, with the aims of identifying and bridging inequities in health and its determinants. In effect, the qualitative nature of these approaches help to "explain" rather than "show" the trends in health changes.

However, this poses some challenges to IAs, including HIA (Morgan, 2003). Indirect impacts on health may be linked to specific changes resulting from an activity; however, the social environments and their coping mechanisms have much to do with how these changes are perceived and dealt with, and therefore their impacts. Therefore, the health impacts that a given activity has on population health are usually as dependent on social and behavioural factors as they are on biological and environmental ones. Although one of the initial founding principles of HIA was

acknowledgement of the contribution of socioeconomic factors to population health [WHO, 1986; ECHP/WHO-ROE, 1999], these are much more difficult to extract, analyse, and present.

The above realisation was one of the factors which drove the World Health Organisation to establish a separate Commission on Social Determinants of Health (CSDH) to address the social contributors to ill health and inequity. The Commission's latest report states that it is the "toxic combination of bad policies, economics, and politics" that is largely responsible for the fact that a majority of people in the world "do not enjoy the good health that is biologically possible" (CSDH, 2008). This highlights the complexity assessing human health determinants, and the need for multidisciplinary approaches in these assessments. To take this point further, it the idea of "social determinants" is accepted, then by definition this means realising that, apart from the core ("scientific" or "biological") determinants of health, most others are situation-specific. In other words, the determinants of health must be *extracted* from the communities on whom an HIA is being conducted.

3.2.1.2 .3 Integrated approaches

Ideally, impact assessments (health and other) should employ a combination of qualitative and quantitative interdisciplinary data collection methods, in order to both identify and explain health determinants and trends, and to widen the options for maximising health benefits of an activity. As with HIA in general, more integrated approaches are seen mainly in policy assessments in developed countries (Kwiatkowski and Ooi, 2003; Utzinger et al, 2005).

3.2.1.3 Models of HIA

Several models of HIA have been developed, including those focusing on government programmes at national and local (Ratner et al, 1997; The Federation of Swedish County Councils, 1998) levels, and those specifically concerned with environmental health (WHO Working Group, 2000). Some of these are summarised in Table 3.1. Veerman et al, 2005 argues that the growing number of methods and data types being used in HIAs necessitates the standardisation of methods and development of clear protocols, to allow for reliable comparison amongst HIAs. However, it this is done too rigidly, it can potentially hinder the flexibility of HIA in different social, political, and economic settings, especially when the interventions are dealing with some of the more vulnerable groups. If this happens, the HIA field may eventually (and unintentionally) lose sight of the definition of "health" as being extremely dynamic, and end up a cluster of "one size fits all" approaches. HIA should ideally develop as a field that is as diverse as the determinants of health of target communities.

Table 3.1 Types of HIA approaches and examples of specific models

Approach type	Example of Model	Comments	References
Largely "qualitative", "broad focus", or "community focused"	Merseyside Mode	Developed for local or central government; impacts rated according to measurability & likelihood of occurrence.	*Fleeman and Scott-Samuel, 2000; Scott-Samuel, Birley & Arden, 2001*
	Swedish County Councils Model	Health impacts of policies, especially on those suffering health inequalities; Utilises questions and health impact matrix (rapid assessment tool)	*The Federation of Swedish County Councils, 1998*
	British Columbia Model (Winters, 1997)	Designed for assessing health impacts of non-health policies; set of questions to evaluate impacts on individuals & communities	*Population Health Resource Branch, 1994; Health Canada, 1999; Winters, 2001*
Largely "quantitative" or "tight focus"	Bielefeld Model	Environmental health impact assessment; epidemiological & toxicological methods, modelling	*De Hollander et al, 1999; Fehr, 1999; Ponce et al, 2000*
	New Zealand	Focused on environmental health and HIA as part of EIA	

3.2.1.4 Considerations in applying HIA in NGO development projects

Although the following sections focus on the challenges with HIA of development projects in low-resource settings, many of the considerations are also applicable on a more general level.

3.2.1.4.1 Capacity to generate and utilise data for HIA

The majority of the literature, developed by and for users in developed countries (e.g. UK, Europe, Canada, New Zealand) or large global institutions (e.g. World Bank, IMF) are difficult to implement in developing countries due to financial and human resource constraints in terms of developing terms of reference for, setting up, and conducting a formal HIA (or acting on the issues identified therein).

An HIA, like other IAs, is only as good as the evidence used to produce it. Where reliable quantitative health data is readily available, this has routinely been used. If this epidemiological approach is to be used in an HIA, sufficient baseline data (of good quantity/quality) must be available and accessible, along with established and reliable means for collecting health data for the duration of the activity's proposed timeline (Hansell and Aylin, 2003).

Recent attempts have been made to address some of these specific challenges in the context of water and sanitation. Fewtrell et al (2007) review the literature on the causative relationships between WSH and associated diseases, and present methods by which to quantitatively assess local health burdens of WSH based on several

community water and sanitation scenarios (Prüss-Üstün et al, 2004). However, while the methods are more suited for decision-making in policy and large-scale development initiatives, the time and capacity required render them largely out of the scope of many smaller, individual players (e.g. NGOs).

3.2.1.4.2 Time

Changes in health (or at least obvious ones) are rarely instantaneous. There is usually a lag period between activities and development of [measurable and significant] health outcomes, which can present problems with donor-funded programmes requiring "quick" results (Ball and Ball, 1991). There is still no consensus in the literature on the timeframe over which an activity's "health impact" is considered. The issue of causality also presents a challenge; if the cause-effect relationship between a project activity's result and certain health problems is not clear-cut, relationships between other confounding factors will become problematic, and will leave the HIA itself open to controversy.

In addition to the above, conducting an HIA itself takes time, depending on the scope of the assessment. Timeframes for conducting an HIA range from a few weeks for short ("desk based") studies, to several months for larger, in-depth ones assuming one person carrying out the assessment (Harris et al, 2007). If an HIA is to be successfully integrated into proposed policies or programmes, it must conform to their timeframe while simultaneously presenting the findings in a manner that is acceptable and understandable by different decision-making parties (Kemm, 2003).

This means that the type of evidence and methods used must be carefully selected to take all these considerations into account.

3.2.1.4.3 Participation

Central to the concept of HIA (and sustainability) is participation of the stakeholders in the process. While participation enjoys a somewhat ubiquitous status in the literature, like sustainability, its parameters remain inadequately defined in practice; in fact, opinions amongst the HIA community is often divided with regards to what constitutes "participation" and its actual usefulness (Mahoney et al, 2007).

Theoretically, any and all groups potentially affected by an activity would be able to participate in the HIA process. Practically, however, this presents enormous time, cost, and logistical constraints (Parry and Wright, 2003). In many cases, the user groups most affected by a programme or policy may be difficult to engage for cultural or other reasons.

Participation in the HIA process itself may have beneficial results on the participants, ranging from perceived lowering of "barriers" between communities and "experts" or "decision makers", to promoting dialogue amongst representatives from different stakeholder sectors (Mindell el al, 2001; Banken, 2003). However, achieving optimum and truly representative participation takes time and a sustained relationship between parties (Parry and Wright, 2003), not simply gathering community members and experts to discuss a programme/policy.

3.2.1.4.4 Funding for conducting HIA

Health projects in developing countries, including those in the water, sanitation, and hygiene sectors, are frequently funded (at least in part) by external parties. In other words, a large part of the implementing group′s accountability is usually to the donor(s). In the case of NGOs, the donor agenda frequently affects the scope of the project itself, including M&E requirements (Carter et al, 1999). Donor groups (along with other stakeholders) usually prefer quantitative indicators in reports on the projects they have funded, which usually means the indicators used are "hardware" indicators (e.g. number of water points) (Ball and Ball, 1991) not necessarily representative of the true impacts on populations in the longer term.

3.2.1.4.5 Obligation to act on HIA findings

Even where HIA has been legislated and criteria set out for when it is mandatory, there is usually no enforceable obligation for the project implementers to act on the findings. This is partly illustrated in the case of the WB-funded Chad Oil Export Project, where international experts were convened to conduct a prospective environmental and health impact assessment of the programme′s activities, in cooperation with locally-appointed committees. The assessment process documented potential ways to minimise adverse impacts on human health (malaria, minor sexually-transmitted diseases, construction/traffic accidents, respiratory and diarrhoeal illnesses) and the local ecology; however, it was unable to deal with larger issues such as local HIV spread, equitable sharing of the programme′s profits and negative impacts, and its inherent unsustainable nature. Nevertheless, the

findings of both assessments by several panels were "largely ignored" by the project proponents, who had "other, more pressing concerns" (Jobin, 2003).

There have been cases where HIA was employed without proper expertise on the part of the consultants/planners, resulting in incomplete mapping of health impacts. In such cases, HIA can become caught up in bureaucracy (or even to protect decision makes later on), rather than a tool for promoting public health improvements. The danger is that HIA, like other IAs in many cases, becomes simply another arduous task to be completed before development activities can commence, rather than a genuine tool for social, health, and other safeguarding (Banken, 2003).

Banken (2003) argues that, if HIA is to reach its full potential as a tool for promoting and protecting public health, it must be institutionalised; that is, absorbed into the rules and procedures followed by the decision-makers. How this is achieved, and how appropriate the procedure and implications are in a particular circumstance, play a big role in how effective HIA, and other IAs, is in influencing decision-makers (Bartlett, 1989). Institutionalisation of IAs, and the extent to which the findings are binding, depends in turn on the individual political realm within which the assessments are conducted. An example with an EIA from Malawi helps illustrate this point.

3.2.1.4.5.1 Case Study: EIA of Uranium Mining Project in northern Malawi

In Malawi, there is no obligation for any party implementing a new programme to specifically conduct an HIA. Although there are few published examples of IAs in Malawi, one recent example highlights the problems associated with IAs in this and similar situations. A 2006 EIA conducted by a South African Company on behalf of Australian company Paladin Ltd.′s proposed uranium mining project in the north of the country sparked outrage among local civil society groups. After the EIA was submitted, red flags were first raised not by government groups, but by NGOs and local community groups (Centre for Human Rights and Rehabilitation, Citizens For Justice, Centre for Environmental Policy and Advocacy, Catholic Commission for Justice and Peace, Foundation for Community Support Services, Uraha Foundation Malawi, and Karonga Development Trust), about the document′s inadequate handling of potential environmental and public health, social, and economic risks to the local communities. These groups accused the EIA of failing to, among other things: specify mitigation/compensation measures upon closure of the mine after the 7-year project timeline; use timely data in estimating socioeconomic and environmental changes; provide case studies of uranium activities, and use accurate animal exposure studies; develop and commit to a closure plan of the project.

In response to public requests for transparency of the agreement between the company and the Government of Malawi, the Finance Minister stated that ‘‘certain details of the agreement have to be kept secret’’. Similarly, NGOs reported threats and harassment being received by their members who refused to back down (Semu-Banda, 2007). This scenario, without pointing fingers at individual parties,

highlights some of the problems faced when development processes lack transparency, and where the public has limited involvement in top-down approaches to policies and programmes.

Chaulagai et al (2005) report on issues with Malawi's health management and information system (HMIS), citing lack of reliable data and "grossly inadequate appreciation and use" of available information in planning and management of health as the two main weaknesses in the country's HMIS system. Despite reform measures being introduced into the health system, in the form of training, improved documentation and monitoring at health services at different levels, and information management, the authors report scant improvement in the actual use of information in rationalising decisions. They conclude that, no matter how adequate the HMIS is, it is of little use if there is no political will to promote the system. The above logic can reasonably be extended to the issue of mandating IAs, as there is little use in committing often already-scarce resources into formal assessments if there is little government backup to enforce the findings (Gulis, 2004).

3.2.1.5 Potential roles of HIA in NGO WSH programmes in Malawi

Having discussed the idea of HIA and its benefits and problems, it is clear that the field is in a stage of ongoing development, no single set of methods exist for its implementation, and the criteria for its conduction situation-specific. Its inherent challenges become even clearer in the context of settings like Malawi. Having said that, the developing nature of HIA has the advantage of allowing some flexibility and innovation in its (and other forms of IA) use.

In the context of water supply and sanitation (WSS) programmes, Ahmad and Alibhai (2001) conducted an HIA of a WSS project implemented by the Aga Khan Planning and Building Project (AKPBP) in villages in northern Pakistan. They used several methods to do this, including baseline surveys on incidence and knowledge of diarrhoeal disease, different hygiene practices, and observation of environmental hygiene status in/around the houses. The results were then compared to later ones repeated at 4-6 week intervals after the interventions. Also, these were compared to matched villages that did not have any interventions. They report that, from July 1999 to January 2001, there was a 58% median reduction in diarrhoeal disease incidence in the villages of one of their study areas, along with significant improvements in indicators of hygiene behaviour (e.g. handwashing times). However, the variation in reductions in diarrhoeal disease incidence in this study was large (0-100% reduction). This may be due to uncertainty factors such as recalling incidents of diarrhoea or defining what respondents considered "diarrhoea". Nevertheless, it is just one illustration of the difficulties in reliably estimating true quantitative health impacts of WSH programmes, which in turn highlight the need for situation-specific methods to be developed *in situ*. This is especially important when the HIA methods used in the past are as time, resource, and expertise-intensive as the one performed in northern Pakistan, was presumably internally funded (the authors at the time worked in the AKPBP). In NGO programmes whose flexibility in M&E is to a large determined by donors as well as their institutional capacity, the methods used in the past would likely make changing the status quo unattractive to the implementing agencies.

To minimise confusion in terminology and definitions, it is prudent at this point to clarify some points. First, recognising that health impacts of activities are frequently considered in the context of other assessments, and therefore considered health impact assessment, reference to "HIA" henceforth refers to deliberate and methodological efforts to gauge an activity's contribution (positive and negative) to the health of the affected population(s), or to plan interventions/modifications.

Second, the following assumptions and their implications are defined, in order to set the stage for the potential development use of HIA to improve NGO WSH projects in Malawi:

1) public health is a dynamic phenomenon, composed of multidisciplinary determinants in dynamic relationships. Therefore, individual health impact studies in isolation are not dependable tools for evaluating WSH programmes (World Bank, 1990);

2) in the context of WSH programmes, health impacts are divided between factors that are user-dependent and those that user-independent;
    a. *user-dependent* factors include behaviour (e.g. hygiene) and community cohesion;
    b. *user-independent* factors are those derived from operational sustainability of the programmes/projects (e.g. availability of spare parts and materials);

3) both types of factors are addressed in the context of sustainability assessments of related projects;

4) health impact of WSH projects can be addressed as part of a sustainability assessment, since many indicators in the latter serve as indirect determinants of the programmes′ health impact (e.g. changes in water use, hygiene behaviour). These proxy indicators would then in effect form the sustainability assessment of the "software" component of a WSH programme.

3.3 Sustainability-oriented approaches for rural water supply & sanitation (WSS)

"Sustainability" has become one of the most frequently touted concepts in project planning and proposal development by groups varying from small, community-based NGOs to governments and international agencies. Despite the almost universal occurrence of the term in papers and discussions related to development, only rarely is it explicitly defined in terms of time frames of expected outcomes (Kvarnström et al, 2004). For example, for WSH projects, what is the timeframe over which the functionality of a community-based operation and maintenance (O&M) system of a water point is deemed "sustainable"? Without defining the parameters of what constitutes sustainability, it can be argued that no rural water supply system is truly "sustainable", as eventually there will invariably be a breakdown somewhere along the O&M chain. For one thing, as technology changes, pumps used in an area (or country) may be replaced by different designs, and unless local manufacture of the existing model is ensured, these will eventually become non-functional.

Webster et al (1999) provide a good definition of "sustainability" in rural WSH programmes: "the continuous functioning of the system, both hardware, (physical) and software (non-physical), and the continuance of the derived benefits at the beneficiary level from that system once the "external" hardware and software assistance have been essentially phased out". This will be the definition alluded to from this point on.

3.3.1 Sustainability of water supply programmes

True total sustainability is both a poorly defined and perhaps unrealistic goal, since no matter how much awareness, training, and capacity building, there still needs to be some backup for the most complicated technical issues (Webster et al, 1999). Literature related to sustainability of development programmes is extensive, but for water supply programmes, relatively united on the following themes with regards to maximizing the sustainability (WELL, 1998; Colin, 1999; WHO/UNICEF, 2000; De Gabriele, 2002; Sugden, 2003):

3.3.1.1 User groups' perceptions and expectations

One of the defining predictors of any sustainable development programme's success is the beneficiaries' understanding and appreciation of its value, as well as the implementing party's understanding of beneficiary expectations. In the case of communal water supply programmes, these must be established from the very onset, to prevent the programme's impacts from fading away after direct support from the implementing agency is withdrawn.

The value placed on having an improved water source varies between communities. It is important to keep in mind that any new water source is simply an addition to those already being used by the communities; ones which, regardless of safety, have been used for a long time. Therefore, it is important to establish what factors (quality, quantity, convenience, reliability) drive people to use one source preferentially over another. Usually, it is a combination of all these factors, and patterns of use for different sources may show seasonal variations (WELL, 1998, Chap. 2.5).

3.3.1.2 Promoting community ownership of facilities

Implementers of rural water supply programmes have recognized the importance of instilling a feeling of "ownership" in villages, and require communities to make some (usually nominal) financial contribution as well as labour and materials (e.g. sand, water, quarry stones). Similarly, communities are encouraged to participate (as much as technically possible) in things like borehole siting, O&M management style, etc. While this is unarguably important, it does not necessarily mean that the user groups will be able to sustain the water source.

Especially important are the attitudes of the user groups' towards responsibility for upkeep of the water source. They may feel that "ownership" of the borehole comes from their monetary and labour contribution for its installation, and while they are entitled to its use, maintenance and repair is the responsibility of the government or [for example] the NGO that provided it. This is a recognized problem in Malawi,

where true demand-driven approaches to water resources are seldom adopted (De Gabriele, 2002; Mulwafu and Msosa, 2005). Even if the implementing agency has sensitized the community to the benefits of being able to maintain their own water source, the latter may agree in order to get the facility, but still have a low commitment level to subsequent operation and maintenance. Mulwafu and Msosa (2005) suggest that such state-dependent views may be a legacy from previous approaches to development, which saw the state play a dominant role, or an acquired reaction to unfulfilled promises by political candidates.

3.3.1.3 Identifying and involving actual user groups

In Malawi, and worldwide, the burden of water collection and related tasks are almost exclusively placed on women (World Bank, 1990; WHO, 2000; UN-Water, 2006). For this reason, it is imperative that women are encouraged (and supported) to play an active role in the development of new water sources. The number of women in committees is not necessarily indicative of involvement, as was found in an assessment of VHWCs in two states in India (Stalker, 2001). In some of the communities, women practiced a form of purdah; a tradition where women are completely covered and do not interact with men not directly related to them. Thus, despite making up about a third of the village committees, women were normally represented in meetings by their sons, brothers, or husbands.

3.3.2 Village level operation and maintenance (VLOM) water supplies

The 1980s (Decade for Water and Sanitation) saw a new concept introduced aimed at promoting sustainability of water supply programmes (specifically handpumps): village level operation and maintenance (VLOM). VLOM stemmed from the idea that handpumps could be successful in meeting water requirements of villages, if they were technologically feasible (i.e. reliable and durable in the field), economic to install and maintain at the community level (i.e. cost effective), and spare parts readily available to the communities (Arlosoroff et al, 1987).

Experiences before the 1980s, with different pump designs and post-installation maintenance and repair, revealed problems in both the technical and operational aspects. For example, the so-called "first generation" handpumps developed during the early 1900s, despite being able to withstand the pressures of heavy and prolonged use, were too complicated to service or repair by communities when they broke down. This promoted a centralized system for the maintenance and repair, depending largely on government and other larger players to provide such services (Wood, 1993). Unfortunately, this is not feasible on a large scale. On the other hand, simpler family-oriented pumps used in Europe and N. America for over a century would not be feasible for communal use, as they are not geared towards such heavy usage.

In between the two are the "second-generation" pumps developed during the 1960s-70s. An example is the India Mark II. It emerged along with a 3-level management system: communities would undertake maintenance (Level 1- preventative), local

trained mechanics would undertake complicated repairs (Level 2), while the government (Level 3) would maintain teams of "mobile technicians" for complicated below-ground issues. As the number of facilities grew, so did the pressure on the system (particularly the government teams), with down time averaging up to 45 days (Colin, 1999). The pump itself was deemed one of the most cost-effective handpumps for water depths of >45m, theoretically even in Africa where procurement costs meant it was significantly more expensive than India. However, in Africa, this proved not to be the case because of the management system, which either failed or was not implemented (Wood, 1994).

One of the first VLOM handpumps to emerge was the Afridev pump, first produced in Kenya and considered the "classic" VLOM model (Arlosoroff et al, 1987). This is the most common model deployed in Malawi for depths below 15m, with and is imported mainly from India. For shallower wells (<15m) the Malda pump is frequently used.

3.3.2.1 Water point committees

Maximum participation of user groups in caring for communal water points is fundamental to their long-term sustainability. This is normally promoted by appointing and training an individual (pump caretaker) or group of people who should (Elson et al, 1999):

- carry out (and record) regular inspections and maintenance of pumps,

- monitor pump performance,

- keep facility (including surrounding apron) clean and free of debris/refuse,

- make sure excess water is properly drained (i.e. canal and soakaway functioning),

- make simple repairs and know when/how to enlist help for more complicated ones,

- ensure availability of spare parts in community,

- train others in the above.

This means identifying users who are motivated, self-sufficient, and known in their communities, and who are willing to undertake the responsibility of the water supply.

The importance of water point committees can be illustrated in the following examples from Malawi. Upon examining126 existing boreholes in three T/As in Mangochi District and 89 boreholes in two T/As, De Gabriele (2002) found:

- 10% of the boreholes were properly cared for and maintained where no formation and training of water committees was undertaken by the implementing agency,

- 20% were properly maintained where committees were formed (but not trained), and,

- 50% were properly maintained where water committees were formed and trained.

Even in the presence of trained water committees, half of the boreholes were properly maintained, or to put it another way, half were not properly maintained. This figure is lower than the frequently quoted estimate that around 60% of water points nationwide are functional at any one time (Ph.2.1). Both, however, further illustrates that involving and training communities in the management of their water supplies does not guarantee sustainability of the projects.

Part of the scope of a VHWC's work lies in ensuring a consistent inflow of funds from the communities to maintain the water sources. In many WSH programmes in Malawi and elsewhere, this entails community members contributing monthly towards a funding pool for the VHWC. However, this does not always happen, for many reasons, including true or perceived costliness, lack of trust in VHWCs, and low priority of paying for something when the immediate need is not clear to the user. In a study of user satisfaction and sustainability of rural drinking water schemes in Nepal, the committees in the villages reported that over 50% of people in their communities had not paid the monthly dues for 2-3 years (Bhandhari and Grant, 2007). However, it was not the satisfaction with the water scheme itself which proved to be the most significant factor in the willingness to pay (WTP) for

maintenance of the water points, but rather the how trustworthy the committees were perceived to be.

Clearly there are a multitude of interconnected factors to be considered in the VLOM of water supplies, some of which can be elucidated by examining some of the assumptions inherent in VLOM.

Ph. 3.1 Children playing on an abandoned borehole in Chikwawa District (Sept.2006)

3.3.2.2 Important assumptions in VLOM

There are inherent problems with models such as this which tend to generalize what is observed, particularly with regards to the human element, and try to fit scenarios to the model. While the VLOM approach has many stories of relative success, including in Malawi (WB, 2004), it relies on inherent assumption about the nature of villages: that they are a homogenous entity with individual constituents working for

the good of the whole. In reality and by human nature, individuals and households tend to function on a relatively independent basis, each with their own interests and perceptions. Every community has its politics, with "good" and "bad" relationships between individuals and households (Parry and Wright, 2003). Most of the time, differences can be put aside or dealt with for the good of the community at large, but when local coping mechanisms fail, the results can be (and often are) disastrous for the programme's sustainability.

The VLOM approach also assumes that supporting community-based management (CBM) of operation and maintenance is less tedious than more centralized systems. This has not necessarily been true in practice, especially where community-based systems rely on chronically under-funded and poorly managed government institutions with low motivation for support (WHO, 2000). It also places almost all the burden of O&M on user communities, whereas in reality strong community involvement does not substitute for weak support from government institutions, unless there is a strong presence of other agencies (e.g. NGOs) to fill in the gaps. In many cases worldwide, both user groups and governments do not seem to have the abilities to maintain the pumps in running order (Morgan, 1993).

Second, the VLOM approach assumes that true ownership of the facilities is transferred to the community when the pump is handed over. In practice, however, this is rarely the case with communal facilities (Morgan, 1993). People often feel no obligation to contribute to maintenance funds or even for repairs when the pumps break down. This is especially a problem where there is a belief (rightly or not) that the government is responsible for the facility's upkeep (Colin, 1999; Sugden, 2003).

Thus, despite training in preventive pump maintenance, even communities able to carry out repairs often do not carry out routine maintenance regularly.

Even with a strong sense of ownership, some community members may simply refuse to contribute in the event that repairs are too costly (Colin, 1999). In other words, community members' willingness to pay (WTP) may simply be too low/fragmented to sustain the facilities, and if the amount required is more than the WTP, people may revert to using the unprotected sources. An important point to keep in mind is that communities will have been using these unprotected sources long before (even after) the WSH programmes.

3.3.3 Sustainability in sanitation and hygiene programmes

Initiatives targeting improved sanitation and hygiene face more complicated problems than water supply, largely due to the more pronounced dependence on sustained changes in individual, household, and community behaviour. Several studies on sanitation in Africa have documented poor household and latrine hygiene, despite the ownership of sanitation facilities (Grimason et al, 2000; Tumwine et al, 2003). Numerous factors were found to be associated with improved cleanliness of sanitation facilities, including socioeconomic status, level of education, and material used in building the facilities (Taha et al, 2000; Tumwine et al, 2003). Latrine walls built with bricks were associated with reduced fouling of the facilities and surroundings in Kenya, Tanzania, and Uganda (Tumwine et al, 2003); the type of material used may serve as an indicator of the households' economic status.

The traditional focus of combating WSH-related diseases has been on promoting and providing water and sanitation infrastructure; it is relatively recent that a shift has been made towards incorporating hygiene and hygiene behaviour into intervention considerations (Kolsky, 1993; Varley et al, 1998). Achieving health gains through sanitation and hygiene is more challenging than water supply, although the three are inextricably linked. Impacts of sanitation and hygiene are much more intimately linked with human behaviour than water supply. This complicates the issue even further, as the need to address the human element of health involves a host of other complex and interrelated determinants (cultural, personal, religious).

Most NGO WSH programmes include a health education component, whereby the transmission and control of diseases is taught to communities or their representatives using a variety of approaches (Laryea, 1995). The approaches used in hygiene promotion activities are an important determinant for how long the impacts are sustained after the projects, and therefore their health benefits. It is important to distinguish between "education" and "promotion". The two terms are very different, as are their impacts; behaviour changes after a promotion campaign are more likely to be seen in the few years after the intervention Shordt (2004).

3.3.4 Approaches to monitoring and evaluation (M&E) of WSH programmes

Before going into examples and methods of M&E, it is important to stress that the intended role of the M&E activities should be understood by all parties, to prevent misinterpretation of results (WHO, 2000). If the reason for evaluating project activities is to be able to take action on findings, then there must be a real dedication

to do so, otherwise the M&E becomes yet another task to undertake for documentation purposes, and is an improper use of time and resources. This is particularly applicable to donor-dependent programmes (e.g. NGOs).

3.3.4.1 Indicators routinely used in WSH programmes

Numerous guides have been published for monitoring WSH programmes. Some of the most commonly used indicators include are summarized in Table 3.2 below (World Bank, 1990; Billig et al, 1999; WHO, 2000; Sugden, 2003).

Table 3.2 Common indicators for WSH programmes

Indicator type	Example	Comments
Water supply	Population : borehole ratio	
	Percent of households with access to safe water	Monitoring indicator; does not tell about source "adequacy"
	Percentage of boreholes functioning adequately after a defined interval after project completion (usually years)	Monitoring indicator
	Average down time (pump)	Ideally <10 days/year
Sanitation	Percent of households with access to sanitation facility	Monitoring indicator; often seasonal
	Percent of households using *hygienic* sanitation facility	Impact indicator; may be variable
Hygiene	Average water consumption/person/day	Impact indicator; also used as water supply indicator

The indicators listed in Table 3.2 are quantifiable, and are relatively easy to collect data on. However, most do not account for the behavioural factors involved in health; aspects which represent a large part of this research. Even if water quality, or even quantity, is improved, health benefits are unlikely to be sustained or even attained in the absence of hygiene and other behavioural changes.

3.4 Rural WSH players in Malawi

While each of the non-government groups below has their own programmes, they often work in partnership with government institutions. For example, an NGO might provide the borehole infrastructure ("hardware") and training in maintenance/minor repairs of boreholes, and partner with the MHP in health education ("software") alongside the sanitation promotion component of the programme. Since this research focused on NGOs, the following focuses on these groups.

3.4.1 Governmental groups

These are mainly the Malawi Ministry of Water Development (MWD) and to a certain extent Ministry of Health and Population (MHP). Similarly, individual political candidates/parties sometimes drill boreholes in their own constituencies, where influential (voting) populations are. Since water is often viewed as a tool for winning constituent support in the short term, water point installation is often on an ad hoc basis, and not necessarily need/demand-based (Mulwafu and Msosa, 2005).

3.4.2 Non-governmental groups

These include faith-based organisations (CCAP, CSC, World Vision, Adra, and Mai Aicha Trust) and other national and international non-governmental organisations.

3.4.3 Non-governmental organisations (NGOs)

The World Bank defines non-governmental organisations (NGOs), whether acting on a national or international capacity, as "private organizations that pursue activities to relieve suffering, promote the interests of the poor, protect the environment, provide basic social services, or undertake community development". Their role in development, relief, provision of services, and research (including knowledge translation) is well recognized. NGOs form important partnerships with the governments in their countries of operation, yet importantly and by definition, are independent from government (Delisle et al, 2005). Countries such as Malawi are often unable to provide adequate long-term investment in healthcare and infrastructure, and government healthcare tends to have a greater curative rather than preventative component. Directly and indirectly, this results in resource diversion from other sub-sectors.

Non-governmental organizations (NGOs) play an increasing role as major partners in development and health in such resource-poor settings. They have several advantages in terms of resources and resource allocation, representing part of an entirely different funding (and therefore perceived accountability) pool (Mulwafu and Msosa, 2005). This fact however, also has its downfalls, namely flexibility in

programme design and M&E. Similarly, NGO support eventually phases out once their external funding for a particular programme has stopped (Brandberg, 2001). Still, NGOs in the water and sanitation sectors are important conduits of technology transfer to communities they serve and their governments, and often provide more innovation and support than latter (although they often work together) (Pathak, 1996).

The last decade or so has seen a significant rise in the number of NGOs globally; over 37,000 in 2002, up nearly 20% from the 1990 figure (UNDP, 2002). Just over a quarter (26%) focused on economic development/infrastructure and research (26% and 23%, respectively) (Global Policy Forum, 2002). In Malawi, a surge in the number of NGOs in a wide array of fields began after multiparty elections in 1994, and the subsequent easing of restrictions (in all fields) previously in place during the former authoritarian government (Makuwira, 2004). NGOs in Malawi are required to register with the Council of Non-governmental Organisations in Malawi (CONGOMA), as per the Non-Governmental Organisation Act 2000 (GoM, 2000). A list of NGOs in Malawi, broken down by sector, can be found on CONGOMA's website.

Although involvement of NGOs in development is usually a positive phenomenon, there are several issues to consider. First, if there is no coordination amongst those with similar programmes, duplication of efforts frequently occurs (Mulwafu and Msosa, 2005), and their impacts may not be as optimized as they would be if there was a system for discouraging duplication by at least sharing details of activities in an area. In Malawi, the ad hoc drilling of boreholes by charities, NGOs, and political

parties (especially around election times) was a major factor in prompting the MWD, in conjunction with donors (e.g. USAID) to set up a mapping system for boreholes and other water provision systems throughout the country. This database indicates the locations of the water points, their types (e.g. borehole, protected shallow well, gravity-fed scheme, etc.), the implementing agency, the date installed, and status (functioning or non-functioning).

3.4.4 Implementation and management of rural water supply and sanitation programmes

The government of Malawi, along with other groups such as NGOs and faith-based groups, have focused on relatively high-technology means of providing water in rural areas (Water for People, 2006), usually in the form of drilling boreholes. This follows a worldwide trend in this development sector (Carter at al, 1999). The estimates with respect to rural water and sanitation access in Malawi were discussed previously, and major players in rural WSH in the country were outlined in sections 2.4.1-2.4.3. The following sections will introduce various components and challenges of impact assessment of these programmes in developing countries, with a focus on Malawi.

3.4.4.1 Challenges in improving WSH-related health in Malawi

A number of issues involving water and sanitation access in Malawi have been highlighted in several documents by governmental and non-governmental groups in the country, including:

- Weak national water and sanitation policies, outdated sector development guidelines, and poor regulations and enforcement (De Gabriele, 2002; Mulwafu and Msosa, 2005; Anon, 2006). Administration of existing legislation is scattered between government agencies (Anon, 2006).

- Poor inter-sectorial coordination (Anon, 2006) and national coordinating systems between Ministries and between these and NGOs (Malawi COMWASH design mission report- Health component, 1999). Within programmes to increase water supply and sanitation, there is inadequate training of extension workers, community members, and families in promoting better water, sanitation and hygiene (De Gabriele, 2002; Mulwafu and Msosa, 2005).

- Inadequate financial, technical, and human resources at the government level to implement environmental health programmes and enforce relevant regulations.

- Fragmented stakeholder involvement in planning, implementing, and monitoring water and sanitation programmes. An example of this is the exclusion of many organizations, highly experienced in the water and sanitation field, from consultation in defining sector priorities within the 2001 poverty reduction strategy programme process.

3.5 Summary

Chapter 3 has provided an overview into different ways of assessing the impacts of development activities (in general and in the WSH sector) on the health of a population, as well as the vast range of difficulties in doing so (particularly in resource-limited settings). The ways in which health impacts of an NGO's project/programme can be directly or indirectly measured are in theory as varied as the populations they serve. In practice however, there is a need to develop ways to extract situation-specific indicators as early in the programme as possible in order to form a comprehensive picture of the baseline health status, and be able to predict and document changes to these resulting from the interventions. These form the basis of the goals of this research, and thus the need for a comprehensive understanding of the different considerations and constraints which play a factor in being able to carry out proper impact assessments. With NGOs in particular, satisfying the donors is of priority when selecting the methods of monitoring the impacts of their activities. In some cases, the constraints can manifest even before a programme is fully planned, as funding applications will often stipulate (explicitly or implicitly) the types of indicators and outcomes donors are interested in.

The more "traditional" determinants of health are complex and require time, human, and financial resources to measure and monitor. At the same time, they can be misleading, owing to the multitude of factors interacting to determine health status. Finally, they tend to measure endpoints rather than processes related to health, which inherently limits their dependability. Therefore, in order to

accommodate these concerns, as well as those of the NGOs and even donors, a HIA should ideally:

- not be too cumbersome as to make the idea of an HIA seem just an unwanted burden on the implementing teams;

- be able to extract direct and indirect determinants of health of beneficiary populations in a manner as representative as possible;

- be relatively uncomplicated to perform within the capacities of the individual NGOs;

- produce a set of qualitative and quantitative (or semi-quantitative) indicators that can easily be integrated into the planning, monitoring, evaluation, and donor reporting processes of the NGOs.

Chapters 2 and 3 have introduced the major environmental and public health issues this research is concerned with, as well as the constraints faced by various players in implementing and assessing programmes aimed at improving the situation in (particularly) resource-limited settings. Chapter 4 introduces the methods employed in this research, as well as the area and communities involved.

Chapter 4- Methodology

4.1 Description of study area

This chapter introduces the communities in which the research was carried out between end of August 2006 and June 2008, and the different methods used in the research. Both quantitative and qualitative information was collected in order to develop a quantitative baseline for future use through a participatory survey, and to elucidate the more community-specific behavioural and perception-related contributors to the health impacts of the water and sanitation projects. This section describes the two villages and the NGO's involvement in their communities, the projects themselves, and the subsequent activities undertaken during this research.

Thyolo, in Malawi's Southern Region, is a predominantly rural District with almost 500,000 people (NSO, 2005). It is home to sprawling tea and coffee estates, and many of its residents are engaged in seasonal work (ganyu) in these facilities. This District (Fig. 4.1) was chosen for the research for two main reasons. First, it ranks amongst the top Districts in Malawi for diarrhoeal, respiratory, and HIV infections. Second, several major NGOs operate in Thyolo District, including the UK-based NGO who's programme area was studied in this research; this NGO is one of the leading implementers of rural water supply and sanitation (WSS) programmes in Malawi.

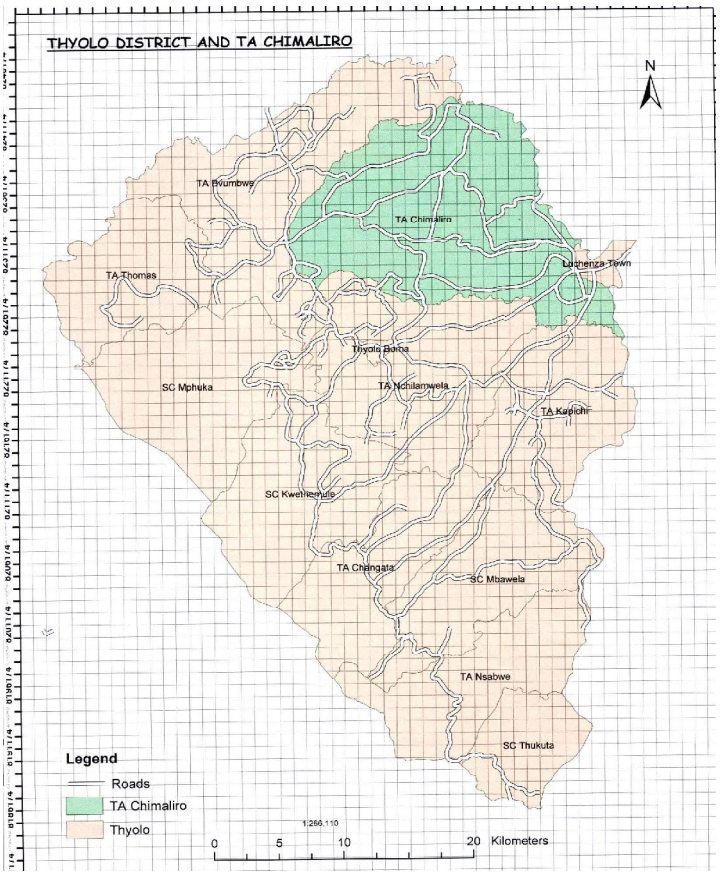


Fig. 4.1 Thyolo District and Traditional Authority Chimaliro (NSO, 2008)

4.2 Selection of study villages

The NGO was approached via email several months before the fieldwork, and the author's aims and proposed research explained. The NGO expressed interest in the research, as they would benefit from the study, and agreed to assist with initiating contact with the communities and providing project information as needed.

In selecting the two villages to be included in the study, meetings were held with the manager of their Water and Environmental Sanitation (WES) programme to discuss the NGO′s work in Thyolo and the locations and timings of past projects. From the list of villages in which the group was active in rural WSS, four were shortlisted in Traditional Authority (T/A) Chimaliro (Fig. 4.2). After visiting these, two were selected. The following criteria were kept in mind in selecting the T/A and villages:

- In selecting the T/A for research, available funds for fuel had to be considered. Many trips over the course of several months were planned, in order to interact with the communities throughout the research. T/A Chimaliro is about 30km from Blantyre, where the author was based, and the villages were an appreciable distance offroad.

- Time from WSH project completion. The WSH Programme in the communities had to have been completed at least 1.5yrs previously, and around the same time in both communities.

- Accessibility: Access to many rural villages in Malawi necessitates navigation through dirt roads and paths. Thyolo is relatively mountainous, and some villages are located on very rough terrain. Many routes are non-navigable during the rainy season.

- NGO input and suggestions; for example, the WES Programme Manager′s opinion on which communities in an area were considered by

the NGO as "good" participants in their programmes. This was important to be able to get an idea of, and correlate findings with, the NGO's expectations.

- After four villages were shortlisted, the author visited them with the WES team in order to speak with their respective headmen. Meetings were requested with the Village Headmen, making it clear that (a) participation was strictly voluntary, and any participants were free to withdraw from the study at any time, (b) the research is independent from the NGO, and no remuneration would be provided for the participants, (c) the research findings would be communicated back to the community and NGO, and any implications discussed. In one village, the headman was not present, and so the research was explained to the "acting headman", who was hesitant to get involved. Of the remaining three, all agreed to participate, and so two (Mwitiwa and Katundu 3 villages) were chosen randomly by writing their names on pieces of paper which were drawn from a hat.

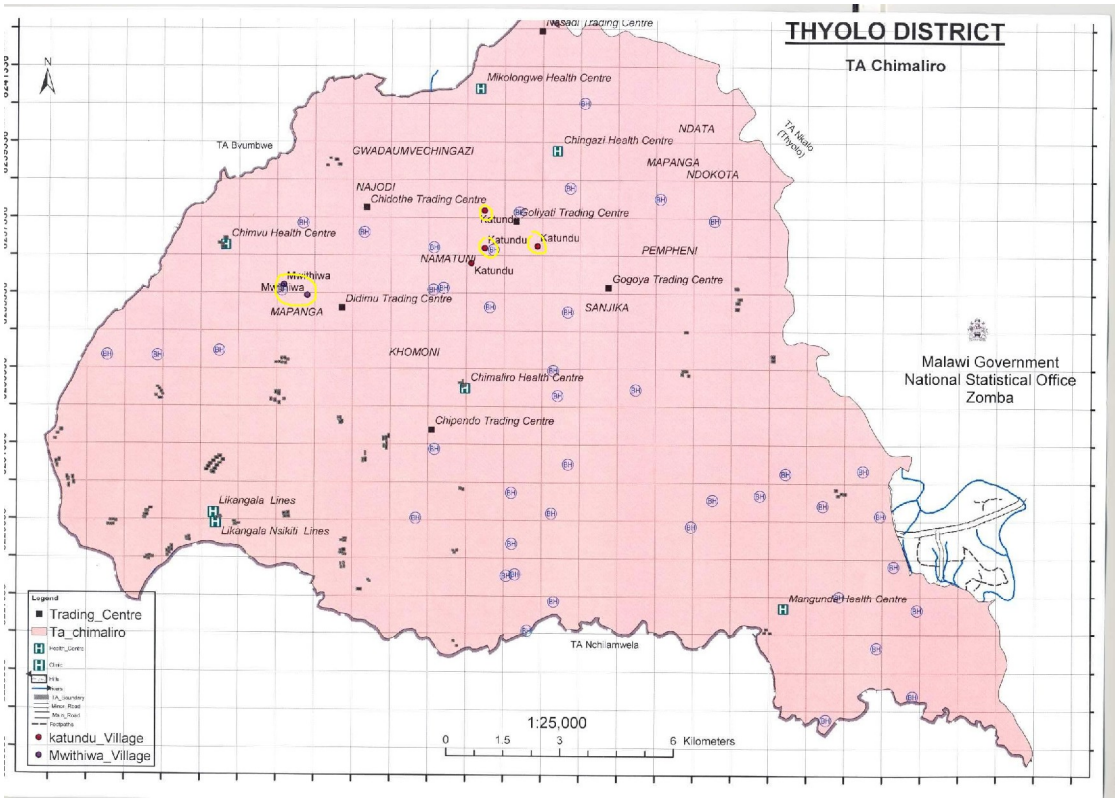


Fig. 4.2 Map of T/A Chimaliro, with the two study villages circled

4.3 Basic characteristics of communities

Mwitiwa Village (94 households) is located approximately 10.5km off the main highway in T/A Chimaliro, Thyolo District. Of these, 9km are over a rocky dirt road (Ph. 4.1), and the remainder down a steep, rocky hill. Initially, the village was recorded as having 110 households, but this was revised down to 94 after a number of houses were later found to be empty. Also, a borehole on the border with a nearby village was initially reported by the community as belonging to Mwitiwa was subsequently found to belong to the neighbouring village.

Ph.4.1 View along remote path to Mwitiwa Village, T/A Chimaliro, Thyolo District

Katundu 3 Village (250 households) is located approximately 16km off the main highway (Fig. 4.2). The terrain here differs markedly from that of Mwitiwa; the path to and around Katundu 3 is relatively flatter, and much more easily accessed by dirt paths. Katundu 3 is much larger than Mwitiwa, and has two village health and water committees (VHWCs): in its "Portugal" and "Kalika" zones. In total, there are four Katundu villages: Katundu 1, 2, 3, and 4. It is important to note that there are no strict boundaries between the different Katundu villages; the "borders" are delineated by individual households. This may have represented a source of error in this study; i.e. overlapping in households between two communities. However, the community members recruited for/accompanying the participatory data collection identify themselves as belonging to Katundu 3, and so were able to make sure the households

included in the study were indeed part of Katundu 3, even if geographically they may appear located closer to another community.

4.4 Introduction to the UK-based NGO's WSH programme

The NGO ran its WSH in T/A Chimaliro from July 2001-December 2004, targeting WSH at both the community (household) and institutional (clinics, schools) levels. Improving water access was through the training of community VHWCs and installing water supplies (mainly gravity-fed schemes, boreholes, upgrading/installing shallow wells, and upgrading springs). At the household level, improved sanitation was promoted in the form of training VHWCs in constructing latrine slabs with lids (either Sanplats or dome platforms). Ventilated improved pit (VIP) latrines were also promoted, particularly at the institutional level.

Initially, assessment of existing conditions and needs was carried out by the Thyolo District Assembly, which was the basis for recommending project sites. On this basis, proposals were put together after consultation with communities in the area, and the communities sensitised to WSH-related health issues. Before commencing the actual projects within the programme, communities had to "show commitment". "Agreements" were signed, VHWCs nominated by their communities, and a small token fee raised by the communities (around MK2,000 at the time, depending on individual circumstances). At the start of the project in the communities, they were responsible for sand, bricks, quarry stones, and labour (construction of latrine slabs, borehole aprons); they were also responsible

for security measures for drilling equipment. Government extension workers in the area were trained in repairs, with the intent of having skilled individuals locally for more complicated repairs. The establishment of community support groups (CSGs) was also promoted, with a "train the trainers" approach in mind. The involvement with each community was for several months.

VHWCs consisted of 10 people in each village (usually 6 women), and were trained for a total of five days (March and April 2002 in the cases of Mwitiwa and Katundu villages respectively) in the responsibilities of a VHWC, namely pump maintenance and simple repairs, and general health education and sanitation promotion (including construction of sanitation platforms). In the case of Katundu 3, which was one of four Katundu villages, the 10 trained individuals were from all 4 villages; upon completion of the training, they returned to their respective communities and became part of a 10-member VHWC for that particular village. These were then integrated into separate committees in their respective villages; the "Portugal" and "Kalika" VHWCs had two fully trained members each, who then went on to train the rest of the 10-member committees in their zones (NGO's Sanitation Coverage project documents for T/A Chimaliro). In a sense, each Katundu village started off with less than 10 trained members (in the case of Katundu 3, three people).

Contents of training were: pump maintenance and simple repairs, leadership, fundraising (for spare parts/maintenance), and hygiene/health education (in conjunction with the Ministry of Health). The education consisted of basic information on waterborne diseases (diarrhoeal), home cleanliness, and

sanitation and health (including handwashing). At the household level, simple handwashing facilities were promoted, using locally available materials (Ph.4.2).

Ph.4.2 Simple handwashing facility using plastic container, a can and wire (Nov. 2005)

Targets, as outlined in the LogFrame matrices of the programme proposal for the NGO's WSH programmes in Dedza, Ntcheu, and Thyolo (Appendix D), are summarised below. Note that only the points measureable at a community level are included:

- Ratio of people per (safe, year-round supply) water point of 250, as per Government of Malawi targets

- 95% of households have access to a safe, continuous supply of water
- At least 50% of households use an improved latrine
- At least 50% of households wash hands before and after eating
- "down time" on handpumps of not more than 3 days
- Establishment of CSGs to carry out major maintenance/repairs
- Minimum of one-third of households using handwashing facilities
- "participatory system" of monitoring and impact evaluation developed with VHWCs

Above information was obtained by personal communication with THE NGO'S's Water and Environmental Sanitation Programme Manager, and the programme funding proposal. More detailed programme indicators relevant on a District level, including extension staff training and provision of equipment/salaries/etc. are not included.

4.5 Methods used

A number of different methods were used in the research (Fig.4.3), conducted from the end of August to November 2006, both in order to allow results from each to be compared (triangulation) and to help actually guide the research direction itself. Health impact assessment (HIA) is concerned with the health of communities; contributors to health status often vary between populations, and the HIA should thus be directed based on multidisciplinary indicators from the populations themselves. Information obtained from the first round of focus group discussions (FGDs) was used to direct the research; for example, the

women identified the health centres most frequently used by their communities and so these centres were where the data was collected from out-patient department (OPD) registers. As a feedback system, data from these health centres were compared with information from the FGDs, which was used in the second round of FGDs, and so on. In this way, a more participatory approach, rather than top-down one, to data collection was ensured. A total of five FGDs were conducted: one with the VHWCs and four (two rounds of two groups) with women's groups.

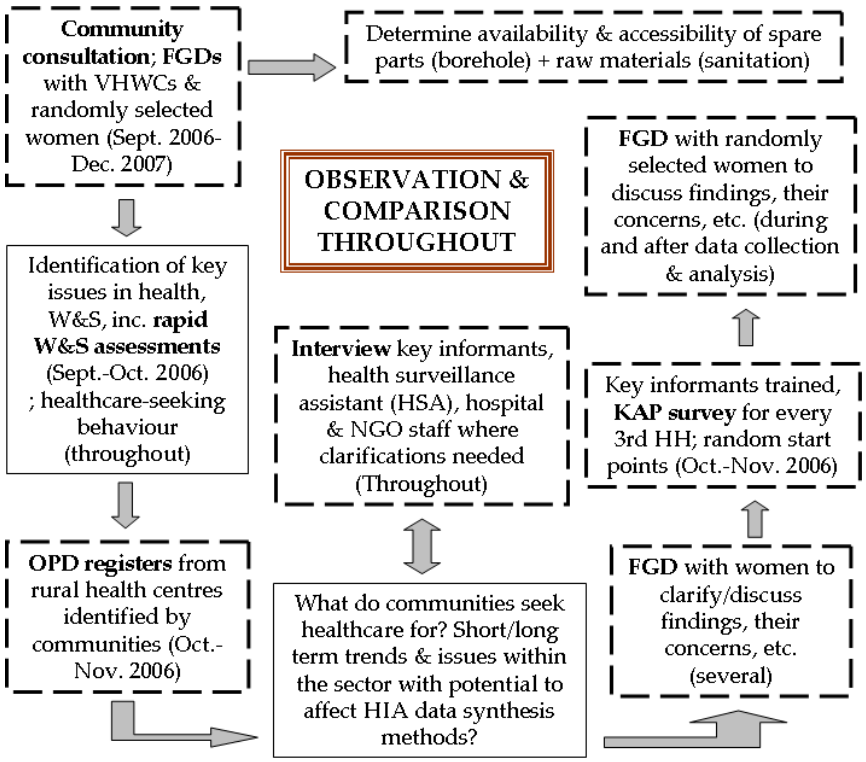


Fig.4.3 Flowchart of various methods used in the research (NB: FGD= focus group discussion, OPD=outpatient department, HSA=health surveillance assistant, KAP=knowledge, attitude & practice, W&S=water and sanitation)

A field journal was also kept over the course of the research, and the discussions were digitally recorded, after obtaining permission from participants. These methods were extremely useful as they allowed the researchers to better capture and document points like tone, body language, etc.

4.5.1 Research team

The author employed a local maternity nurse/midwife as a primary research assistant to assist in the data gathering and interpretation. This was for two reasons. First, being a maternity nurse/midwife, she had extensive experience in dealing with women (primary user groups in water and sanitation considerations) and communities. Second, with the research having a predominantly qualitative component, a female health worker would be able to elucidate traditional views and local practices related to health which the author may not have considered. Both the author and the primary research assistant were involved with the villages for nearly two years, in the research (August-November 2006) and other small projects (February 2007-June 2008), and subsequently built a close relationship with the communities.

4.5.2. Focus Group Discussions (FGDs) with Village Health & Water Committees

The village health and water committees (VHWCs) of each village were the initial point of contact within the communities. The composition of the VHWCs was described in section 4.4 introducing the NGO′s programme. Permission to

digitally record the FGDs was obtained, to enable the recordings to be referred to later if necessary.

After the discussion with the VHWC, a research assistant (3rd year agriculture student at the University of Malawi) was instructed to number all the households in both villages with chalk and record the household name (for future identification when the chalk wore off). Each house had one household, that is, one "family". In 2004, Mwitiwa was reported to have 293 households (NGO village statistics); however, in another (sanitation coverage) document, the NGO's 2004 project data indicated 99 households. Only 94 were recorded at the beginning of the research (August 2006). This initially caused some confusion, particularly having two estimates from the same source.

After mentioning this, the village headman informed us that the initial estimate of 293 was true, but the village had been split by the traditional authority because of problems between sub-communities. This could explain the discrepancy within the organisation's estimates; still, the 99 figure for 2004 is much closer to the one obtained during this research (94). This issue should not present a problem, because the sanitation estimates are based on the 94 households for this research, and compared to the NGO's sanitation estimates at the end of their activities in 2004 (99 households).

Topics covered during this discussion with the committees (Sept. 2006) were related to training, operation and functioning of the committees, and borehole

maintenance issues. Also, the committee was encouraged to bring up/discuss other issues they felt were important to them.

4.5.3 Focus group discussions (FGDs) with women

Focus group discussions (FGDs) are a valuable tool both for gathering qualitative data which can direct further interventions/activities, and to help explain results of other data-collection methods. Women were targeted for these activities during the research because they are responsible for household chores, fetching water and firewood, and cooking; also, they have the responsibility of children's health and that of the household (Blackden and Wodon, 2006). Their participation was therefore imperative in order to help direct the research, as well as explain the results and other issues specific that were bound to come up.

For the first FGD in each community, household numbers were written on small pieces of paper, which were in turn placed in a hat. In each village the chief was invited to pick the first number. The "head woman" or "mother" of the corresponding household was invited to participate in the focus group discussion; if she declined (none did), the process was repeated. She was then asked to pick a number from the hat, and the procedure was repeated until there were ten women in each of two groups (for each village); the second group in each community was invited to participate in later FGDs. FGDs were held with the VHWCs of both villages, at locations convenient to the groups, but separated from potential "drop-ins": the village church in Mwitiwa and under trees with

the "Portugal" and "Kalika" VHWCs in Katundu (separate FGDs for each committee in Katundu).

This research involved the use of both open-ended questions to direct discussion, and more specific inquiries based on trends observed during other information-gathering activities. The FGDs began with each person (including the author and research assistant) introducing herself. The overall aims of the research were briefly explained, and the participants were assured that their identities would be kept confidential. Permission was sought to digitally record the sessions, again emphasising that only the author and the research assistant would have access to the tapes; all the women consented. This activity was carried out over the course of a day (morning in Mwitiwa, afternoon in Katundu 3), and each FGD was aimed at 45 minutes, although the Katundu 3 women were quite involved and so the discussion was allowed to continue for slightly over an hour.

This activity was also useful to identify potential key informants in the communities, with whom the team could speak with throughout the research; these were invaluable in providing clarifications on small issues as they arose. The respondents were informed before beginning the FGDs that they were always free to withdraw at any point in the activity.

4.5.4 Examination of health centre outpatient department (OPD) register

Outpatient department (OPD) registers were examined from the health centres identified by the women during the first round of FGDs. The purpose of this

activity was two-fold. First, the OPD registers were a valuable source of information on general health-seeking behaviour of the communities. Recognising the inherent problems with diagnostics (Chisi, Nkhoma & Sternberg, 2007; Mallewa et al, 2007) and epidemiological data in such settings, the aims of this exercise were to a) get an idea of what people sought medical care for (health-seeking behaviour), b) to correlate information obtained at the HCs with findings in the communities, and c) to aid in the planning of further FGDs. Also, this activity provided a chance to interact with the providers and sector employees, in order to clarify any issues which were uncertain.

Permission was requested from the Director of the Thyolo District Hospital to access OPD registers for three rural health centres (HCs) from previous years (May 2004 onwards). The HCs were identified by the communities themselves during the FGDs. The following information was sought for patients presenting to the OPD from both villages: date, village, age, gender, diagnosis (or diagnoses), and disease code for diagnosed condition(s). To ensure ethical handling of confidential patient information, the registers were viewed only by the researcher and the primary research assistant, were never taken out of the records room (where the data clerk was constantly present or in the adjoining room), and only the gender, age, diagnosis, and treatment information were used.

4.5.5 Knowledge, attitude and practice (KAP) surveys

In order to capture some of the communities' knowledge, attitudes and practices (KAP) on different health issues, a comprehensive survey was administered (Oct.-Nov. 2006) which included demographics, indicators of socioeconomic status, and behavioural/perception questions on a wild range of health-related topics. The KAP survey used in this research (Appendix B) was based on similar ones conducted in the country (Thomson, 2002; Morse, 2006). Recognising that changes in knowledge, when used in isolation or without analysis of behavioural change, is a relatively weak indicator to assess the impact of a programme (Roberts and Hofmann, 2004), information from this method was correlated with that from other activities. The aims were to collect baseline information on: basic demographics for the two populations, socioeconomic indicators, knowledge/opinions of VHWCs, health-seeking behaviour and health surveillance assistants (HSAs), knowledge of the major health conditions and associated indicators, and reported practices with regards to the same. The self-reported practices were important to compare to other observations noted throughout the research.

Women from the communities who had attained secondary education and could read Chichewa (the local language) were trained for two days (including supervised pre-testing on the second) to administer the surveys, which had the text in both English and Chichewa. Following the training of the survey administrators, the survey was pre-tested in the communities (3 households in Mwitiwa and 10 in Katundu 3) in randomly selected households. The households

whose women were included in the pre-test were recorded in order to make sure they were subsequently not included in the actual survey later. The purpose of this exercise was to make sure the subjects were comfortable answering the questions, and that they understood what was being asked, so that any areas of uncertainty could be changed or clarified by the research team before the formal KAP survey administration.

Random sampling for the starting point was by the procedure previously described (Section 4.5.3), and every third household from there. Since Katundu 3 is bigger, the number of questionnaires was divided among the administrators, and the starting points were from each of the boreholes. If the "head woman" of the household refused to participate, the household immediately to the left was approached. This was carried out until a third of the households in each village were surveyed.

The respondents were informed before carrying out the survey that they were always free to withdraw at any point in the activity.

Although every effort was made to ensure that the survey was comprehensive enough to serve both as a baseline data and as a data source that could be triangulated with other data, its sheer length may have been one of its limitations. The effort and time required to both administer and to answer the questions may have resulted in some questions not being answered, or in the administrator simply duplicating answers from previous households. These occurrences would be most likely towards the end of the questionnaire, and it is

difficult to avoid this. However, this only highlights the importance of using multiple data collection methods, particularly when dealing with public health and behavioural issues, in order to triangulate the information and compare results from each activity.

4.5.6 Second round of focus group discussions with women

A second round of focus group discussions was held with women in both communities. The reason for this was that women in the community heard about the activities and requested specifically if more could be allowed to participate. The selection method for the second pairs of FGDs was as outlined in section 4.5.2. After the FGD had formally ended, some women who had not joined stopped by for informal chats (particularly in Katundu 3).

These series of FGDs was slightly more targeted than the first, slightly longer (largely due to the participants′ enthusiasm) and was based largely on results from the KAP survey and examination of the OPD registers of the health facilities indicated in the first FGD. A number of specific questions, dealing with risk factors for diarrhoeal diseases, were also presented to the women′s groups. As the discussions progressed, women were encouraged to lead the discussion in terms of related topics, with the lead researcher moderating to keep the discussion on track. Topics covered included: the trends in seeking mainstream heath facilities, clarifications of observations, elaboration on points in the KAP survey.

4.5.7 Participatory observations

Participatory observations of the water sources (protected and unprotected) in each community, including activity around them, informal talks with men and women along the way, observation of household hygiene conditions (indoor, cooking, presence of animals, etc.), and other general points.

In addition, after the aforementioned 3-month baseline data collection period (Aug.-Nov. 2006), the research team remained involved with the communities through implementation of other projects (dairy farming income generating activity in Katundu 3, and upgrading water sources in Mwitiwa) between early 2007 and through June 2008. In Mwitiwa, a natural spring was upgraded with concrete surround and installation of a pipe; the community preferred this to a tap since the water flow was year-round. They also chose the source to be upgraded, its location, and the type of work to be done. In Katundu 3, a dairy farming project was set up as an income-generating project to support the village health and water committee of the "Portugal" borehole. The members themselves suggested the idea of an IGA during one of the FGDs, and put together a comprehensive proposal including rationales for a dairy farming project. Members of the committee (as well as other community members and some from a nearby village, since there would be little difference in the cost for additional people) were provided with hands-on, on-site training for one week by the Blantyre Agricultural Development Division (ADD) of the Ministry of Agriculture and Food Security. The VHWC then constructed a shelter (under supervision) and selected a dairy cow. The money from the milk was/is sold to

the Dairy Board near Goliati marketplace, and the funds placed in the VHWC′s bank account.

This continued involvement with the communities enabled the research team to interact more closely with not only the communities in their environments, but also involving other players in various relevant sectors.

4.6 Data analysis

Information from the FGDs was analysed by the lead researcher and primary research assistant examining the notes from the field journal, as well as going over the recordings of the discussions. The results were also discussed with the communities, mainly the women in later rounds of FGDs. This meant that the interpretation was community-oriented, and could be used to target not only data analysis but also future data collection.

Information from the OPD registers provided not only an idea of the pathologies most prevalent in the communities, but also a) information on the healthcare seeking behaviour of the communities, and b) issues within the healthcare system itself with regards to diagnosis and collection of epidemiological information.

KAP survey data was entered into SPSS 14.0, and this software was used for data extraction. Microsoft Excel was used to generate graphics. Data from the surveys was entered twice into separate databases to ensure accuracy. The use of

rigorous statistical methods was avoided for several reasons. Firstly, the methods used in this research are intended to be replicable in environments/teams where it is highly unlikely that any type of formal statistical analysis is conducted. It is unlikely that NGOs involved in water and sanitation have (or intend to have) the resources to undertake more complicated statistical analyses. Furthermore, the usefulness of data generated by rigorous statistical analysis would be questionable. For one thing, the statistics may *illustrate* points, and may reveal interesting trends if the quantitative data is collected regularly, but they would not *explain* any observations/trend. In situations where behavioural factors contribute so significantly to health, basic and simple analysis of the quantitative data collected, combined with qualitative data, provided much more information than any more rigorous statistical analysis would have.

4.7 Conclusions

This chapter has provided an introduction to the research area, the communities, and the NGO′s water, sanitation, and hygiene activities there; also, the different qualitative and quantitative methods of data collection have been outlined. The participatory, community-directed approaches were aimed at ensuring as much as possible that the indicators of health (particularly environment-related ones) were as individualised to the populations as possible. The next chapters present the results of this research, including discussions of the implications for future environmental and public health initiatives by both governmental and non-governmental actors in the area.

Chapter 5- Baseline characteristics of the communities and functionality of village health & water committees

5.1 Introduction

This Chapter discusses the demographics of both communities, including socioeconomic factors, and goes in depth into the social and economic dynamics that influence the effectiveness of the village health & water committees. More in-depth analysis into knowledge, attitudes and practices (KAP) of health and health-related issues is discussed along with the relevant KAP survey results in the next Chapter. Due to the multiple data collection methods used and the highly qualitative nature of the research, the results and discussions are combined in Chapters 5 and 6, and will be categorised according to themes. The results of the KAP survey are presented in their entirety in Appendix C. Where pertinent, they are presented in tabular and/or graphic form; the rest are referred to as relevant by their location in Appendix C.

5.2 Demographics and population characteristics

Mwitiwa Village is composed of approximately 94 households (403 inhabitants), while Katundu 3 is larger at 250 households (1094 inhabitants); these represent the numbers at the start of the research in 2006, and almost definitely are in a state of fluctuation.

The age breakdown of the knowledge, attitudes and practices (KAP) survey respondents is given in Fig. 5.1 below, while the number of people in the respondents' households is shown in Fig. 5.2.

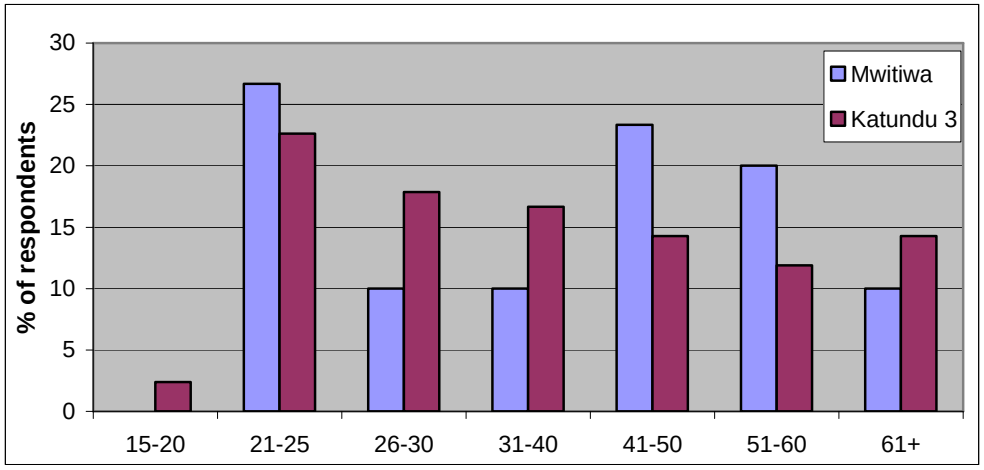


Fig.5.1 Age breakdown of KAP survey respondents (N=114)

Most of the households surveyed were headed by men, with just over a quarter (26.5%) being female-headed. Nearly half (44.8%) of the respondents' HHs in Mwitiwa were female headed, more than double the figure for Katundu 3 (20.2%).

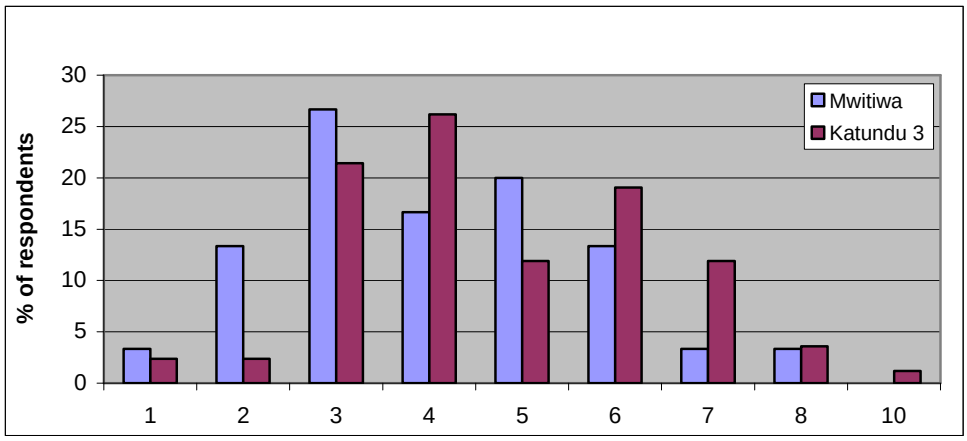


Fig.5.2 Number of people in respondent HHs (N=114)

Children 15 years old or younger made up over half of the respondents' households (57.3%); under-5s made up 28% (Fig.5.3).

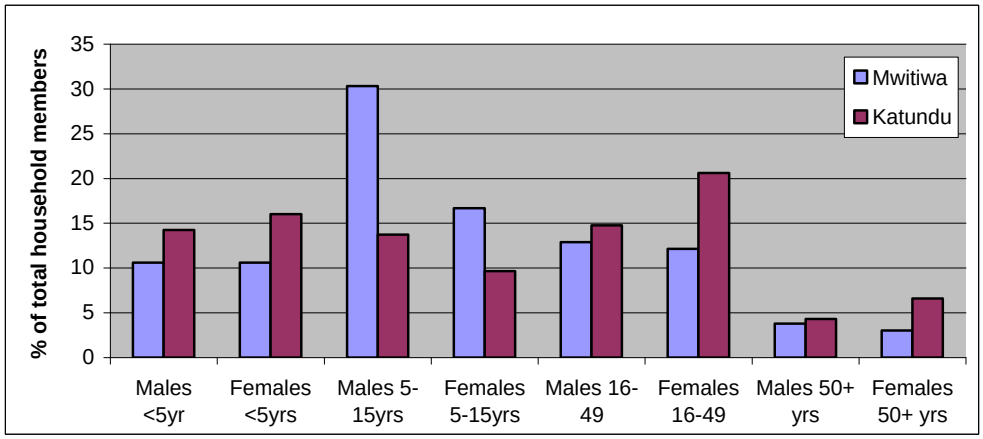


Fig.5.3 Age profile of respondents' households (N=114)

5.2.1 Education and occupations in the households

Overall, 37.7% of respondents have no level of education, just under a fifth (18.4%) have between 1 and 4 years of schooling, 33.3% between 5 and 8 years, and only 10.5% reaching secondary school (Fig.5.4).

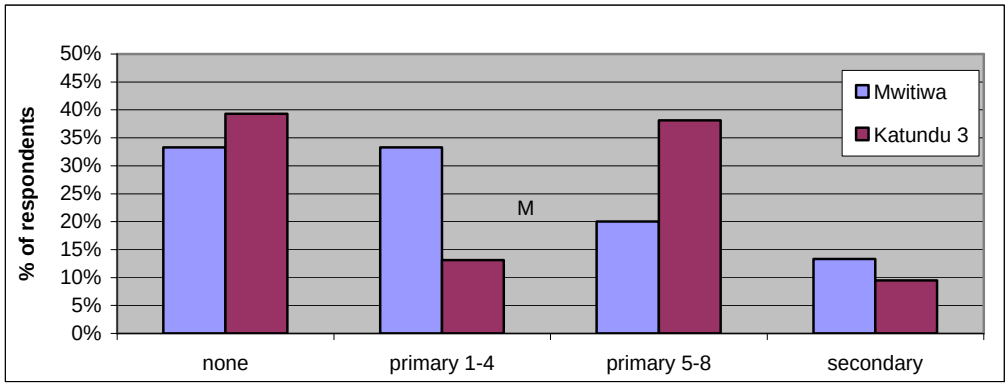


Fig.5.4 Highest level of education attained by respondent (N=114)

Almost half (45.6%) are unable to read Chichewa at all, 9.7% able to read with difficulty, and 44.7% able to read easily. The majority of those who have no education were in the 31+ age groups (81.4%), with the same age groups comprising the majority (75%, n=52) of those who cannot read Chichewa (Appendix C, Table C1301). This may be related to the abolishment of primary school fees in 1994, combined with increased access to primary schools in the area.

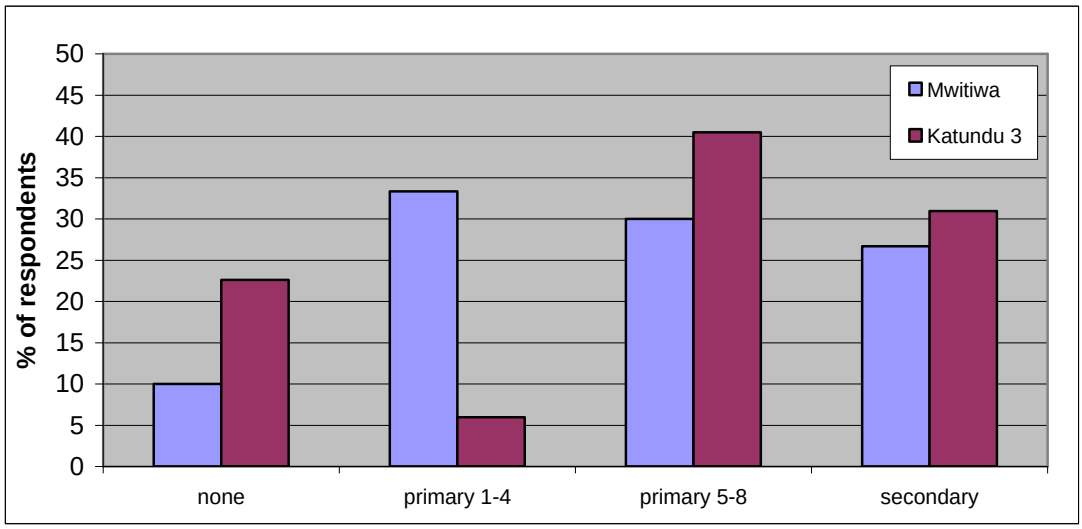


Fig.5.5 Highest level of education attained in the HH (N=114)

Children were frequently seen running around and helping in water collection (Mwitiwa especially) during what would normally be school hours. This was brought up in the FGDs as a point of interest. Most participants attributed this to "laziness" on the part of the mothers. One possible reason for the apparent lack of interest in education could be the extremely limited prospect of finding employment as a result of increasing education level, especially in Thyolo, and this topic was brought up to the women. One woman in Katundu 3 said she didn't think that was a major contributing factor in her community, and said education was very important so that "no one can cheat us at the market, and we can know how to calculate things properly".

Respondents were asked about the occupation of the head of their households, as well as a number of questions relating to ownership and indicators of financial status.

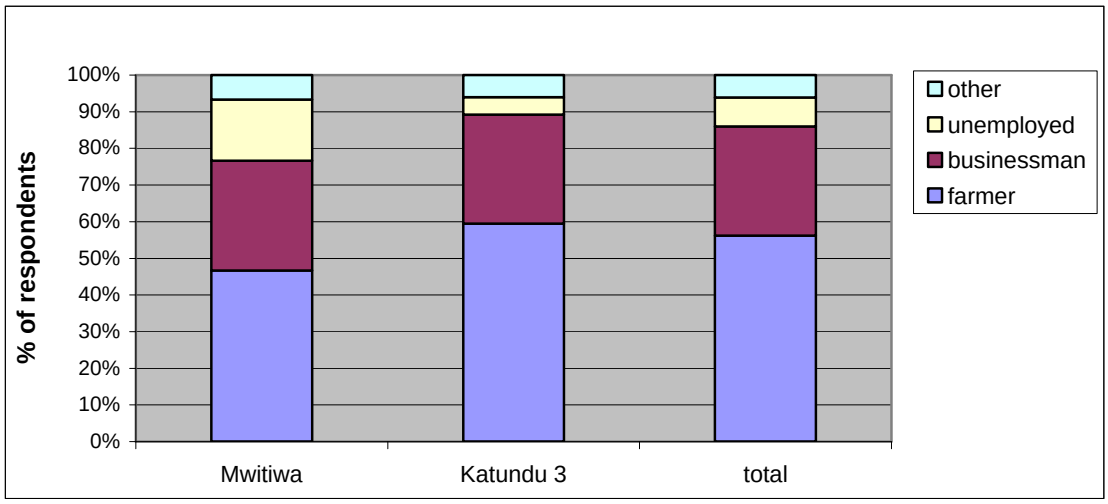


Fig.5.6 Occupation of head of HH (N=114)

Farming represented the main occupation for households in both villages (Fig.5.6). Business (small-scale businesses) and "other" were roughly equally represented as main occupations of household heads in both villages. "Other" almost exclusively meant "ganyu", or casual/piece jobs undertaken by people as opportunities arose. During the FGDs, this was further clarified as seasonal labour on the surrounding tea estates.

5.2.2 Indicators of economic status

To get a better idea of the socioeconomic ranking of the households, the structural makeup of the house was used. This has been demonstrated to be a sensitive indicator of socioeconomic status in Malawi (Etttling et al, 1994; Thomson, 2002). Similarly, the type of material used in flooring is also used as an

indicator of economic status (NSO, 2005). These are shown below (Figs. 5.7 and 5.8) for the two communities.

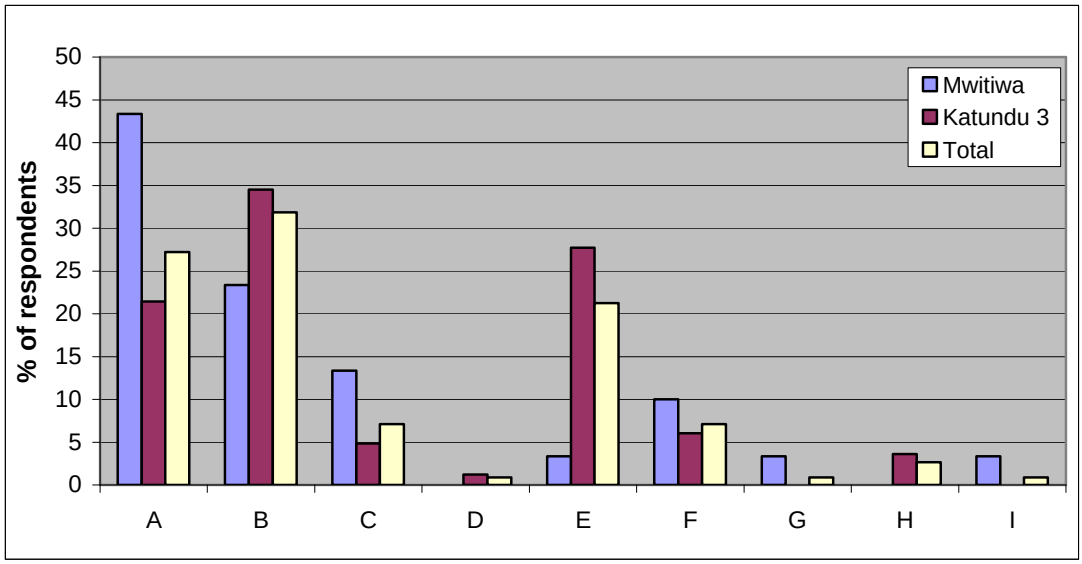


Fig.5.7 Physical composition of respondents' houses (N=113)

The corresponding criteria for the categories are given below.

Symbol	Definition
A	Walls= mud brick; roof= grass; no windows
B	Walls= mud brick; roof= grass; open windows
C	Walls= mud brick; roof=metal/tiles; windows= open windows
D	Walls= mud brick; roof=metal/tiles; windows= screen or glass
E	Walls= fired brick; roof=metal/tiles; windows= open windows
F	Walls= fired brick; roof=metal/tiles; windows= screen or glass
G	Walls= mud brick; roof=grass; windows= screen or glass
H	Walls= cement brick; roof=metal/tiles; windows= screen or glass
I	Walls= mud bricks; roof=metal/tiles; windows= no windows

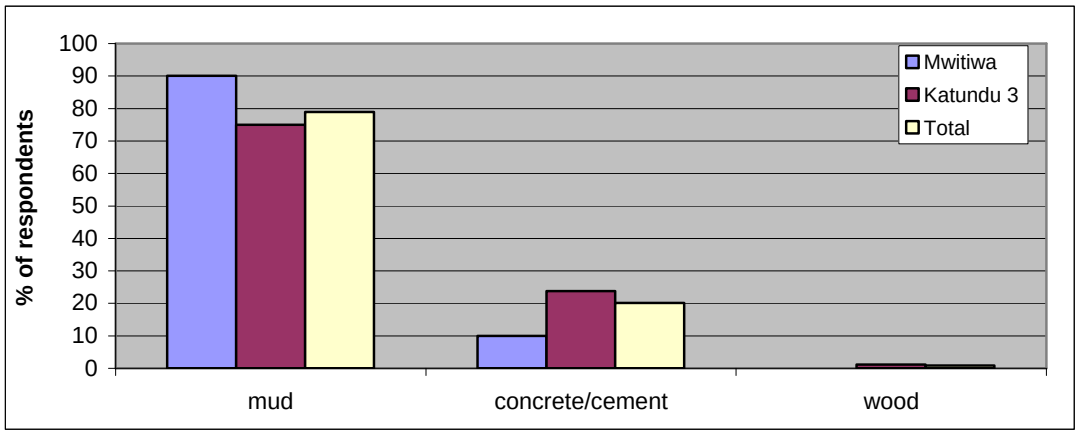


Fig.5.8 Flooring of respondents' HHs (N=114)

The results presented in the two figures above will be used in later sections to explore correlations between them as relative indicators of financial status, and trends in (particularly health-related) indicators. Respondents were also asked about ownership of a number of items (Fig.5.9) not only as indicators of economic status, but also, in the case of radio/TV ownership, for future recommendations on potential ways of communicating public health messages relevant to this research's findings.

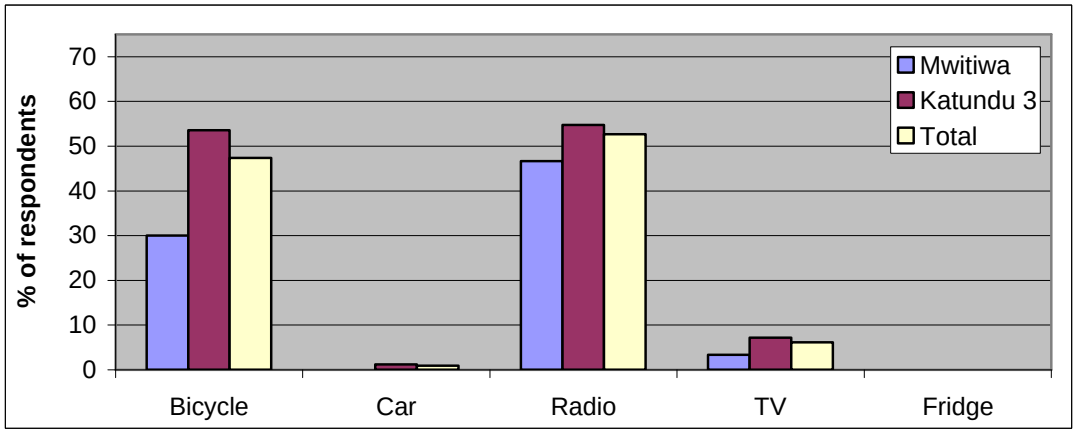


Fig.5.9 HH ownership of listed items (N=71)

5.2.3 Sources of energy in respondents' households

An estimated 98% of households in rural areas in Malawi use firewood/straw as the main fuel for cooking (NSO, 2005). This was, as expected, the trend in the two communities (Fig.5.10).

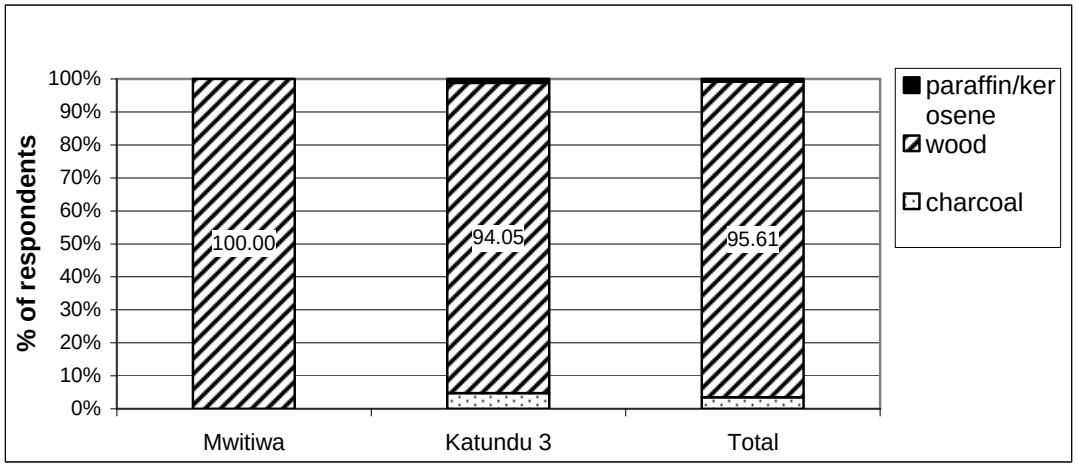


Fig.5.10 Energy source for cooking (N=114)

Firewood is the main fuel source for cooking, and parallels the district and nationwide pattern (NSO, 2005). All respondents in Mwitiwa stated wood as their energy source in cooking, compared with 94.1% in Katundu. The households reporting charcoal use were those with a higher socioeconomic status as indicated by the type of housing construction materials and the flooring of the house (Appendix C, Table C1302). Although largely unavoidable in areas such as these, these biomass fuels are associated with higher risks of various respiratory illnesses, particularly when used in confined spaces (Mishra , 2003; Kilabuko and Nakai, 2007) as many of the respondents do (Fig.5.11).

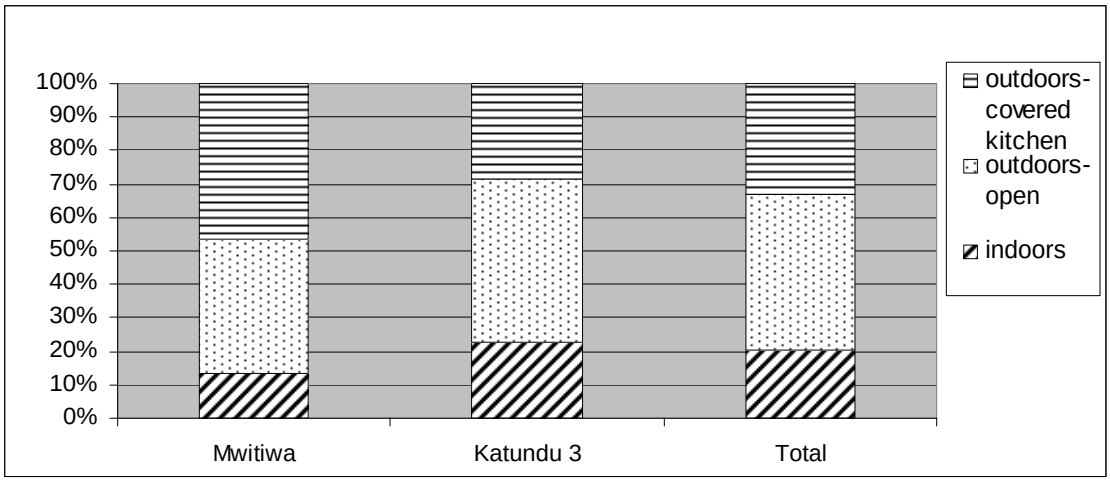


Fig.5.11 Cooking location in HH (N=114)

5.3 Village health & water committees (VHWCs)

During the FGD with the VHWC in Mwitiwa, the Health Surveillance Assistant (HSA) unexpectedly arrived to the FGD discussion carrying ivermectin (drug for onchocerciasis distributed annually in Thyolo District using CDTI under the APOC programme) and a notebook (saying he was in the village to collect demographics), and the research team was introduced before politely informing him that a subsequent meeting would be arranged with him at the health centre. Later, the participants were asked if he visited regularly. Most VHWC members said no. However, over half (56.7%) of Mwitiwa respondents in the KAP survey actually did not know the HSA for their village; still, of those that did (n=13), 39% (n=5) said the HSA did not visit their village. Most women in the FGDs also said the HSA did not visit regularly.

The HSA position is meant to provide a direct link between the public health system and (particularly rural) communities in Malawi. The health surveillance assistants undergo several weeks of training by the Ministry of Health & Population, and are responsible for community-level activities (e.g. documenting health indicators status, liaising with community members, carrying out health education, registering households, organising community-based drug distribution where applicable, etc.). Above the HSA is the Assistant Environmental Health Officer (AEHO, who in turn reports to the District Environmental Health Officer (DEHO). At the top of the public health chain is the District Medical Officer/District Health Officer (DMO/DHO)

A common observation with the VHWCs in both communities was the level of frustration at the obstacles members faced in performing their duties. The main ones, and associated factors, are discussed in the following sub-sections. The general attitudes of the VHWCs in the two villages to these problems were very different.

5.3.1 Loss of members of original VHWCs & committee's capacity to carry out responsibilities

In Mwitiwa, although the committee originally had 10 trained members (five women and five men) only four of these remain; the rest "defaulted" between March 2002 and August 2006. In Katundu, the "Portugal" VHWC currently has seven members (six women), and the "Kalika" committee five (one woman). However, only one person of the originally trained group remains (chairman of

the "Portugal" VHWC). The original group was dissolved, due to "misappropriation of funds" in 2004 (nearly 2 years from its formation). The other members have no training, except what the chairman of "Portugal" VHWC passes on, and "hands on" experience. All VHWC members in both communities brought up the need for refresher training.

Interestingly, the borehole was clearly better maintained in Katundu's "Portugal" zone, where only one trained VHWC member (the committee chairman) remains. It has reportedly never broken down, maintenance is also reportedly carried out regularly, and a night watchman hired by the committee to guard the pump against theft/vandalism. Asked what would happen if there was a breakdown and the chairman was not there, all members held up their hands and looked up to the sky smiling ironically.

5.3.2 Problems collecting community contributions for water point upkeep

In both Mwitiwa and Katundu 3's "Portugal" committees, reluctance of households to contribute MK20/month to a maintenance and repair fund was cited as a problem. This phenomenon is a common occurrence elsewhere (Appiah, 1999). In Mwitiwa, people reportedly contributed when the NGO was still working there; when the NGO left, many people would not contribute unless there was a breakdown in the pump. As one member put it, "we are told to go away; that all we want is money". The VHWC previously tried two methods to combat this non-compliance: tracking down non-payers and putting a lock on the pump. However, "they run away and sneak back at night", or, if

there is a lock on the pump, break the lock at night and draw water. The Village Chief, who was present at the discussion with the VHWC, broke in at one point asserting that the VHWC was "weak" for not collecting contributions monthly.

Similarly, in Katundu 3, reluctance of households to pay MK20/month (MK40 if drawing water for cattle) was seen as a problem by the "Portugal" VHWC. In an effort to counter this, the VHWC uses a "name and shame" system, whereby at the end of collection, the names of those households who did not pay are publicly read out to the rest of the village. The committee also records and presents receipts for expenditures, and displays them publicly to the rest of the community, in an effort to be transparent. Transparency in terms of planning and executing responsibilities is a key factor in the credibility of these committees (Lopez-Gunn and Cortina, 2006). Still, the VHWC cited funds and unwillingness to pay regularly as major problems.

Despite having only one trained member on the committee, the "Portugal" borehole was fully functional, and according to the committee, regular maintenance is undertaken under supervision of the [trained] chairman. For security, some of the collected funds are used to employ a man to guard the borehole at night (MK1,000/month), to prevent theft of parts. One point, brought up by the women when lamenting on the difficulty of collecting monthly contributions, was the need to start a "small business, like a garden", to ensure adequate funds are available on a regular basis.

The "Kalika" VHWC said community contribution is not a problem for them, as the households "have dignity": if they don't pay, they don't draw water. It was not possible to carry out observations on this point, as the borehole had been vandalised (twice, Ph.4.13) and was out of commission for the duration of the research and for many months after. In the first vandalism incident, a local politician contributed to a new pump, which was stolen weeks later; theft of borehole parts is a common occurrence in the area and elsewhere. There seemed to be no real effort from the "Kalika" VHWC to collect funds to rectify this, or to improve security around the borehole. During the FGD, numerous statements were made by the men to the effect of "why don't you (researcher) buy a pump and give it to us". Lack of knowledge about the importance of access to safe water did not seem to be an issue; for example, the committee repeatedly made reference to concerns about schistosomiasis, saying they "are forced to use the [Matapwata] river for all uses", and "many people get *Likodzo* (Bilharzia)". Another concern was the restriction of water for irrigating gardens and crops, forcing these activities to be concentrated around land near the Matapwata River.

Despite the differences in the state of the boreholes under the responsibility of the three VHWCs, ranging from functioning with no apparent problems (Katundu 3's "Portugal") to completely non-functional (Katundu 3's "Kalika"), community reluctance to contribute regularly was evident in all three groups. If the issue was frustration with/lack of confidence in the committees due to perceived inadequate management of the water sources, then Katundu 3's "Portugal" committee would (theoretically) not be expected to report difficulties in user fee collection. The fact that this issue was a constant in all three cases may

point to a more complex issue with community perception of responsibilities. A possible link to this, and one which should certainly be explored in future research in the area (and Malawi) is whether some users feel they are being charged disproportional fees, i.e. a family that draws 10L/p/d pays the same (MK20) as one that draws 30L/p/d. As it stands in the communities, all users, regardless of family size or frequency of water collection, pay the same flat rate. The exception is with Katundu 3′s "Portugal" VHWC, where MK40 is charged if a family has cows and draws water from the borehole for their upkeep.

5.3.3 Lack of community confidence in VHWCs

Bhandari and Grant (2007) found, in a study of user satisfaction and rural water supply programme sustainability in Nepal, that perceived trustworthiness of the water committees was a crucial factor in the ongoing performance of these systems. Lack of confidence in the committees in this research will obviously impact the resources available for the committees to carry out their responsibilities. However, this cannot be solely to blame for some community members′ reluctance to contribute monthly, as discussed in the previous section. Katundu 3′s "Portugal" committee reported publicly showing any receipts for purchases of spare parts/equipment for the borehole; they call the village together and go through the expenses incurred. Upon examination of the bank book, the activities appeared well organized; the expenditures were itemized and the balances updated.

Lack of confidence seems to contribute significantly to community members′ reluctance to pay for borehole upkeep and repair in both communities. For example, while collecting contributions, committee members in Mwitiwa reported being faced with comments such as: "we gave before and the borehole is still not working properly. Why should I pay if I have to pump for a long time?"

The central (main) borehole in Mwitiwa was noted to be functioning poorly (low pump pressure) during the research period (August-November 2006) and throughout sporadic involvement with the community until mid-2008. A borehole technician, commissioned by the researcher during a separate safe water project to upgrade a natural spring in the village in mid 2008, classified the problem as wear and tear and poor maintenance. Although the VHWC had previously said that maintenance was undertaken regularly, this is highly doubtful. "Money" was the reason given by the VHWC for it not being repaired. However, observations and subsequent interaction with the committee strongly suggest lack of motivation and organization as playing a big role. For example, during the aforementioned project, the committee was unable to even organize people to provide enough bricks, quarry, and sand.

In this same project, the committee was offered a chance to repair the borehole infrastructure, which they readily accepted; the technical problems were complicated and required a higher level of skill to address. The VHWC were then asked to obtain an estimate on parts and labour for this. Weeks later, nothing was done, as many of them thought another had taken responsibility for

this task; a clear problem with communication within the committee. Lack of communication was one of the points brought up by the village's HSA in terms of problems he observed with this VHWC and others.

During discussion about previous problems with Mwitiwa's main borehole, it emerged that when the pump had problems in the past the committee had commissioned individuals from the surrounding areas to carry out repairs. They did not know (or check) the qualifications of said individuals, the authenticity of spare parts (which were purchased by the commissioned workers), and the borehole was never repaired properly. It is possible (and probable) that the parts were either used and/or in poor condition, or simply the wrong ones, purchased for a cheaper price than was paid to the "technician". Anecdotal evidence from various NGOs, community-based organizations throughout Malawi, and individuals suggests that this is common. The effects amount to yet another factor contributing to the communities' lack of confidence in the committees, their reluctance to contribute, and even a lack of confidence of the committees in themselves.

5.3.4 Availability of spare parts

VHWCs of both villages reported that spare parts for the boreholes are usually available. These are purchased in the Luchenza township, about >28km from Mwitiwa, and 17->30km from Katundu (depending on route). Since both villages are an appreciable distance from the main highway, VHWC members walk, or use either bicycles or *matola* (paid rides on e.g. transport/pickup trucks) to get to

the highway, and subsequently take a minibus to Luchenza to purchase spares. The trip takes several hours from either village, often the entire day depending on transport availability. Trips are made on an as-needed basis; i.e. no stocks are kept within the community in case of pump breakdown. Despite the spares being available in theory, the difficulties lie in actually getting them in terms of the time/expense/effort to get to them and transport them back to the villages.

A road is currently being built which runs directly from the main highway through Goliati Trading Centre. This may improve transport time for Katundu 3 residents and others in the area in the near future, but likely not for Mwitiwa′s VHWC, as they are further and take a different route to the highway.

5.3.5 Attitudes of the VHWCs towards problems faced

Mwitiwa′s VWHC were clearly very passive (almost resigned) in their approaches to problems they face and their responsibilities as a whole. This was in contrast to their relative eagerness to speak about the actual problems themselves. When asked about possible ways of addressing the issues they had brought up previously, the exclusive theme was the need for funds and technical support from NGOs and the government/government agencies (in which they have little confidence to begin with, a fact observed in both projects in the villages). The tones of the men (who were the main contributors in the FGD) were dejected, and they seemed overwhelmed by the issues they faced with the community. The body language of the participants echoed this theme, as the men spoke of frustrations and the women sat timidly, many looking at the ground,

and reluctant to speak. When asked specific questions about their responsibilities, all members hesitated, looking around at each other as though unsure of how to respond.

The "Kalika" committee in Katundu 3 also brought up the issues of support from external players, but in their case, they assumed it was the duty of these groups to provide them with a water source, and maintain it. This was in part suggested by the long time their borehole was left out of commission after being vandalised, and their repeated demands for external assistance. When the researcher brought up a question of possible solutions to these problems (both the resources to replace stolen parts, and the security issue) the men in the committee firmly listed various external players who should fix the borehole. The conversation rapidly turned into complaints by the committee about how little help they were getting from NGOs as well as government agencies.

Despite also being a part of Katundu 3, the "Portugal" VHWC had a very different outlook. After discussing the main problems they face as a committee, they were asked about possible approaches to handle these. They said that, since the main problem was money, and it is difficult to persuade some community members to pay, they had long thought about starting a small business to ensure funds for the borehole and other activities. Also, since most of them have no training, they wanted to have funds available to hire a professional in case a complex technical problem with the borehole arises. However, they did not know who (agencies) to approach for support, so their ideas for income-generating activities ("some cows" or a garden) remained just that.

Interestingly, the "Portugal" group was the only one of the three VHWCs that brought up the issue of sanitation promotion and making sure the capacity existed to act on this. Two of the women would sometimes go on day trips to other communities for sanitation promotion and to encourage the women to push for latrine construction in their household; this was confirmed with the NGO.

In light of the above, and considering the varying levels to which the VHWCs appeared able and willing to resolve managerial and technical problems, the lack of backup mechanisms is clear. Even if there are extension workers in the area, and even if there exist mechanisms to get help for complicated repairs, the VHWCs in both communities are not able to access them. Not having a backup scheme for operation and maintenance, either because none exists or it is inaccessible for whatever reasons, is one of the main factors which lead to reduced performance of water, sanitation and hygiene projects (Noppen, 1996; Musambayane, 2000; Barnes and Ashbolt, 2006).

5.3.6 Community involvement in VHWCs' work and vice versa

Problems with VHWCs are frequent worldwide, and it was interesting to learn after the KAP survey that 11.4% of respondents overall did not know their village had a "village health and water committee" (Fig.5.12; Appendix C, Table C1201). Over a quarter (26.7%) of KAP respondents in Mwitiwa indicated not knowing whether the village had a VHWC committee. Of those that said their

village did have a committee, six (28.6%) did not know who its members were. In Katundu 3, only one person did not know whether the village had a VHWC, and three (3.6%) said it did not. Of the 95.2% that knew of the existence of the committee, every single one knew who the members were. This difference in cohesion was observed during the FGDs and ongoing interaction with both communities; Mwitiwa seems to have a more socially fragmented population, whereas in Katundu 3, almost every person the research team interacted with had a clear social involvement with their neighbours and the community as a whole. This was illustrated on few occasions where FGDs had to be organized on the spot at short notice; it took much more time to get people together in Mwitiwa, whereas the women in Katundu 3 for example had an idea of who would be at home at the time.

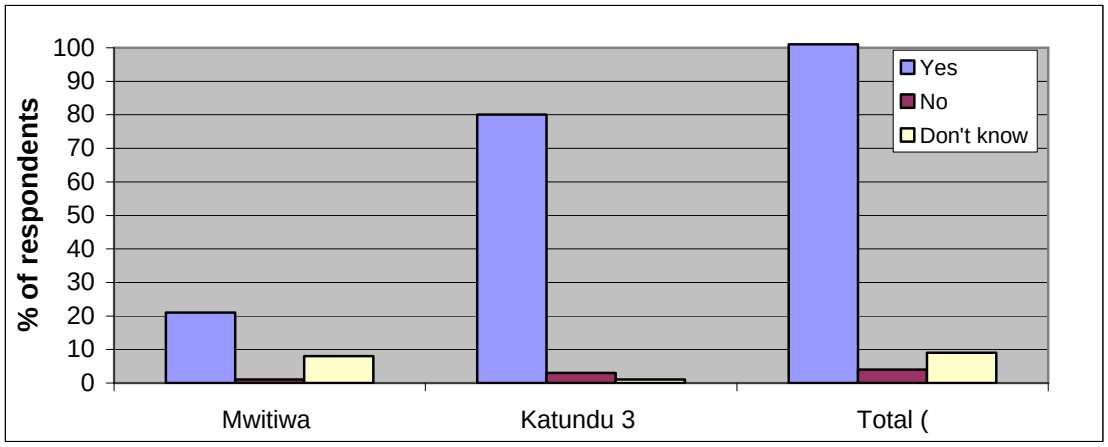


Fig.5.12 Knowledge of existence of a VHWC (N=114)

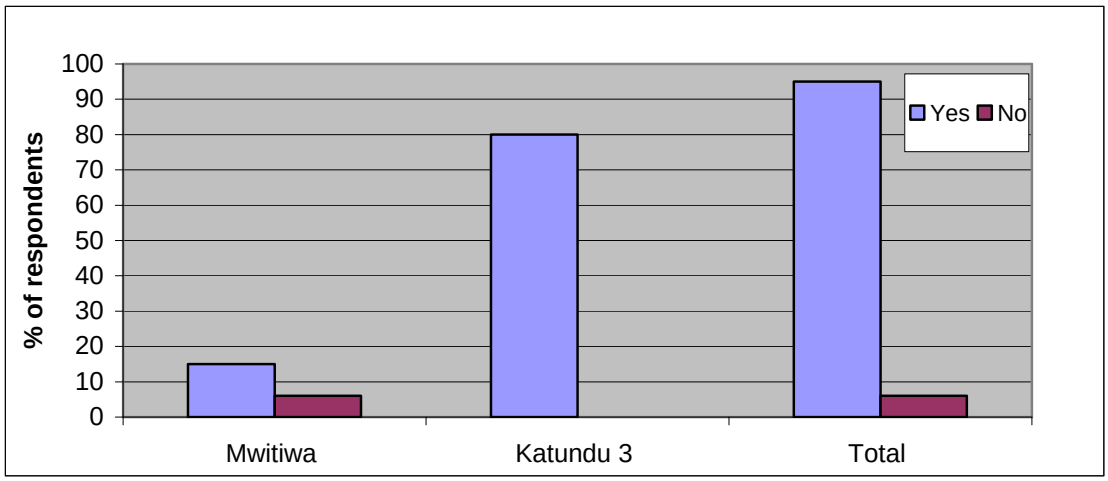


Fig.5.13 Knowledge of VHWC members (N=101)

The answers from the KAP survey point to a number of issues, which must be taken into consideration when interpreting them. First, the level of integration of the VHWCs with the rest of the community may be weak, such that some committee members are simply known to others in the community on a personal/social and informal level, rather than as part of an organised committee. This was most evident in Mwitiwa and Katundu 3's "Kalika" committee, where, not only did the committees display uncertainty about their roles within the communities (other than collecting fees for borehole maintenance), they were even uncertain as to what each member was doing.

By contrast, Katundu 3's "Portugal" committee was very well organized, had the bank book updated and safely stored, and were the only committee to proactively bring up the subjects of challenges in implementing sanitation and the need for income-generating projects to purchase materials. The questions regarding knowledge of the village's health/water committees would likely have

yielded quite different results had the two zones of Katundu 3 been treated as separate entities; those that did not know the committees and their members would probably be mainly within the "Kalika" committee's zone.

Second, although the VHWC was trained (initially) to take over responsibility for the upkeep of the water source and sanitation/hygiene promotion, they may simply see their tasks as confined to maintaining the pump. This in turn may be due to frustration at resources available, lack of confidence in their abilities (particularly after previous problems in retaining trained members, and inability to fix complex technical problems), or simply that they prioritize their own work/responsibilities over voluntary, unpaid work as part of the committee. The last point is very probable, and the HSA responsible for Mwitiwa noted that "since they are volunteers, some do not show up to regular meetings; sometimes 40% of the committee". He (the HSA) commented that one of the main problems with that particular VHWC is "lack of communication between committee members". One way of approaching this issue would be to have the villages discuss and vote on whether their VHWCs should be rewarded for their services. The incentives will vary between communities, but some suggestions include gratuity or other form of financial compensation (Cairncross & Feachem, 1983, 1993), in-kind assistance (e.g. in fields), or other form of distinction such as supplying them with monogrammed clothing or giving them priority at water points during times of congestion (Appiah, 1999).

In both communities, the VHWCs were perceived as "keepers" of the water points, and their functions largely limited to this.

5.3.7 Women's participation/involvement in the discussions with VWHCs and beyond

Although women made up roughly half of both villages' VHWCs, there were stark contrasts between the groups in the actual participation. The women in Mwitiwa and Katundu 3's "Kalika" VHWCs barely participated in the discussions, and appeared to be overwhelmed by the men in the group. The women in Mwitiwa's VHWC were clearly dominated by the men during the FGD, and appeared withdrawn from the discussions. Despite both the lead researcher and the research assistant encouraging them to participate, even asking them direct questions, they were hesitant to speak up, even looking bored most of the time. When they did speak, they spoke timidly, with little eye contact, often looked to the men for confirmation/acknowledgement of their statements, or mirrored opinions given by the men.

In Katundu, however, the women were much more outspoken. During the FGD with the "Portugal" VHWC, the women dominated the discussion groups (actually, made up the majority of the committee). They were very proactive in bringing up topics (such as the need for income generation) with minimal lead questions. On the other hand, the women in Katundu 3's "Portugal" VHWC (and indeed the rest of the community) are very involved, and play a leading advocacy role; for example, promoting sanitation and pushing for latrine construction during rainy seasons. In the "Kalika" group, which had three men and three women (none from the original trained group), both genders

participated, although the women tended to indirectly second the men′s opinions and only respond when asked directly.

Positions of leadership in the VHWCs are occupied by men in all three committees. In each, the chairperson is male, and in Mwitiwa and Katundu 3′s "Kalika" committees, the secretaries/treasurers are both male. While this in and of itself does not automatically present a problem, it may limit the ability of women (who are largely responsible for water and family health issues) to contribute to the functioning of the committee. Indeed, in the latter committees, the women seemed to have little or no input. This is a key point, as it highlights the need to distinguish gender representation and participation when considering sustainability.

The aforementioned point was discussed by Musambayane et al (2000) in a review of sustainability WSS programmes in Easter and Southern Africa as related to how their approaches addressed factors such as poverty and gender. One of the most important points raised in this four-country assessment (Zambia, Malawi, Kenya and South Africa) was how efforts to integrate gender into policies/programmes run the risk of in essence burying gender-specific issues in more general indicators. The authors caution that, in the process of mainstreaming gender in their programmes (in this case WSS), stakeholders must not "transplant" their experiences in mainstreaming gender from one community to another; rather, gender issues should ideally be addressed in the particular contexts (social, economic, etc.) of each community. This conclusion can be extended to any public health-related issue (particularly sanitation) where

socio-behavioural dynamics play a role in sustainability and health outcomes, and forms a central theme around the issues discussed in this thesis.

WSH issues in general are perceived to be "women's domain"; however, even here there may be differences in roles between men and women. For example, men may traditionally be seen as responsible for the technical upkeep of the water sources (this was particularly evident in Mwitiwa), while the women represent the chief user groups. It is therefore reasonable to expect that each will have a different vested interest in the water sources, and by extension require different approaches to engage.

Another, external factor that may have affected the level of participation of the women who were trained in the VWHCs is the fact that almost none of the NGO's field staff involved in the training were female; this was confirmed by one of the organisation's headquarters in Blantyre. This will likely have impacted how much benefit was derived from the training, since much of the health topics (particularly sanitation-related) are extremely sensitive. It was obviously uncomfortable for the women to start talking about sanitation with the (female) researcher and the (female) research assistant at the beginning, although they soon became more comfortable and quite happy to voice their concerns. In the case where the facilitator is male (or indeed even if a man were present at all), much of the women's input into this crucial topic would likely be dampened or lost altogether.

This was not the case during the women's FGDs, where women in both communities engaged in enthusiastic and animated discussions. It was a pleasant surprise to see the difference in the participation of women in the women's FGDs in Mwitiwa. In start contrast to the situation during the discussions with the VHWC, the women were eager to speak when there were no men, even thanking the research team for having them participate. As an aside, some children had told one of the research assistants how happy his parents were that "someone is asking our opinion".

The low representation (if any) of women on the programme's field staff was a stark reminder that an initiative with best of intentions and resources may still fail to reach and mobilise the key players in some stakeholder groups. This issue needs to be addressed as a priority for similar programmes in all settings in Malawi, and one recommendation is to encourage high visibility of female field staff, which would also serve to set an example (in terms of health and health-seeking behaviour) for the women while carrying out education and training in the communities.

Chapter 6- Healthcare access, community health & associated indicators

6.1 Introduction

Chapters 4 and 5 introduced the communities, the water, sanitation, and hygiene programme in the area, and provided some baseline information on the demographics and socioeconomic indicators of the populations. Chapter 6 builds on these data, with in-depth analyses of health and health-related indicators. Most importantly, the trends and patterns observed throughout the research period are addressed, with an aim of illuminating the social and behavioural factors that may explain them.

6.2 Perception of main health issues in respondents' communities

Respondents were asked to list some of the main problems they think their community faces (Fig 6.1).

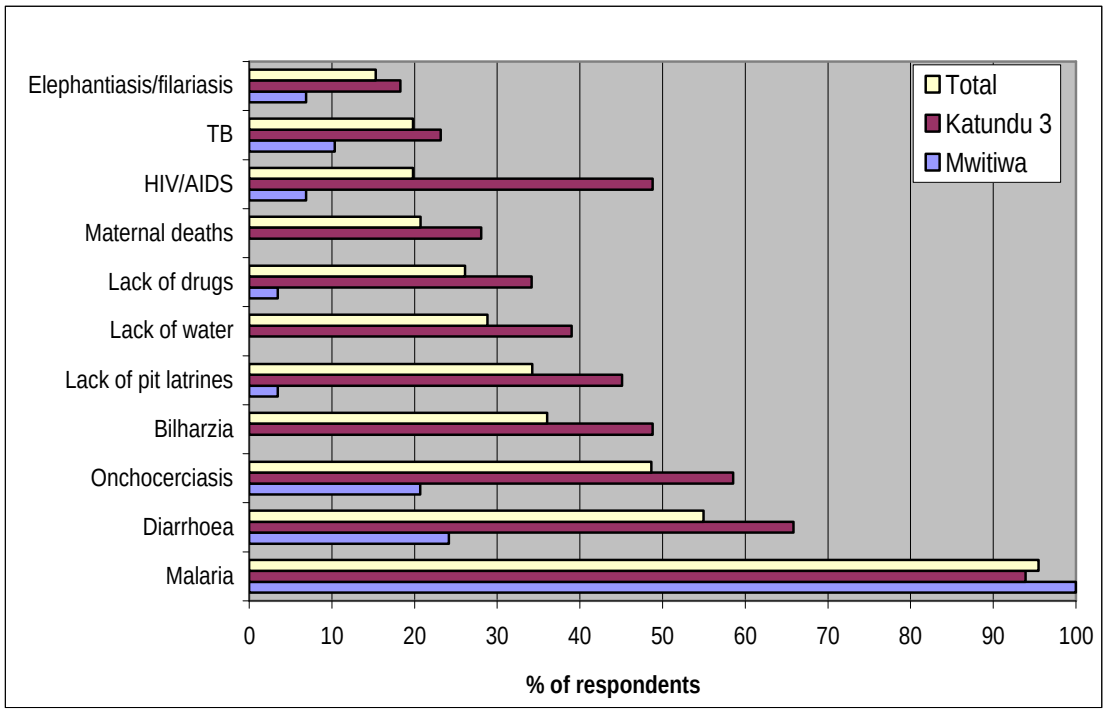
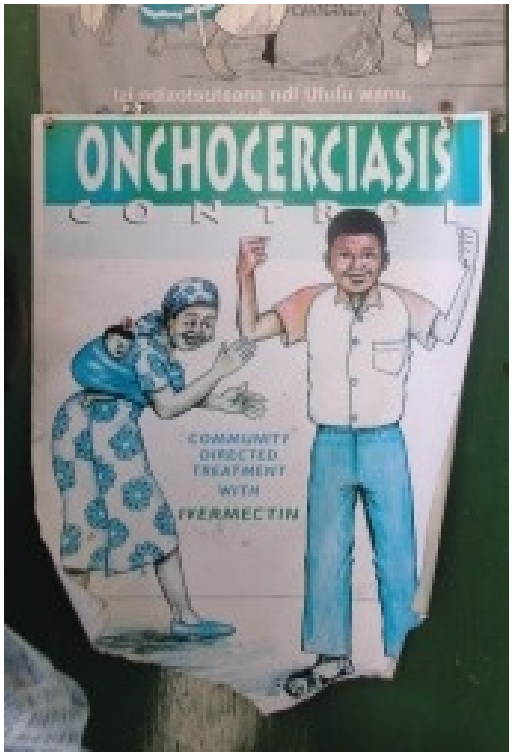


Fig.6.1 Main health problems faced by communities (N=111)

In terms of the % of respondents citing health problems, malaria, diarrhoea, and onchocerciasis were the top three. Malaria was by far and large the most frequently cited (100% and 93.9% of Mwitiwa and Katundu 3 respondents respectively), followed by diarrhoea. However, less than a quarter of Mwitiwa respondents mentioned diarrhoea. The perceived importance of these two conditions parallels the District and national trends as documented by national and international groups (NSO, 2005; Bowie, 2006; WHO, 2007). These perceptions become important when the practices associated with some risk factors for malaria and diarrhoeal diseases are discussed in sections 6.4.2 and 6.4.4 respectively.

Onchocerciasis, which is endemic in Thyolo District among others, came third in the ranking (58.5% and 20.7% of Mwitiwa and Katundu 3 respondents respectively). This was followed up on during the FGD with women, in order to ascertain whether this was due to actual knowledge of the disease or if it was simply knowledge of the name due to the yearly ivermectin distribution and sporadically-placed posters aimed at promoting the distribution programme (Ph.6.1). The local name for the condition is *zokandakanda*, referring to the intense itch caused by an immune response to microfilariae in the skin. In Mwitiwa, women knew that onchocerciasis was an issue related to insects/water, and could cause blindness. Katundu 3 women went into more detail, saying onchocerciasis was spread by a small fly called *chipwita* (the local name for the blackfly vector *Simulium sp.*) which was found around rivers, and that it could cause blindness.



Ph.6.1 Poster on community-based onchocerciasis control (Chimvu Health Centre, Oct. 2006)

Of note is the absence of any mention of schistosomiasis (known locally as Bilharzia or *likodzo*), maternal deaths, and lack of water by respondents in Mwitiwa. This is despite the fact that, during the FGDs, knowledge of schistosomiasis as a condition was relatively well known in terms of risk factors, and maternal health issues made up a large part of discussions on health and healthcare. There may be several explanations for this. First, the actual number of problems listed in Mwitiwa was much lower than Katundu 3, with an average of 1.8 responses per person (compared with Katundu 3′s 5.7/person). Respondents may have interpreted the question ("What are the health problems your village faces?") to mean actual medical conditions, in which case factors such as pit latrine and lack of water may have been under-represented. Also of interest is the

low (6.9%) mention of HIV/AIDS as a problem in Mwitiwa, which may be due to the stigma surrounding the disease or simply the low number of overall responses. Knowledge of and attitudes towards HIV is discussed in section 6.4.3.

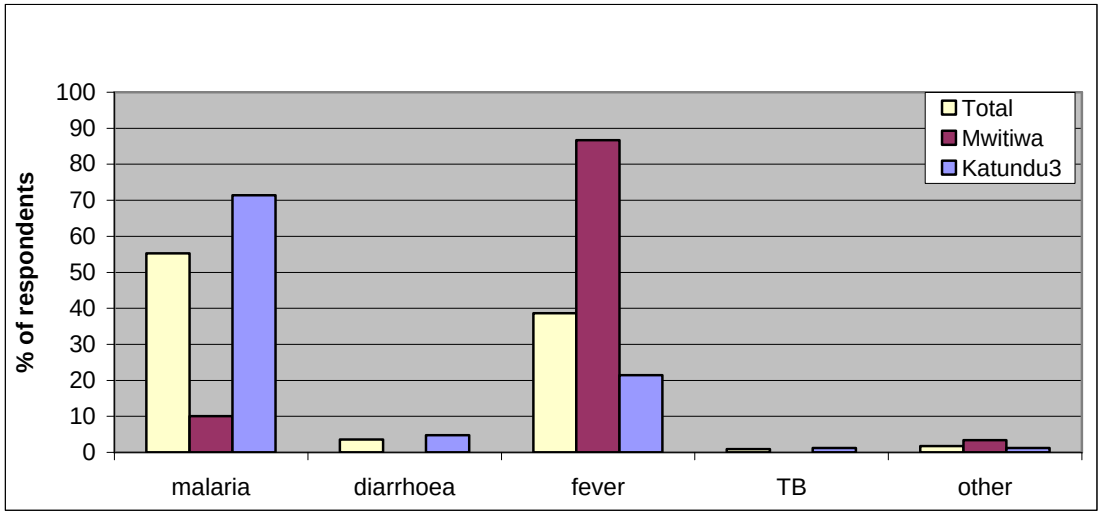


Fig.6.2 Main cause of sickness in children, according to respondents (N=114)

Malaria and fever were perceived to be the main causes of illness in children (55.3% and 38.6% of total respondents, respectively), as shown in Fig.6.2. In follow-up discussions, women were asked about the differences in choices for malaria ("malungo") and fever ("kutentha thupi"), which it turned out were largely perceived to be one and the same. Women associated fever mainly with malaria, followed upon prompting by pneumonia ("chibayo"). Although diagnosing a "fever", particularly in children, may be subjective, regional studies and observations suggest that mothers, for the most part, are able to diagnose fever in their young children with reasonable accuracy. For example, one study in Burkina Faso (Ye et al, 2007) found that mothers were able to diagnose fever

(T>37.5°C) in their children (<3yrs of age), with sensitivity and specificity of 76.2% and 87.1% respectively.

One very important point in the above figures is the absence of pneumonia or other lower respiratory tract infection (LRI) as an important health concern. While this was not listed in the questionnaire, the question was a multiple response one, and they respondents were prompted for answers until they had no more; they were not shown the list, so their answers would not have been confined to those listed. If they had named a condition not listed in the survey, it would have been classed as "other". Nevertheless, error on the part of the survey administrators cannot be ruled out completely. In order to clarify this, and determine perceptions on RTIs in general, the two questions were put to women in the FGDs. None of the participants in two separate FGDs brought up the issue of RTIs or ARIs without being prompted by the researcher. This and other points are discussed in section 6.4.1 on respiratory tract infections.

6.3 Healthcare and health-seeking behaviour

The women in both villages were initially asked about sources of healthcare, in order to get the discussion going. In fact, this was the topic they were most eager to discuss, with animated discussions in both villages. Clearly, healthcare access is a huge issue in the villages, as every woman in the FGDs was keen on contributing her opinion and relating stories of her experience.

In Mwitiwa, the main sources of healthcare are three government health centres (HCs) were identified: Mikolongwe, Chimaliro, and Chimvu HC. The first two are a significant distance from the village (over mountainous terrain), while Chimvu HC is about 3km through the hills. In stark contrast to the VHWC FGD, the women (including two members of the VHWC) were keen to participate.

6.3.1 Healthcare facilities

People in both communities are at least an hour's walk to any type of health care facility. After ascertaining the most frequently utilised facilities by each community, these were visited.

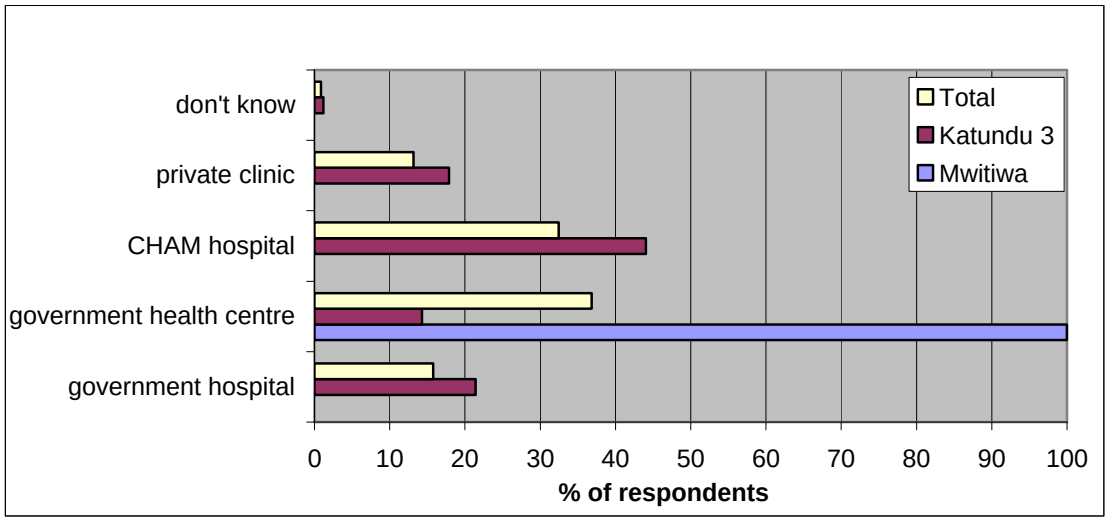


Fig.6.3 Nearest healthcare facility (N=114)

In Mwitiwa, the most utilised facility was reportedly Chimvu Health Centre (Ph.6.2), a government facility roughly 3km from the village. Two other government facilities were also mentioned, Mikolongwe and Chimaliro Health

Centres (approx. 7km and 5km respectively), but those are much further away. For Katundu 3, Mikolongwe (~4.5km), Chimaliro (~4.7km) and Monjeza (<3km) were the main health facilities named. These former two are government health centres. However, Katundu 3 respondents reported using some private clinics in the area in case of severe illness or (mainly) first pregnancies, and when funds permit. Maps of the area are found in Appendix A.

Ph.6.2 Family planning clinic in Chimvu HC (Oct. 2006)

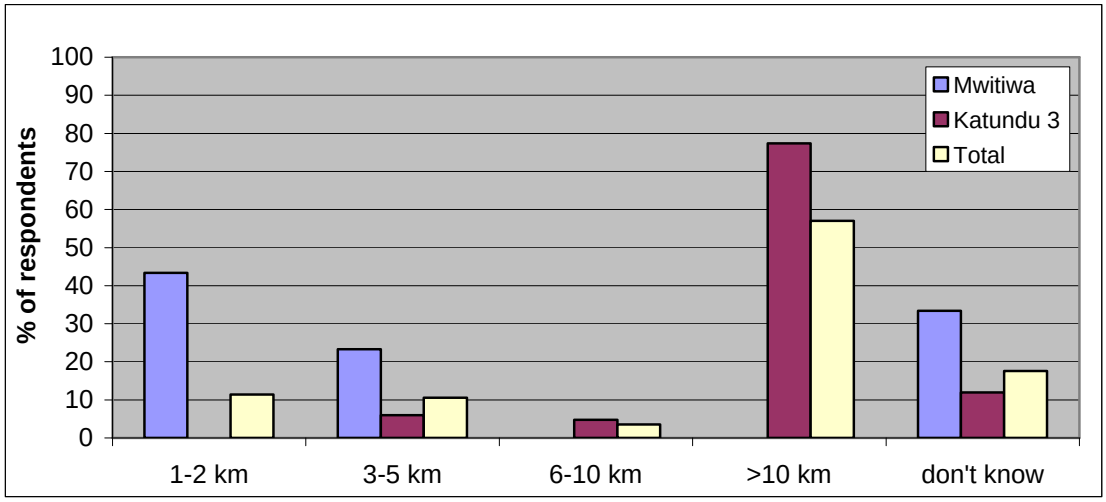


Fig.6.4 Distance to the nearest health facility (N=114)

Of note are the varied responses of the distances of the "nearest" health facility from the respondents' villages. Fig.6.3 shows the distribution of Katundu 3 responses with regards to which is the nearest health facility to them. Over three quarters of respondents from Katundu3 replied that the health centre is over 6 km from them, where in reality, the furthest is less than this distance. This, along with perceptions of time, was commonly found throughout the research, especially when correlating respondents' estimates of water collection time with observations. For this reason it is recommended to use other measures of time and distance when attempting these estimates (e.g. relative to cooking a pot of *nsima*, or boiling a pot of water). Nevertheless, distance was the main cited obstacle to accessing these services

Unlike Katundu 3, which is located along relatively flat dirt roads, Mwitiwa is located in much more hilly terrain, and so it takes more time (and effort) to navigate between points. All KAP survey respondents from this community reported that distance is a problem they face accessing healthcare facilities, followed by "no bridge" over the river (92.6%). The latter is usually a problem during the rainy season only, as the "river" is actually a stream during the rest of the year; in the rainy season however, FGD participants say they are afraid to cross for fear of being swept away by the swollen waters.

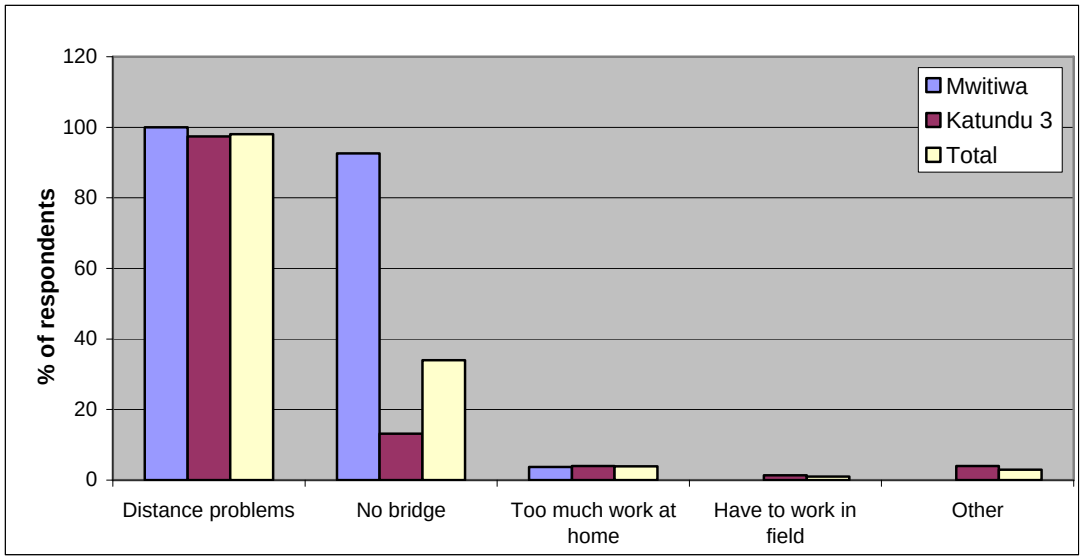


Fig.6.5 Problems accessing health services (N=103)

6.3.2 Utilisation of mainstream healthcare facilities

Upon examining the out-patient registers (OPD) (from Aptil 2004-June 2006) for Chimvu (and later Mikolongwe and Chimaliro centres), it was noted that there was relatively low usage by Mwitiwa residents (835 consults in the interval, no missing registers), even less than other communities located much further away from the health centre (e.g. Kabuthu). This was brought up during subsequent FGDs and interactions. The main reasons mentioned were distance to the facilities, time spent accessing healthcare, and problems with the care itself. The last point was clearly the most important to them, and their choice of what type of healthcare to access is determined, according to both men and women, by "how they welcome us".

For Katundu 3, Chimaliro and Mikolongwe Health Centres were the main government facilities used, although the women preferred, when possible, to use a private (Monjeza, a Mission facility) facility slightly further away. The reasons for this parallel the points brought up by community members in Mwitiwa, and are discussed further in this section. It is not possible to comment on uptake, as the registers from April 2005 to March 2006 were missing and could not be located.

When people in Katundu 3 do access government facilities, it is for (according to the FGDs) abdominal pain, severe diarrhoea ("cholera"), ulcers, significant tooth/back/headache, worms, HIV testing, and sexually transmitted diseases (they mentioned syphilis and gonorrhoea). Where possible, pregnant women prefer to deliver at Monjeza HC or at home with a traditional birth attendant (TBA). Neither village has a trained TBA, so where possible they recruit someone from the area (usually an untrained but experienced older woman).

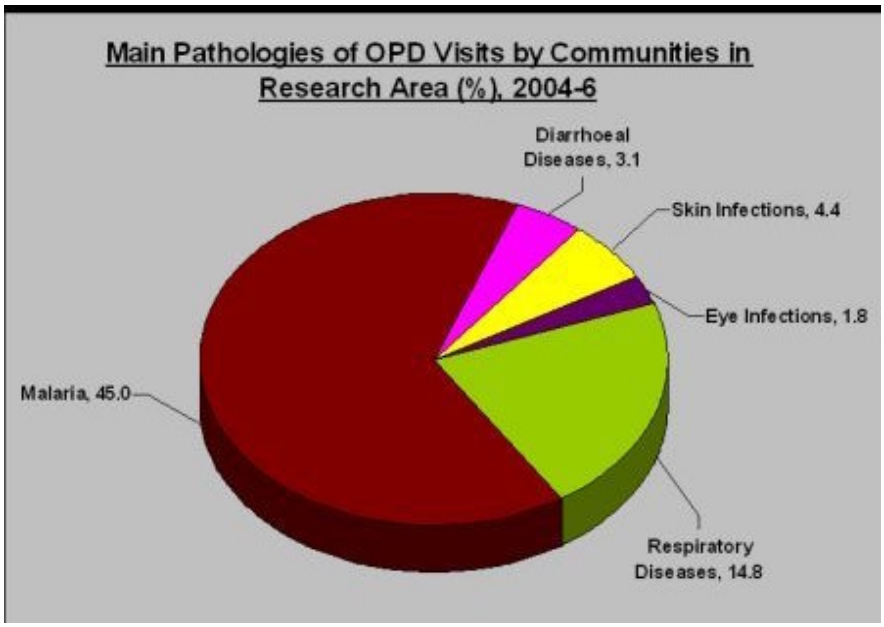


Fig6.6 Main pathologies of Health Centre OPD visits for communities (April'04-June '06)

The women in both villages were very anxious to talk about their experiences and feelings regarding healthcare, and the otherwise timid women in Mwitiwa (during the FGD with the VHWC) became very animated and involved in the women's FGD. In fact, other women in the villages later requested additional FGDs to discuss their problems with healthcare.

Some of the statements that summarise the basis of their lack of confidence in mainstream healthcare facilities, and subsequent reluctance to use them, are given below.

- **Waiting times**: "they leave us sitting, no one attends to us". In the KAP survey, the majority (89.6%) of respondents indicated this was one of the problems they faced at the facilities.

- **No, or insufficient, "mankhwala" ("drugs"):** Many women complained that many times they make the long journey to a (government) health centre, only to find that the medicine they need is not available; "sometimes we are told there are no drugs". This was also seen in the KAP survey, where almost 60% of respondents listed "no drugs" as a problem they face at health facilities (Fig.6.7). This may be either due to shortage of supplies from the District Hospital, or due to misappropriation of supplies delivered. Several sources (including a clinical officer and a records clerk) at the Thyolo District Hospital commented that the monthly reports they receive from rural health centres throughout the District, which serve as the basis for allocation/distribution of drugs, do not match the OPD register numbers, which are collected quarterly. These same sources suggested that numbers are inflated in order to obtain larger quantities of drugs, which are then sold outside the facilities. This has also been suggested in a study of healthcare workers by Muula and Maseko (2006) as being one of the coping strategies of under-paid healthcare staff in the country.

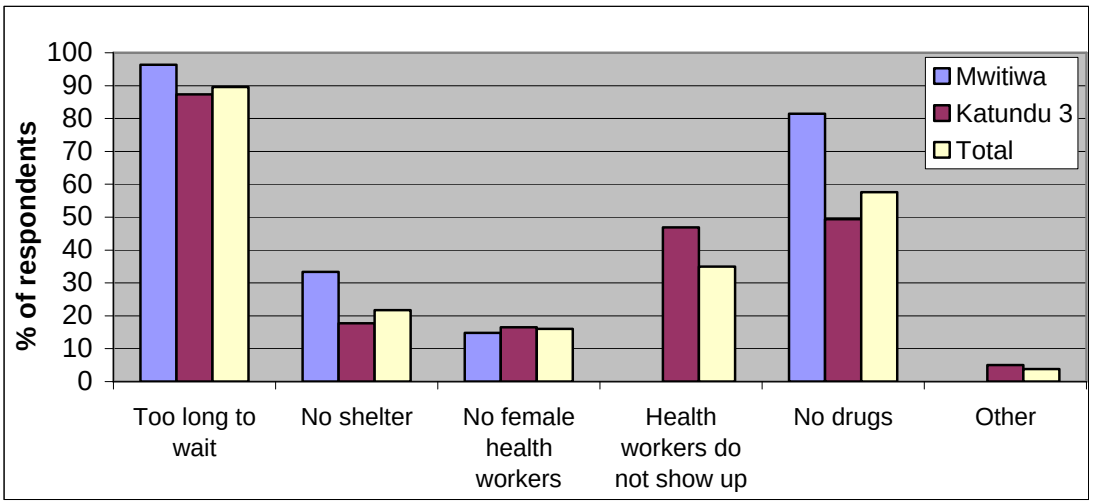


Fig.6.7 Problems faced by respondents at HCs (N=106)

- **Lack of confidence in treatment:** many women voiced their concerns that patients were sometimes getting "wrong drugs", because "if we have abdominal pain, we get aspirin. If we have headache, we get aspirin. If we have a toothache, we get aspirin." Their concern was that they were sometimes simply given what drugs are available, without much consideration of the reason for their complaint. In reality, given the lack of diagnostic capacities in such facilities, combined with the sheer volume of patients seen, their concerns may very well be valid. This is in part highlighted in the OPD registers, where the vast majority of diagnoses were malaria, respiratory tract infections, and non-communicable conditions (trauma). Given the non-specific nature of symptoms many patients presented with, other causes may very well have been missed. (Mallewa et al, 2007; Chisi et al, 2007)

- **Healthcare worker(s) are not there:** Sometimes the staff (usually clinical officer) are not there due to illness (“health personnel sick”), or simply arrive late/leave early. For example, at one government facility, the clinical staff reportedly often arrive around 11:30, close for lunch at noon, and open from 13:30-16:00. “We waste most of the day to go there and no one is there to assist us”.

- **Treatment by health staff:** All FGD participants in both villages said they would think twice about accessing a healthcare centre because of “attitude of staff”. In fact, poor treatment by health staff followed by inconsistencies in treatment provision was the top factors cited in both communities in terms of low utilisation of the health centres. This is particularly a problem with maternity cases. Several women reported that staff (mainly male) at the HCs would call an ambulance from the District Hospital because they “could not be bothered”, and not based on medical need; one woman complained that “sometimes they don’t even see the patient. They just call an ambulance” before assessing the expectant mother; “many women deliver on the way”.

Women reported being accused of being “troublemakers” by midwives when for example screaming during labour. Most participants reported being verbally (“you are bothering me”) and physically abused (slapped), as well as being made to walk distances to collect water for the maternity unit shortly after delivery (“many women collapse along the way”). The patients (or their caregiver) are often responsible for bringing their own supplies, or must wash the linens

following delivery. Also, some midwives/clinical officers are afraid of being, or having the linen be, in contact with blood, so "they leave us to deliver on the floor"; women say the staff are afraid of HIV/AIDS, especially when there are not enough gloves. For these reasons, women in both villages would prefer to deliver either at home with a traditional birth assistant, or at a private clinic if it is financially and medically possible.

6.3.3 Sources of health information

Particularly with challenges faced in accessing/utilising mainstream healthcare facilities, knowing how people get information on various health matters is crucial in planning community health interventions. Radio and health personnel were the main sources for most respondents and their households in both villages, followed by newspaper, song, and dance for Katundu 3, and village committee and friends for Mwitiwa (Fig.5.8).

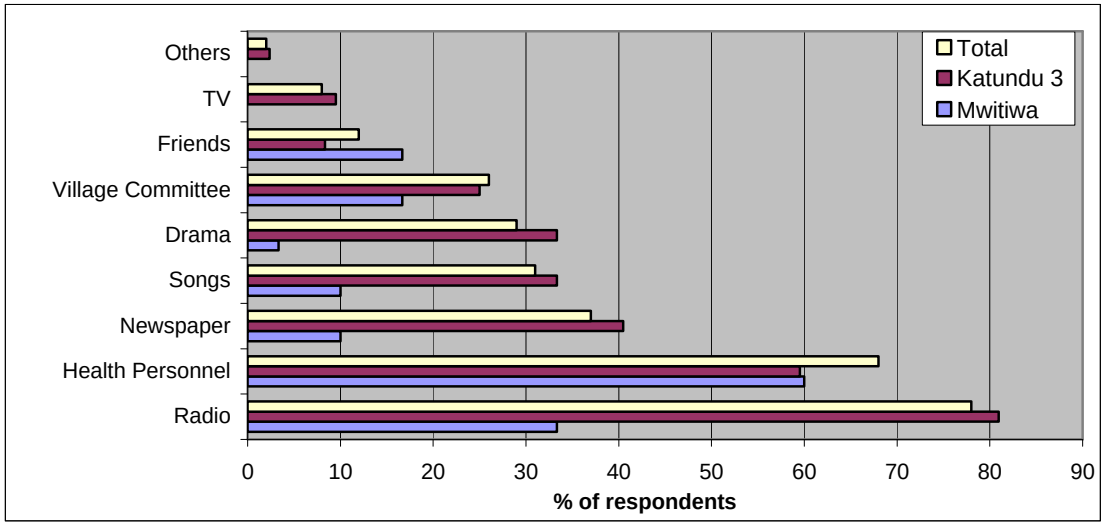


Fig.6.8 Sources of health information in respondents' HHs (N=114)

As an aside, one-third of Katundu 3 respondents said songs and drama are a source of health information for them. However, a nurse at Chimvu HC cited and example that, while most of the women in an ante-natal clinic she runs knew the words to a song on family planning, very little seemed to practice the words: the knowledge-practice gap.

6.3.4 Access to drugs

Noting that the access to mainstream healthcare, for whatever reasons, is an obstacle in both communities, other avenues of healthcare are utilised by the communities. During the FGDs, most respondents said they would buy drugs (especially antimalarials) at the market. During one FGD in Mwitiwa, one woman said she had a headache that day, and "bought some penicillin from the market" the day before; she stated that it "helped very much". When asked why she had chosen penicillin, she shrugged and said "they are tablets; [the vendor said] I should take them for three days". A related observation was that, despite the low confidence in the national healthcare system, the communities believe strongly in the efficacy of medicines themselves. For example, several clinical officers in the rural health centres and the District Hospital said that patients often demand injections, and report feeling "much better" after receiving an injection of (unknown to them) normal saline. Other drugs the communities report purchasing from the markets include sulfadoxine-pyremethamine (SP, or Fansidar), chloroquine, paracetamol, aspirin, and antibiotics such as co-trimoxazole and ampicilin. An example for SP is shown in Fig.6.9 below.

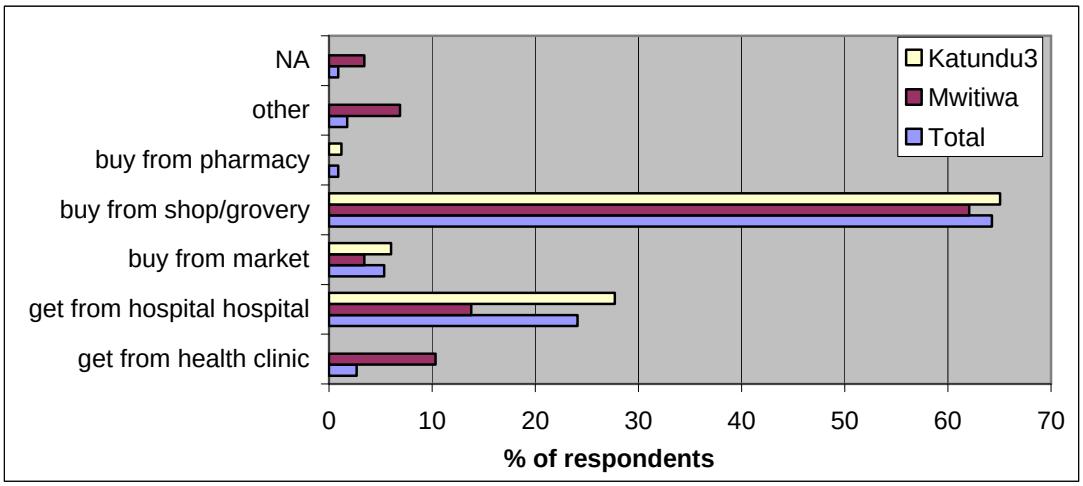


Fig.6.9 Source of SP (sulfadoxine-pyremethamine) for respondent HHs (N=112)

At the beginning of the research, no one brought up traditional healers, saying they would go to the government rural health centres. Later, however, when the results from the OPD registers were discussed with the women, and as the communities became more comfortable with the research team, they began to open up and speak freely. Unless the condition is serious, most of the women first try self-medicating, and if that fails, go either to a traditional healer or a rural health centre. Although the KAP survey did ask about traditional healers, it would be more useful in future to inquire about the order in which healthcare providers are used. Based on the observations in this study, it may well be that a health centre would be the last service visited, after traditional remedies and traditional healers. Whatever the reasons, this highlights the importance of multiple (and participatory) methods of gathering health-related information from communities.

Most of the women who spoke about traditional healers were in Mwitiwa. One FGD participant in Mwitiwa had a severely discoloured thumb and entire side of the hand; the bone in the thumb was exposed, and the entire hand was swollen and painful past the wrist. The lady revealed that she had cut her thumb about 3 months previously, the wound had been getting progressively larger, the hand was turning black and purple, and she was unable to care for her infant because of the severe pain. She had not been to any health centre, but had tried several traditional healers and traditional remedies to no avail. After being urgently referred to the District Hospital by the researcher, the exposed bone and gangrenous tissue were removed; despite the weeks of excruciating pain, fever, and debility of her injury, the woman had still chosen not to seek mainstream medical care, because of (according to her) the lack of faith in the systems.

6.3.5 Alternative forms of self-medication: geophagy

An interesting observation was in another form of self-medication in the communities: geophagy (consumption of soil or earth). This is a very common practice worldwide, in both developed and developing countries; in Syria for example, pregnant women (particularly rural) regularly consume soil/dirt (pers. obs.). Upon inquiring on this point (and after giving examples from Syria), women in both communities revealed that this was common not only amongst pregnant women, but children and men as well. With children, the women said they did it "because they see adults doing it". Reasons for geophagy include: "I just crave soil", therapy for nausea (in pregnancy), therapy for migraines, and to "help open bowels". The favoured soil types are the dark red clays, and soil

around termite mounds/tree barks (Ph.6.2). Women said that they are told by health workers at the health centres not to consume soil, and are aware of the risks of, for example, ingesting "worm eggs". They still do though, and laughingly said "but we don't tell them at the health centres". The soil (which is either collected or available for purchase even in towns) is usually "cooked" to "clean it", but the women in the FGDs said they do not always do this, particularly with soil collected from termite mounds.

Geophagy has been associated with anaemia (Geissler et al, 1998; Nchito et al, 2004) and potential increase in transmission of soil-transmitted helminths, especially for children. No detailed studies, formal or informal, were found on the practice in Malawi, and only one publication mentioned geophageous behaviour as a "marker of pregnancy" in the country (Walker et al, 1997). However, other studies in the region have suggested associations between the practice in children, and higher prevalences and intensities of the non-hookworm soil-transmitted helminths *A. lumbricoides* (Geissler et al, 1998; Nchito et al, 2004), and *T. trichiura* (Geissler et al, 1998). In contrast, Young et al (2007) found no association between geophagy in *adults* in Pemba Island (Zanzibar, Tanzania), and infection with *T. trichiura*. Surprisingly, the practice does not appear to be significantly associated with hookworm infection intensities. However, most studies were based on reported geophageous behaviour and relevant laboratory tests (blood, stool), and most did not simultaneously analyse the actual levels of contamination in the soils consumed by their subjects, which may have shed more light on the risk profile.

Without going into detail about the arguments for and against potential health impacts of geophagy, or whether it manifests as a cause or effect of enteric parasitic infection, the fact that it is so prevalent (~90% of rural women) in the region (Hunter, 1993; Walker et al, 1997) and the research communities should be a further cause for concern for the WSH and health sectors in Malawi. It highlights yet another important exposure pathway for faecal-oral infections, considering the transmission routes of the aforementioned parasites. Geophagy is a behavioural issue, and the specifics are outwith the scope of a WSH programme. However, this finding in the research communities highlights again the gap which exists between knowledge and its translation into action, and provides even more incentive for WSH programmes to place greater emphasis on sustained hygienic behavioural changes to reduce contamination of soil by excreted parasites.

Ph.6.2 Earth deposited on tree barks is collected for eating by the communities (Feb. 2007)

6.4 Specific health issues: knowledge, attitudes, and practices

6.4.1 Respiratory tract infections

Respiratory tract infections (RTIs) are a major cause of morbidity and mortality, both worldwide and in Malawi. As pointed out in section 6.2 on perceived health problems in the communities, RTIs for the most part did not appear among the cited conditions (Fig.6.1); the exception is TB, and even then it ranks low on the list. To follow up on this observation, women were prompted during the FGDs about other problems which may not have appeared in the survey, bringing up the observation that several children of the participants were coughing. Upon this, the women brought up the fact that "chest problems" were common in the communities, especially in women and children. Several men were spoken to later, during other observation activities, and they stated that "yes, everyone gets problems with coughing", but "more the women and children". Upon asking about possible explanations, both the women in the FGDs and the men linked the coughing and RTIs to "the weather". Overall, 90.1% of respondents said someone in their household had suffered a respiratory infection; 83.3% in Mwitiwa and 92.9% in Katundu. The breakdowns of who in the house had suffered the infection(s) are given in Fig.6.10 below.

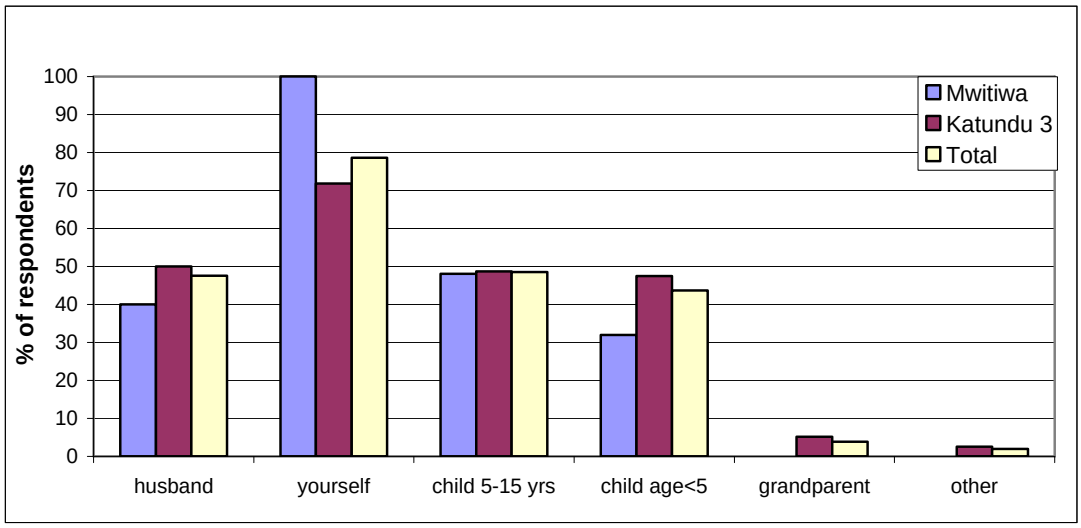


Fig.6.10 HH members who suffered RTIs (N=103)

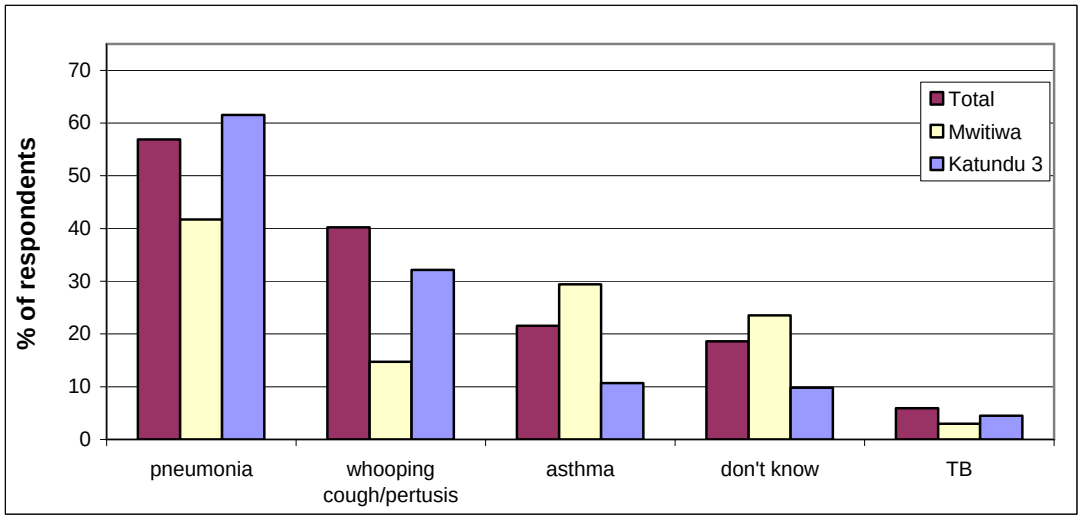


Fig.6.11 RTIs suffered by respondents' HH members (N=103)

Pneumonia (*chibayo*) was the most commonly cited RTI in both villages (Fig.6.11). It is important to note that, many of the time these may not be the actual diagnoses, given the low utilisation of health services. It is difficult to know which of these are self-diagnoses (although unlikely in the case of TB). All

women spoken to in both communities knew how to recognise pneumonia in an infant (e.g. rapid, shallow breathing, chest indrawing). The accuracy of diagnoses of whooping cough and asthma is doubtful, as even in the health centres diagnosis is normally made clinically. It is important to note that many parasitic infections can cause pulmonary symptoms (e.g. *A. lumbricoides*). No studies were identified on helminthic infections in the area, and so this point is mentioned as a point of interest, and to highlight the wide-ranging impacts of diseases related to sanitation and hygiene.

Respiratory infections represent an example of an "unintended" area of impact for WSH programmes, through the potential effects of handwashing on reducing the burden of these conditions (Ryan et al, 2001; Rabie, 2002). For this reason, and partly because it is relatively uncomplicated to incorporate into existing health education components, respiratory diseases and their risk factors should be incorporated into WSH programmes. In particular, minimising exposure to particulate matter should be the focus, as eliminating would be rather an unrealistic goal. Possible focus points would be the presence of poultry in the house (increased risk of e.g. campylobacteriosis), and the importance of ventilation and sunlight in the house (Ph.6.3).

Ph.6.3 A hen running around in a house in Katundu 3 (March 2007)

6.4.2 Malaria

Malaria is major killer in the region, along with HIV/AIDS and pneumonia, particularly in pregnant women and young children. KAP survey respondents were asked about the last time anyone in the household had malaria (Fig.6.12). It is important to bring up two points. First, the diagnosis of malaria, whether in the communities or at the health centres, is a clinical one. Although in theory a blood test should be performed to confirm the diagnosis, this is rarely done, as the sheer numbers of patients at the health centres, combined with often sporadic capacity, makes this unattainable. Thus, and this was supported by the OPD registers examined, presumptive diagnosis of malaria is made for most non-specific symptoms/signs.

Second, unless the illness is severe or associated with a major event, the answers depend on the respondent recalling the illness and its timing. Nevertheless, the results are given below, along with how the respondents would diagnose malaria (Fig.6.13).

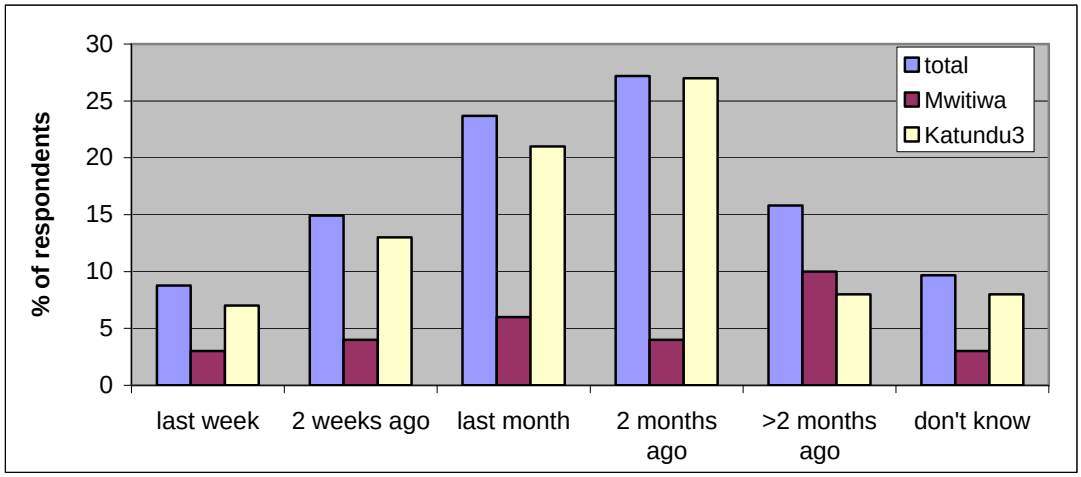


Fig.6.12 Last time someone in the HH had malaria (N=114)

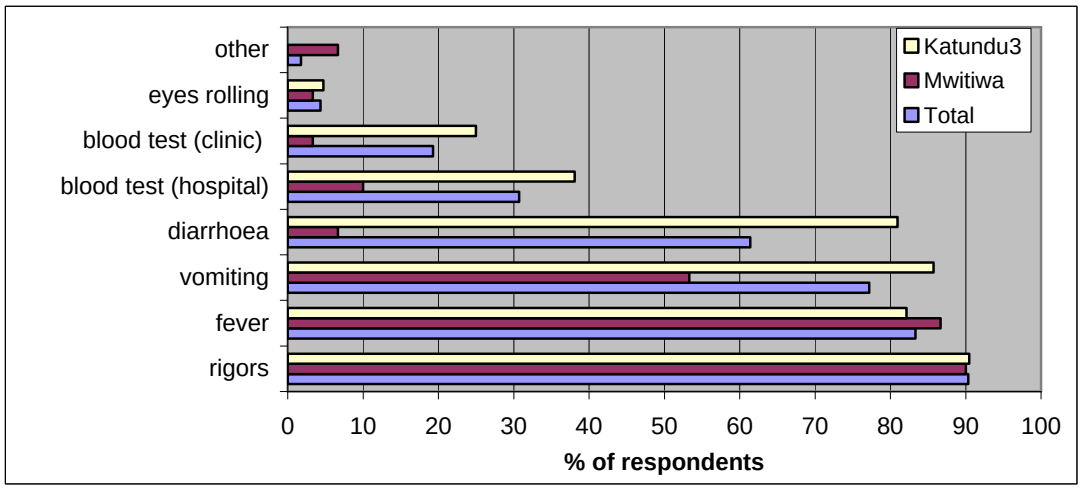


Fig.6.13 How malaria is diagnosed (N=112)

Timely and correct treatment of malaria is crucial. Although most respondents answered that they would take the patient (adult or child) to the hospital (Figs. 6.14 and 6.15), and to a lesser extent to the clinic, this is highly unlikely in practice. Even during the course of the research, many people were observed either having purchased SP (Fansidar) at the market, or asking the research team if they had some. Similarly, women in the FGDs made comments along the lines of "why should we waste time going to the *chipatala* (hospital or health centre), when we can buy the drugs?" In this case, it is very likely that the responses reflected what was thought to be the "right" answer.

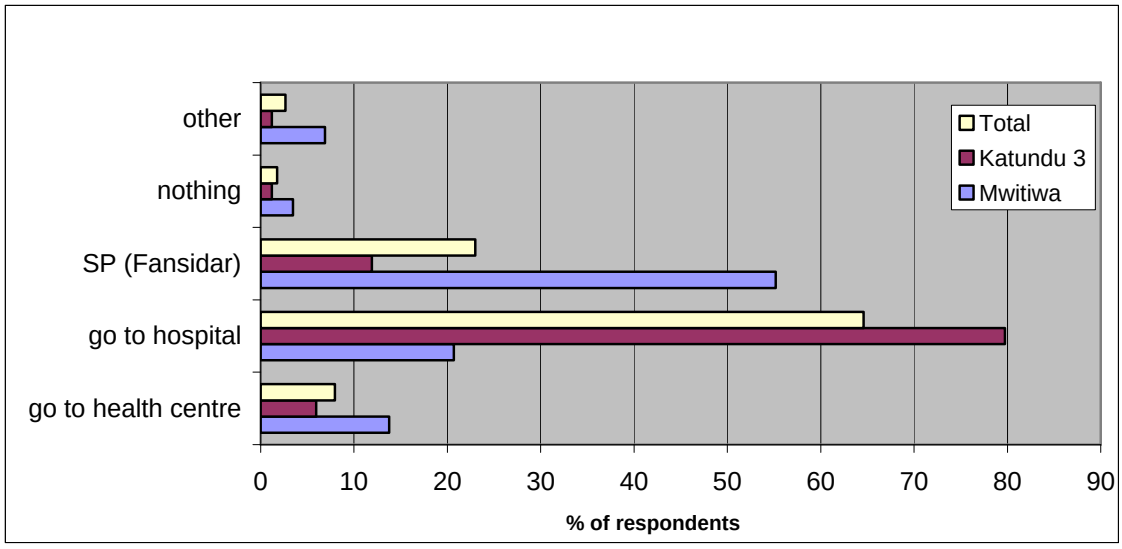


Fig.6.14 Action when adult suffers from "malaria" (N=113)

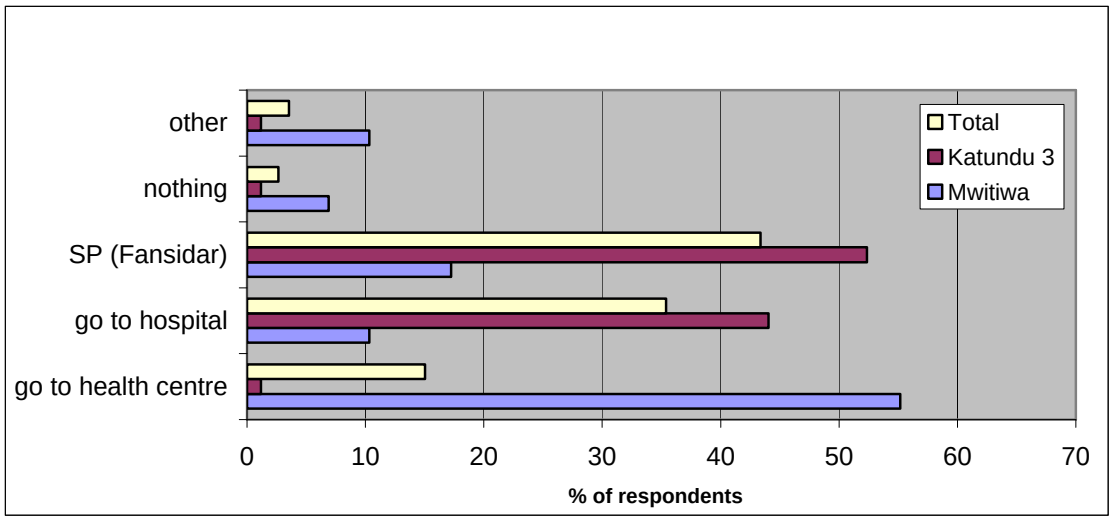


Fig.6.15 Action when a child suffers "malaria" (N=113)

The above trends appear to contradict the numbers in Fig 6.9, where nearly two-thirds of respondents said they buy SP (first-line therapy for malaria at the time of the study) from the market. This suggests, once again, that these responses reflect what is seen as "the right answer", rather than true practice. Although drugs are sporadically out of stock, and an example was seen in Mwitiwa, where a pregnant woman had returned to the village because Chimvu HC had run out of drugs for intermittent preventive therapy (IPT), it is highly unlikely that all those respondents turn to the market for drugs only when supplies at facilities run out. As is the trend around the country, drugs are frequently purchased at the market whenever malaria is suspected. Measures taken by respondents to reduce malaria in the household are given in Fig.6.16.

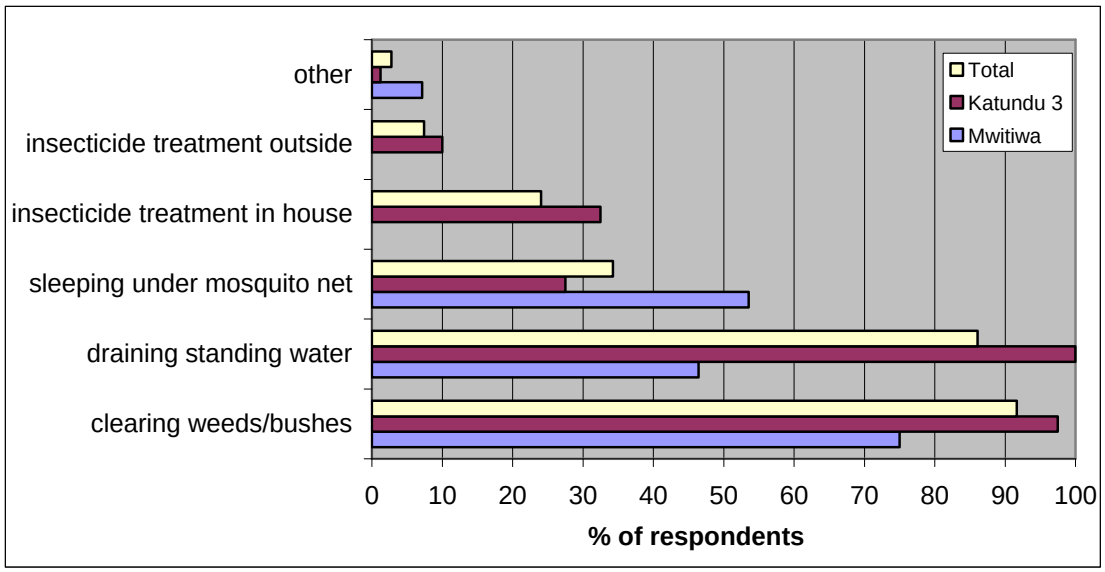


Fig.6.16 Measures taken in HH to prevent malaria (N=108)

All respondents in Katundu 3 said they drain standing water to prevent malaria in their households. This implies a high level of knowledge in the community about the relationship between standing water and malaria (mosquito breeding). However, for the duration of the research, the soakaway of the borehole consisted of a large, deep pool of standing water (Ph.6.4).

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Ph.6.4 Soakaway of Katundu 3 "Portugal" borehole (Oct.2006)

The women, before even being asked about it, said they knew the puddle was creating breeding grounds for mosquitoes, but they had purposely dug out the soakaway and let the water collect. The reason was that several villagers were building houses, and needed water. Rather than draw water from the groundwater aquifer for this, and risk straining the already heavily-pressured reserves, they decided to utilise the excess water from when women drew water for their households. Sure enough, several months later, the soakaway was reconstructed (Ph.6.5)

Ph.6.5 Soakaway of Katundu 3 "Portugal" borehole (May 2008)

Despite over a third (34.3%) citing "sleeping under a mosquito net" as a means of preventing malaria in their households, few report actually owning a net. 53.6% of Mwitiwa respondents cited this method for preventing malaria, yet only 13.3% actually own any nets. In Katundu 3, 27.5% cited this preventive method, with one third of households owning at least one net (Fig.6.17). Again, in Mwitiwa, the discrepancy between the figures suggests that either the method was selected because it was seen to be a "right answer", or a reluctance to suggest that they do not own any nets. Mosquito nets are constantly touted by health campaigns as crucial to preventing malaria, particularly in pregnant women (Ph.6.6) and young children, and some respondents may have felt reluctant to be seen to go against the message.

Ph.6.6 A pregnant woman in Katundu 3 standing by her mosquito net (Nov. 2006)

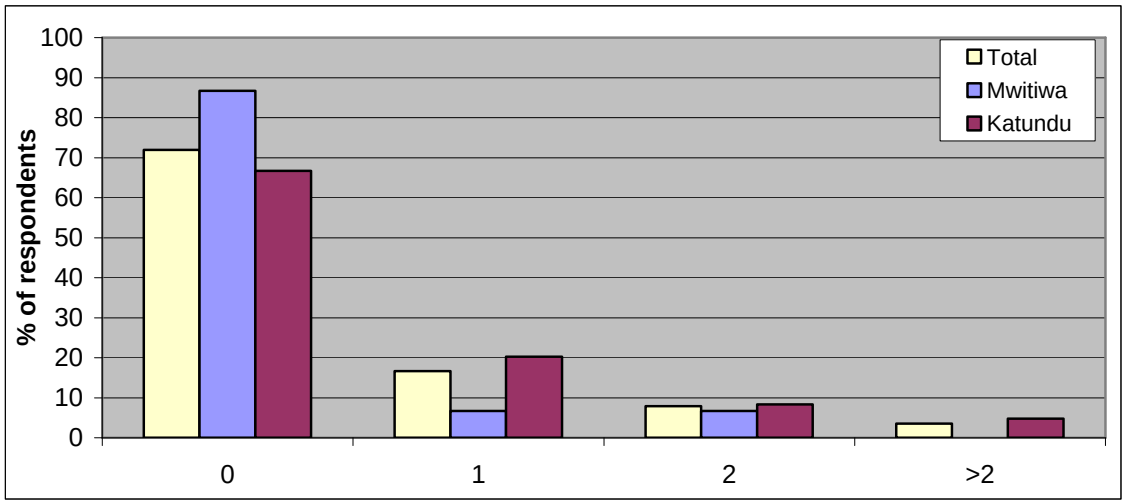

Fig.6.17 Number of mosquito nets in respondent HHs (N=114)

The ownership of mosquito nets appears to be associated (namely in Katundu 3) with socioeconomic status, for example as indicated by the type of house structure (Appendix C, Table C1303). However, in Mwitiwa net ownership is low to begin with, so an association between the two indicators cannot be reliably drawn. Katundu 3 as a community is generally more robust in terms of trade and socioeconomic indicators, and the highest number of households owning at least one net were those that have more solidly constructed walls and roofs. For those not owning at least one net, the main reason was that it was too expensive (Fig.6.18).

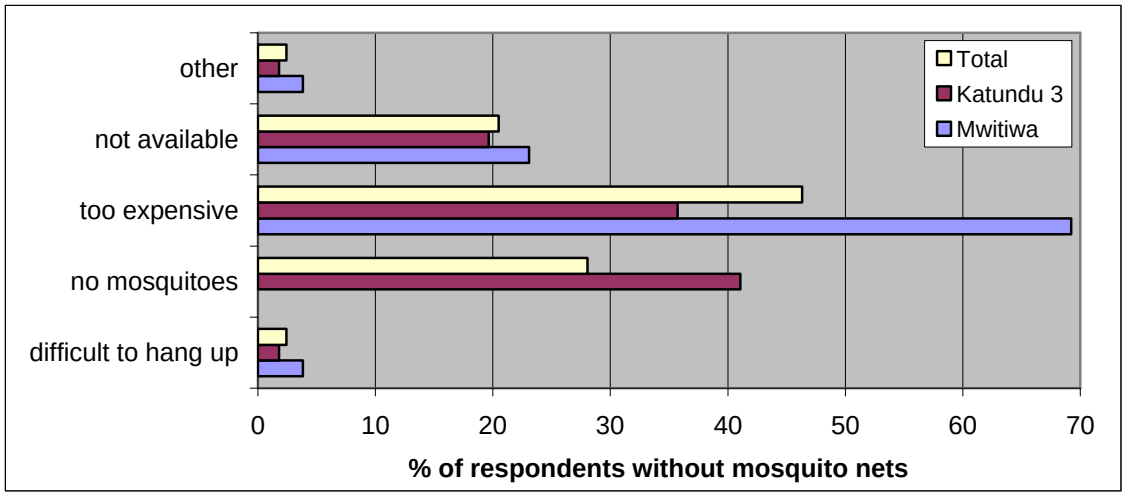

Fig.6.18 Reasons for not owning a mosquito net (N=82)

Interestingly, however, the main reason for not owning a net in Katundu 3 was "no mosquitoes"; this despite the fact that "malaria" was cited as the top health concern in the community ("malaria" and "fever"), and made up the majority of OPD diagnoses (Ph.6.6). It is unknown whether this discrepancy represents a true inability of the respondents to pay for a net, or that malaria is such a

common occurrence that it is seen as simply a part of life that must be accepted, hence a lower priority placed on purchasing a net.

Table 6.1 Of those owning mosquito nets, the source from where nets were obtained

	Mwitiwa (N=4)	Katundu 3 (N=28)	Total (N=32)
Healthcare facility (#)	3.0	25.0	28.0
Other (#)	0.0	1.0	1.0
Did not respond (#)	1	2	3

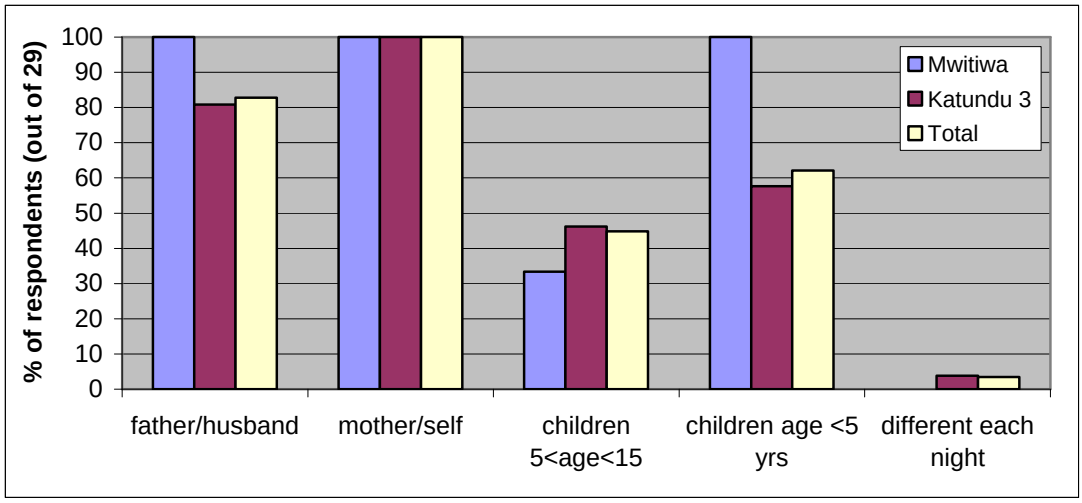

Fig.6.19 Who sleeps under the mosquito net? (N=29)

Of the three households owning mosquito nets in Mwitiwa, all reported that the "mother", "father", and children <5 slept under a net (Fig.6.19). In Katundu 3, 26

respondents said there is at least one net in the house, and in all of them, the "mother" slept under it. 80% said the "father" sleeps under a net, but only 57.7% said children<5 did so. During the FGDs, many women said that some children found it uncomfortable sleeping under a net ("too hot"). It is recommended in the future to try and establish seasonal variations in these trends. Although malaria is present year-round in Malawi, respondents may not prioritise mosquito net use outside the rainy season when mosquito density may be less. The KAP surveys were conducted in September, which may show different responses than if it were carried out during, or immediately after, the rainy season. Of course, there may also be an element of fatalism with regards to malaria, simply because it is so common.

6.4.3 HIV/AIDS

This topic appeared to be somewhat awkward/uncomfortable for some respondents, as the number who actually respondent to the questions was less than for other topics. Fig.6.20 below shows the respondents' perceptions on what causes HIV/AIDS, and along with the subsequent figures suggests a worrying trend in approaches to curb the spread of the disease. For example, all respondents from Mwitiwa listed "multiple sex partners" as a cause for HIV/AIDS, but only 30% listed "unprotected sex"; similarly, less than half of Mwitiwa respondents cited using a condom to prevent HIV/AIDS (Fig.6.21).

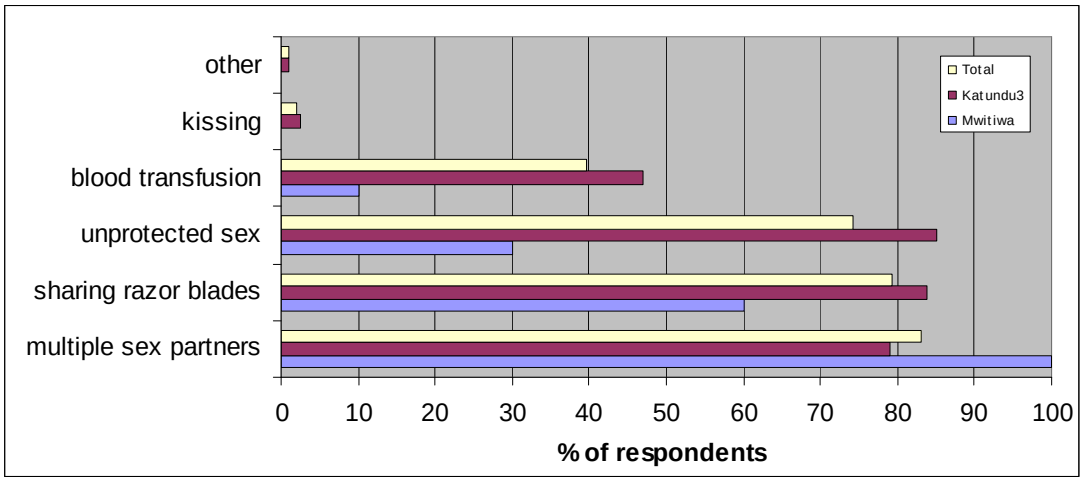

Fig.6.20 Causes of HIV/AIDS listed by respondents (N=101)

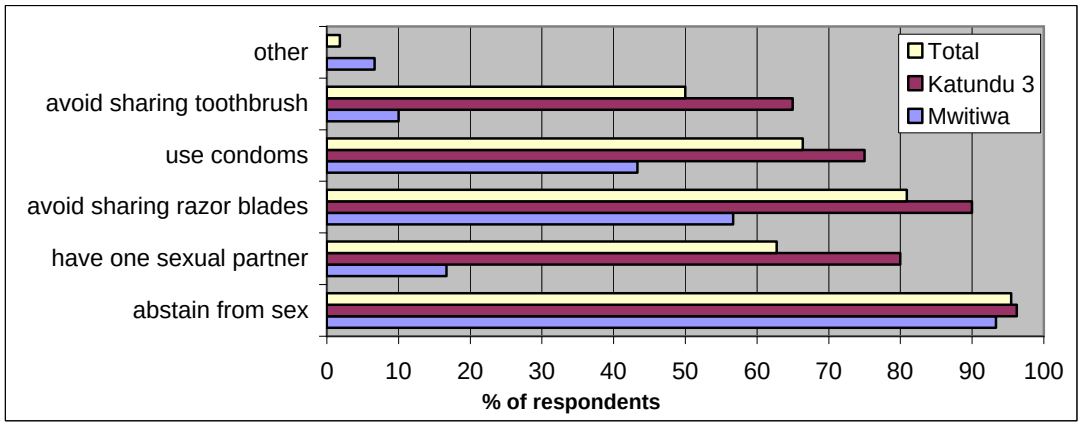

Fig. 6.21 Ways to prevent HIV/AIDS (N=110)

The trends above suggest that there are gaps in knowledge in the biophysical association between sex and HIV infection. Having multiple sex partners is known to be a risk factor, but less than unprotected sexual intercourse (particularly in Mwitiwa). This may be connected to the stigma associated with the disease, that is, the social issue of (multiple sex partners) rather than the biological (unprotected sex).

Overall, 74.6% of respondents report ever receiving education on HIV/AIDS; 16.7% in Mwitiwa and 95.2% in Katundu 3. This corresponds to just five respondents in Mwitiwa. The sources of this education are given in Fig.6.22.

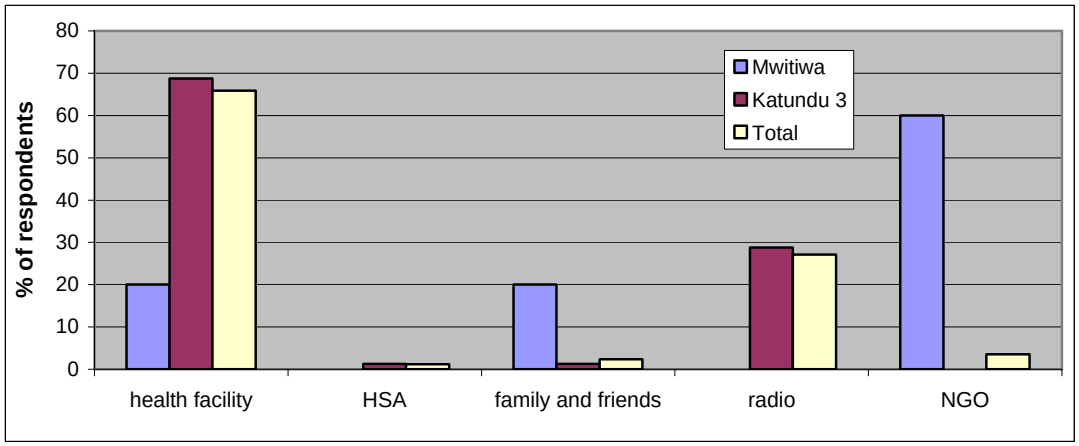

Fig.6.22 Sources of HIV/AIDS message for respondents (N=85)

The NGOs referred to are not known; however, it is likely that Medecins Sans Frontiers (MSF), which operate in the District Hospital are one, as one of the KAP respondents was by chance a pregnant lady whom the researchers had referred to the group at the District Hospital. In Katundu 3, health facilities and radios were the main sources of HIV/AIDS information. Unlike educational messages for diarrhoeal diseases and food hygiene, other people known to the respondents (e.g. family, friends, VHWC) make up only a small proportion of sources for HIV/AIDS information. This is likely connected to the uncomfortable nature of the disease. The main message, however, appears to be a call to abstain from sex, with very few respondents saying the message included advice to use condoms

(Fig.6.23). This is a worrying point, as a sole approach of calling on people to abstain has been shown worldwide to be a failure, and unrealistic.

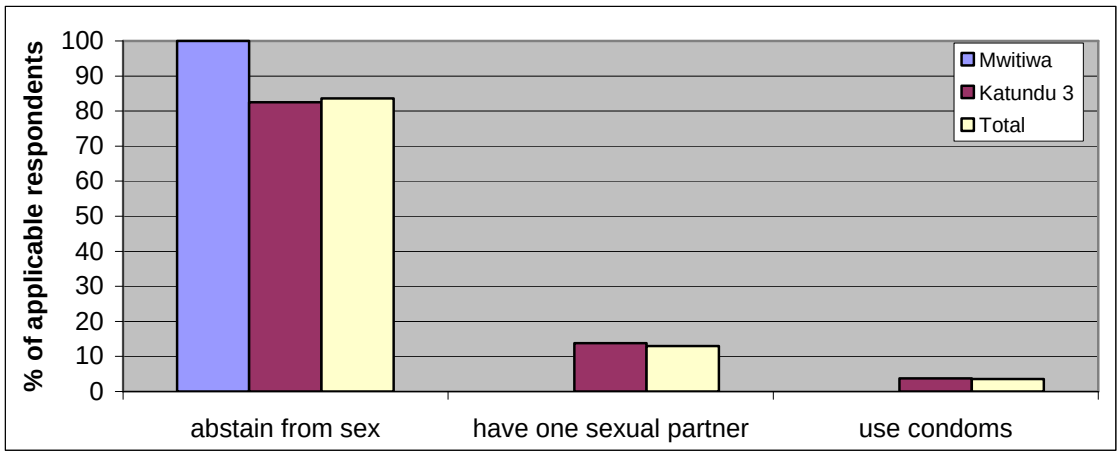

Fig.6.23 Content of HIV/AIDS education (N=71)

6.4.4 Diarrhoeal diseases

Diarrhoeal diseases are a major cause of mortality and morbidity in Malawi, particularly in children and immunocompromised adults. This section deals with the knowledge of community members of main risk factors for diarrhoeal diseases, and attempts to elucidate what behavioural factors exist which would contribute to this disease burden.

6.4.4.1 Recognition of diarrhoea and its dangers

Overall, 80.5% of respondents indicated that a household member has ever suffered diarrhoea; 50% in Mwitiwa and 91.6% in Katundu 3. The low figure in Mwitiwa suggests three possible points. First, some respondents may have

thought the question was referring to recent episodes, as opposed to any. Second, the question may have been somewhat uncomfortable in nature, or some respondents may have taken it as a "test" of how well they looked after their families' health. Third, and probably the most likely, is that what constitutes "diarrhoea" is subjective in nature. The same number and consistency of stools may be considered "diarrhoea" for one person but normal for another. These lines of reasoning apply to both communities. Respondents' perceptions of what constitutes diarrhoea are illustrated in Fig.6.24 below.

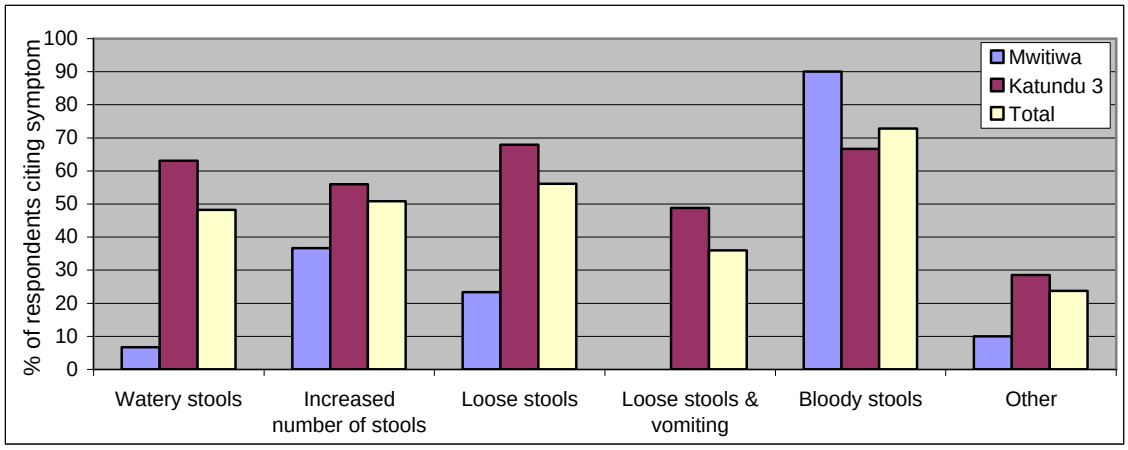

Fig.6.24 Respondents citing symptom of diarrhoea (N=113)

The most frequently named symptom was bloody stools (dysentery), comprising 25.3% (graph not shown here) of total responses and cited by 72.8% of respondents. A lower number of respondents cited increased number of stools (50.9%) and loose stools (56.1%), which are closer to the WHO's definition of diarrhoea as "the passage of 3 or more loose or liquid stools per day, or more frequently than is normal for the individual". Less than a quarter (23.3%) of respondents in Mwitiwa listed "loose stools" as a symptom of diarrhoea, while

90% listed "bloody stools". When the figures are broken down by village, they (and the second part of WHO's definition) demonstrate the subjective nature of this particular health issue, and highlight one of the problems with attempting to quantify self-reported diarrhoea in community health surveys.

The potential dangers of diarrhoea are well known to both the KAP survey respondents and during the other participatory activities in the communities. Only one person (0.9% of the total respondents), a respondent in Mwitiwa, stated in the KAP survey that diarrhoea does not cause death (Appendix C, Table C305). 96.5% of total respondents stated that dehydration is the means by which diarrhoea causes death (Appendix C, Table C306), with the percentages almost identical in both villages (96.6% and 96.4% in Mwitiwa and Katundu 3, respectively). The causes of dehydration according to respondents are given in Fig.6.25 below.

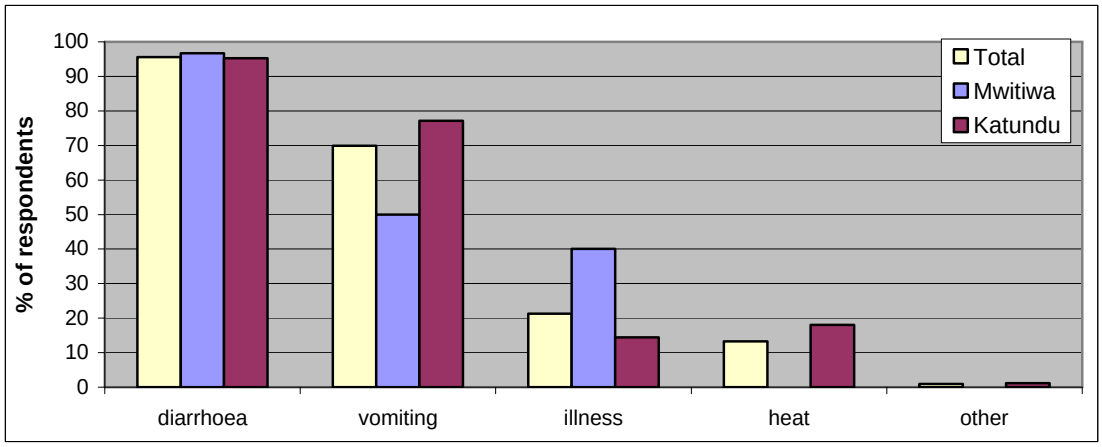

Fig.6.25 Causes of dehydration (N=113)

It is notable that "heat" was not high on the list of dehydration causes, although respondents may have lumped heat from a fever into the "illness" category. Katundu 3 respondents had an overall better grasp of the causes of dehydration.

6.4.4.2 Management of diarrhoea

Appropriate treatment of diarrhoea depends on the severity of the diarrhoea, the age/health status of the sufferer, length/number of episodes, and a number of other unique factors. In all cases, the most important thing is maintaining the hydration and electrolyte status of the individual. Whether or not to seek medical care after that depends on the individual case. KAP survey respondents were asked about what action is taken when a household member has diarrhoea (Fig.6.26).

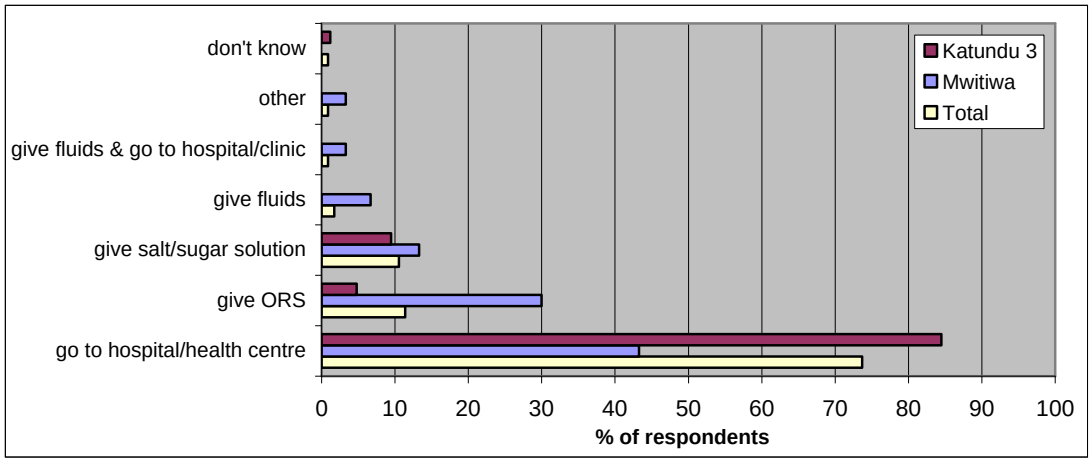

Fig.6.26 Treatment of diarrhoea by respondents; ORS = oral rehydration salts (N=114)

Overall, nearly three quarters (73.7%) said they would go/take patient to a hospital/health centre (in this case, the latter, as the hospital is too far away); most replied they would initiate treatment the same day as symptoms began (Fig.6.27). However, it was established previously that utilisation of health facilities by the communities is low. Respondents in Katundu 3 were nearly twice as likely to choose this option as those in Mwitiwa (84.5% vs. 43.3% in Mwitiwa), despite the nearest health centres being further away from Katundu 3. Conversely, respondents in Mwitiwa were much more likely to practice home-based fluid/electrolyte replacement remedies (43.3% vs. 21.9% in Katundu 3). This may reflect a number of things. As previously mentioned, it is physically more difficult (due to rough terrain) to reach a health centre from Mwitiwa than it is from Katundu 3, and this may be a factor in the differences in responses. Also, and particularly for Mwitiwa in this case, respondents may have answered this question based on what they thought was correct, rather than what is actually practiced. This point was a recurrent theme during the research, i.e. what people know is not necessarily what is practiced.

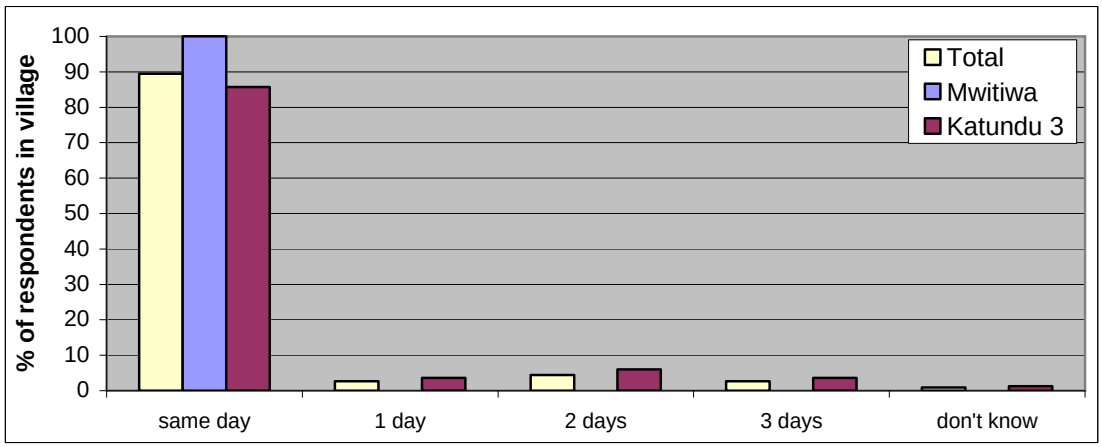

Fig.6.27 Time between onset of diarrhoea and treatment (N=114)

6.4.4.3 Causes of diarrhoea

Respondents' perceptions as to what causes diarrhoea are broken down below. Generally speaking, contaminated food and water were more likely to be associated by respondents with diarrhoeal disease than personal hygiene or a "dirty environment" (Fig.6.28). The exception here is flies, where follow-up discussions with women revealed they associated these largely with poor household refuse disposal.

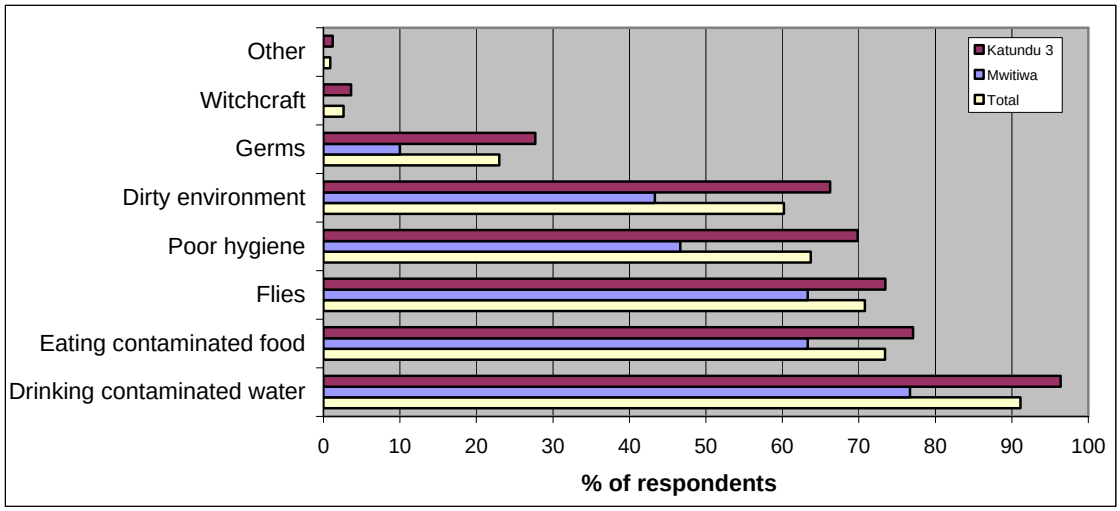

Fig.6.28 Causes of diarrhoea (N=113)

Interestingly, poor hygiene as a cause of diarrhoea was listed by less than 70% of total respondents; 46.7% and 69.9% of Mwitiwa and Katundu 3 respondents, respectively. A similar trend for environmental hygiene was seen (43.3%, 66.3%, and 60.2% for Mwitiwa, Katundu 3, and overall respectively). A pattern observed throughout the involvement with the communities is the association of most WSH-related diseases with water supply as the most important determining

factor. In other words, having a protected water supply was seen as the most important measure in prevention of WSH diseases.

This externalisation of the risk factors for diarrhoea presents a challenge to affecting behavioural change. Assuming the "starting points" for food and water, i.e. at collection source (water) and immediately after cooking (food), are uncontaminated, subsequent quality of both are largely determined by the behavioural factors in personal and environmental hygiene. Examples for each include hand contact with water during transport from a borehole, and eating cooked food with unwashed/re-contaminated hands. The percentages in the previous graphs are not the most important issue though. Throughout the participatory approaches used during this research, members of both communities clearly had relatively good knowledge of diarrhoeal diseases and how to prevent them.

6.4.4.4 Diarrhoea prevention education

Most (90.4%) of respondents said they had received information on prevention of diarrhoeal diseases; 100% in Katundu 3 and 63.3% in Mwitiwa. The top three sources for this information was a healthcare provider or clinic (92.2%), followed by family/friends/VHWC (64.1%), and radio/TV (41.7%). The variations between the two communities are shown below in Fig.6.29, with the nature of the information in Fig.6.30.

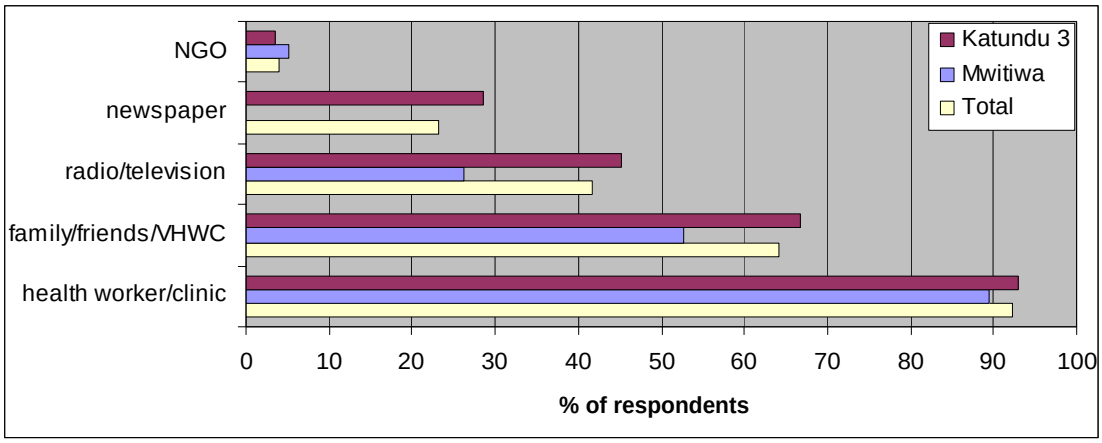

Fig.6.29 Source of diarrhoea prevention message (N=103)

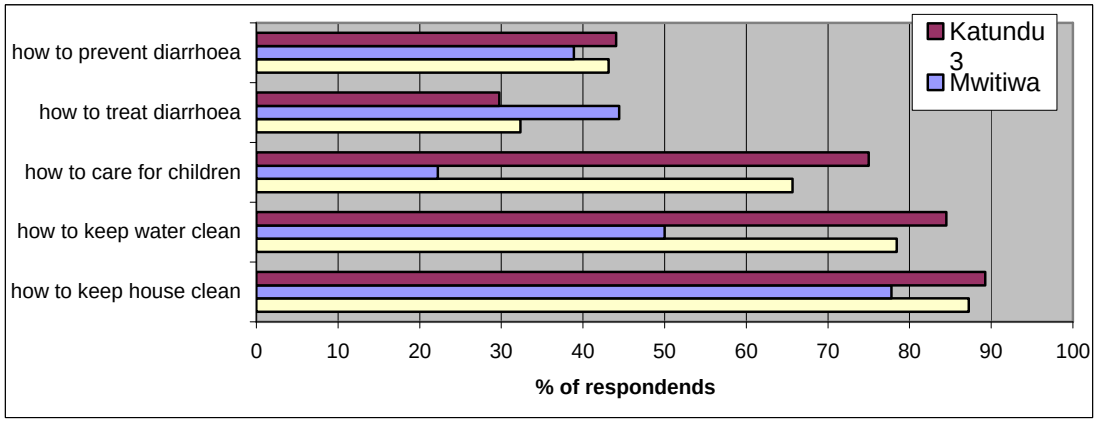

Fig.6.30 Contents of diarrhoea prevention message (N=102)

6.4.4.5 Diarrhoea in children

Diarrhoeal diseases, along with acute respiratory infections (ARIs) and malaria, are leading causes of child mortality in Malawi and worldwide. Knowledge on the symptoms, dangers, and treatment of diarrhoeal diseases is fundamental to reducing their associated morbidity and mortality. Women were asked about the

last time a child in their household had diarrhoea (Fig.6.31). Two points should be kept in mind at this stage. First, the subjective nature of what constitutes diarrhoea, which was highlighted previously. Second, time recall was (along with distance), found to not necessarily correlate with actual timings, as discussed in the context of water collection in section 6.5.2.

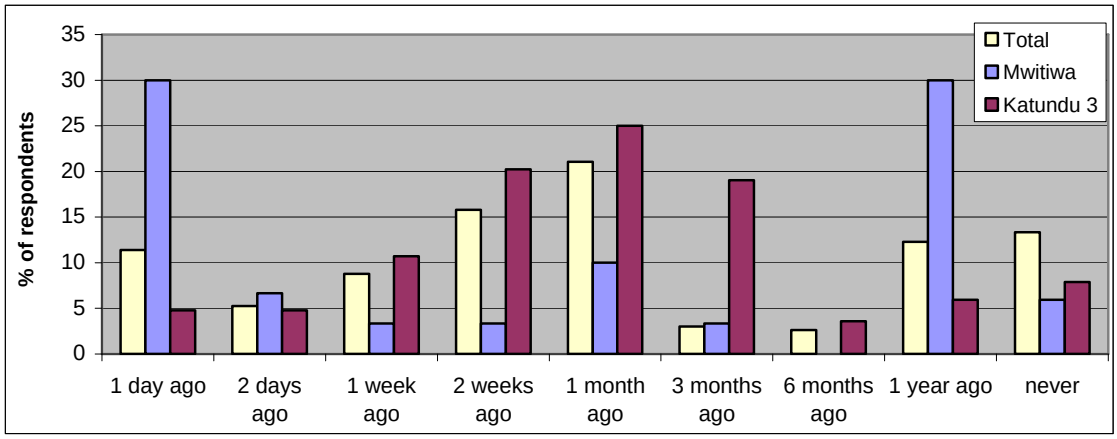

Fig.6.31 Last time a child in the household had diarrhoea (N=114)

Despite the potential uncertainties in estimating times, women are likely to consider an event as "diarrhoea" if there is a change in their children's routine bowel habits. Based on discussions with women in both communities, these "changes" are most likely in the form of increased stool or loose stool. Types of treatments provided for a child with diarrhoea are shown in Fig.6.32.

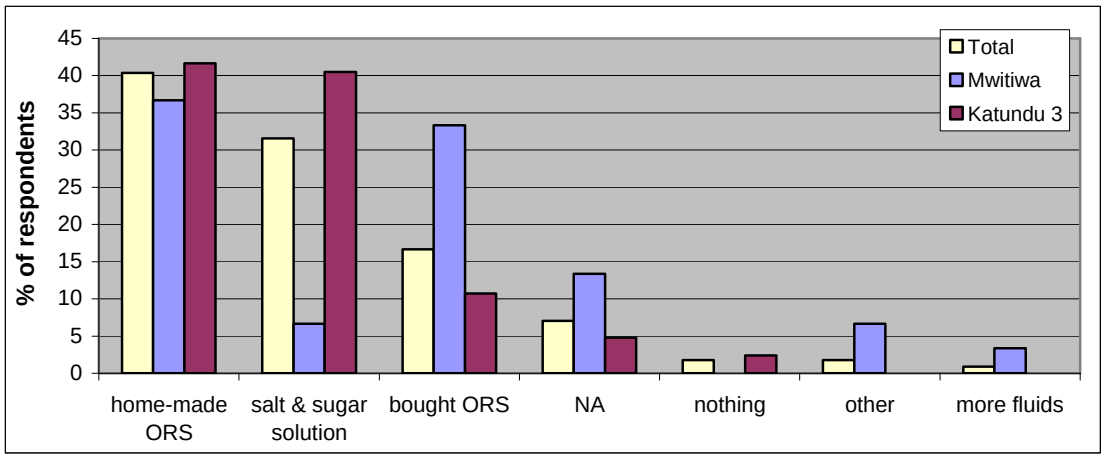

Fig.6.33 How child with diarrhoea was treated (N=114)

Overall, most women reported increasing fluid intake for a child with diarrhoea (Fig.6.34); however, and worryingly, over half of Mwitiwa respondents maintained the same fluid intake for the child.

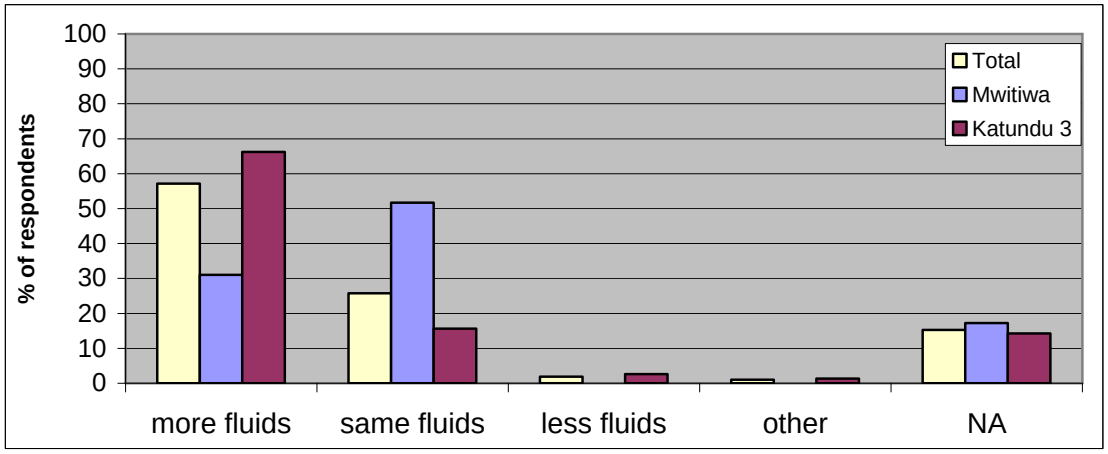

Fig.6.34 If fluid intake was changed for child with diarrhoea (N=106)

A total of 42 women were breastfeeding at the time of the survey, and they were asked if they changed the frequency of feeding when the child had diarrhoea. Most breastfeeding women in Katundu 3 increased the frequency (78%), but only

30% in Mwitiwa (Fig.6.35). Many women in Mwitiwa (30%) said they did not change the frequency of breastfeeding; this follows the trend seen with fluid amounts in children with diarrhoea (51.7%). The reason for this is unclear, and most women asked about this shrugged and said "I don't know". Possible explanations include a) fear of exacerbating diarrhoea with increased fluid intake, and b) inadequate knowledge of the importance of breast milk in children, including the protective properties. The former is interesting, since over 90% of respondents acknowledged that dehydration is the means by which diarrhoea causes death (Appendix C, Table C306); it may be simply a fear of over-hydration making the diarrhoea worse. Whether any of these possibilities holds true, or there are other yet undefined reasons, this is an important point to follow up on in future, since there may be a need to modify the health education component to include more explanations on the mechanisms of danger with diarrhoea.

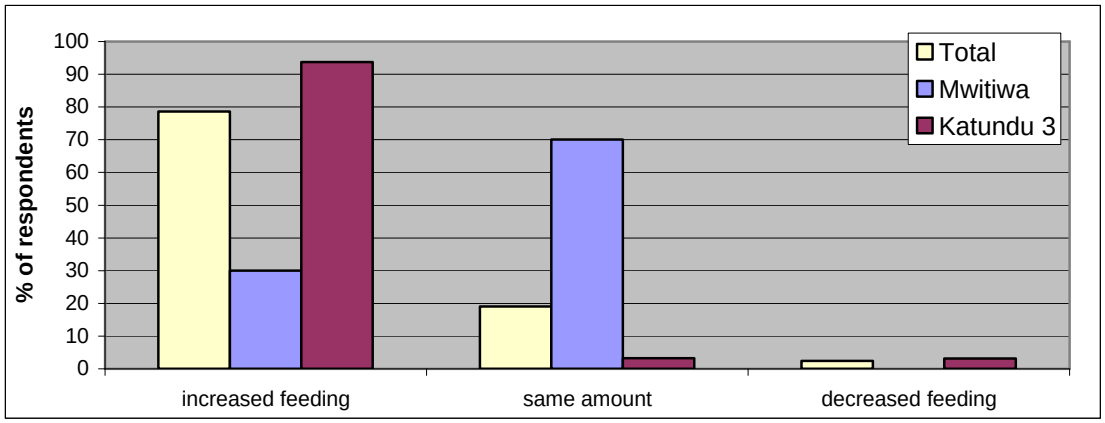

Fig.6.35 Changes in breastfeeding frequency for child with diarhoea (N=42)

6.5 Water, sanitation, and hygiene

This section discusses the water and sanitation situation in the communities at during the research period, as well as the related behavioural and hygiene issues. Both drinking and non-drinking water sources are examined, along with the usage patterns, in order to differentiate the different exposure risks present. Finally, attitudes related to these are examined in an attempt to explain the results found.

6.5.1 Water sources in the communities

The observed water sources in each village are given in the Tables 6.2 and 6.3 below. The boreholes were obvious at the beginning, but determining the presence of the unprotected sources (except the stream/river) required more/prolonged effort, especially in Mwitiwa. This may be for two reasons. First, the communities may have assumed that we were referring to drinking water sources only, and so only directed us to the protected sources. Second, they may have felt that this was the "right" answer. The second reason is very likely. For example, the presence of the spring in Mwitiwa was not uncovered until more than 7 months after the research began. More specifically, it was only when a project began in mid-2007 to protect shallow wells in Mwitiwa that the community directed the team to the spring.

Several other examples of this were observed over the duration of the involvement with the communities, and will be discussed where relevant. Again, however, these were mainly seen in Mwitiwa.

Table 6.2 Water sources in Mwitiwa Village

Type	Number	Description	Comments
Borehole	1	33m deep, installed by CU (Dec. 2001); Afridev pump	another borehole in neighbouring village, also used by Mwitiwa
Protected shallow well	1	Protected by CU; Malda pump	Community does not like Malda pump
Unprotected shallow well	2 observed (1 seasonal)		number may change with seasons; Ph.6.8
Stream	1	Bwaira stream, runs through village	Ph.6.7
Spring (unprotected)	1		Ph.6.9

Ph.6.7 Bwaira stream, Mwitiwa (Sept. 2006)

Ph.6.8 Unprotected shallow well, Mwitiwa (Aug. 2007)

Ph.6.9 Unprotected spring, Mwitiwa (July 2007)

Table 6.3 Water sources in Katundu 3 Village

Type	Number	Description	Comments
Borehole	2	"Portugal" borehole 23m deep, installed by CU (2003); both Afridev pumps	"Kalika" borehole vandalized & out of commission; Ph.6.11
Protected shallow well	0		
Unprotected shallow well	1		number may change with seasons
Stream	1	small seasonal stream	
Spring (unprotected)	0		
Other	Matapwata River: "~ 2hr" walk from central "Portugal" borehole. Used by many for heavy laundry loads/blankets.		

Ph.6.10 Katundu 3 "Portugal" borehole (Sept. 2006)

Ph.6.11 Vandalised "Kalika" borehole in Katundu 3 (Nov. 2006)

Although both communities initially denied using the unprotected sources, women later admitted using them for washing/watering gardens (Ph.6.12). In Mwitiwa, women admitted sometimes foregoing the protected sources altogether when they were too crowded, and in the case of the protected shallow well, when collecting water in the dry season required prolonged pumping due to the lowered water table. This combined use may not necessarily present a significant problem if the unprotected sources are only used for non-drinking purposes (i.e. water-borne diseases). However, schistosomiasis is endemic throughout Malawi, and contact with surface waters such as the Bwaira stream (Mwitiwa) and river (Katundu 3) are obviously risk factors.

Ph.6.12 Children washing clothes in Bwaila stream, Mwitiwa (Sept. 2006)

Interestingly, when speaking to women in Katundu 3 about the Matapwata River, they reported fear of "water snakes", which results in them not wading in when doing laundry; rather, they lean in from the river bank. This may in theory reduce the body surface area exposed to the water, and therefore the skin surface available for the parasites to penetrate. In Katundu, the women use the seasonal stream if the borehole is overcrowded, but for non-drinking purposes. In the uncommon instances where they do use it for drinking, they report sieving (through cloth) and boiling it first, and then adding chlorine.

In both villages, FGD participants cited the following uses for water drawn from protected sources: household (cleaning, drinking, etc), water for animals (only Katundu 3), and for building. Women in Katundu 3 wash clothing using mostly water from the borehole. For gardening and irrigation, shallow wells are dug by

hand. When asked to estimate the depth of these, as related to the heights of nearby trees, the estimates ranged from ~8-15m. Jerry cans (Ph.6.13) are the most frequently used methods of watering gardens; some people own treadle pumps, but these are infrequently used, because "the water dry up quicker".

Ph.6.13 Watering can used for gardening/irrigation (Aug. 2006)

The women reported during the FGDs that prior to the implementation of the NGO's programme, they used to only use (unprotected) surface waters and hand-dug shallow wells, and were frequently sick. The main health issues they complained of at the time were: *malungo* (malaria), *kutsegula m'mimba* (diarrhoea), and *chimbuzi cha magazi* ("bloody stools"/dysentery).

6.5.1.1 Drinking water sources

Drinking water sources, according to KAP survey respondents in the communities, are shown in Fig.6.36 below, and compared with observations.

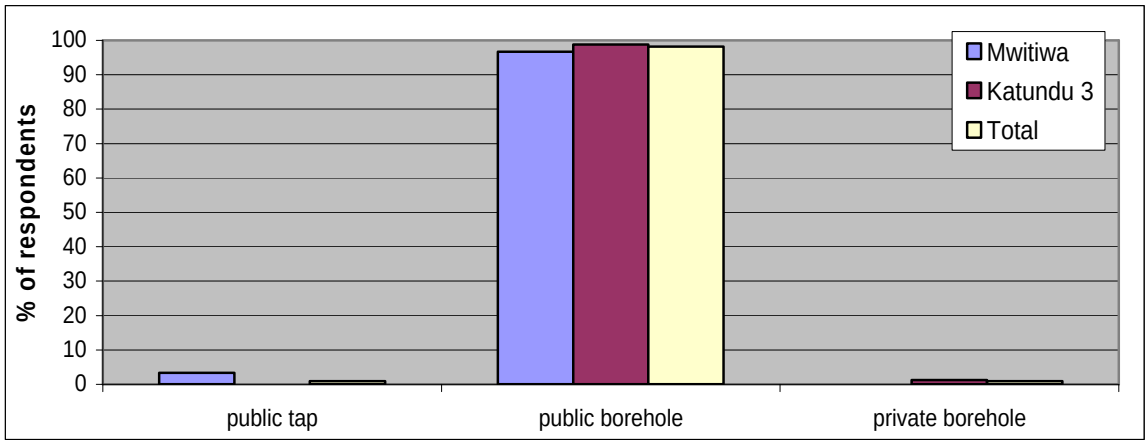

Fig.6.36 Reported drinking water sources in the communities (N=113)

Congestion at water points was brought up in both villages; the VHWCs in both villages bemusedly reported fights at the boreholes as a result of cue-jumping. The VHWCs and women in both communities reported other neighbouring villages using their boreholes. Mwitiwa's borehole is used by neighbouring Kabuthu Village (year-round) and another village, while Katundu 3's boreholes are used by neighbouring Mitabali and Chilombo Villages (year-round). Kabuthu village has a borehole, but as the population is significantly larger than Mwitiwa's, and spread over a larger area, people from Kabuthu routinely visit Mwitiwa's protected sources to draw water (HSA for Mwitiwa, pers. com., Oct. 2006). This means that, although the ratio of 250 people/safe water sources is theoretically met in Mwitiwa, the reality may be very different, and highlights

the importance of considering external factors affecting access to water points when planning water points in an area.

6.5.2 Water collection practices

One fifth of Mwitiwa respondents said they collect water only once a day (Fig.6.37), which was surprising since time spent collecting water was identified as a major problem during the FGDs. One possible explanation is that, although one trip is made per day, that trip may include more than one person collecting.

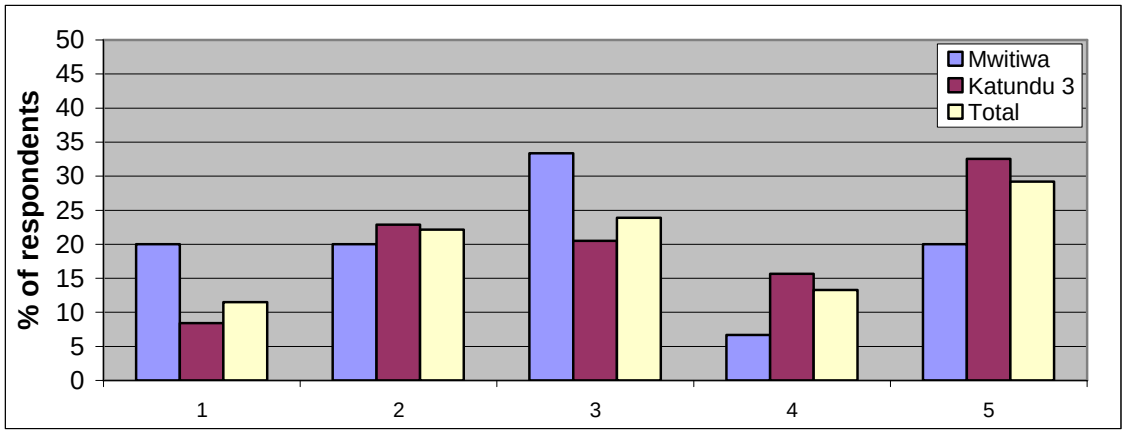

Fig.6.37 Frequency of water collection per day (N=113)

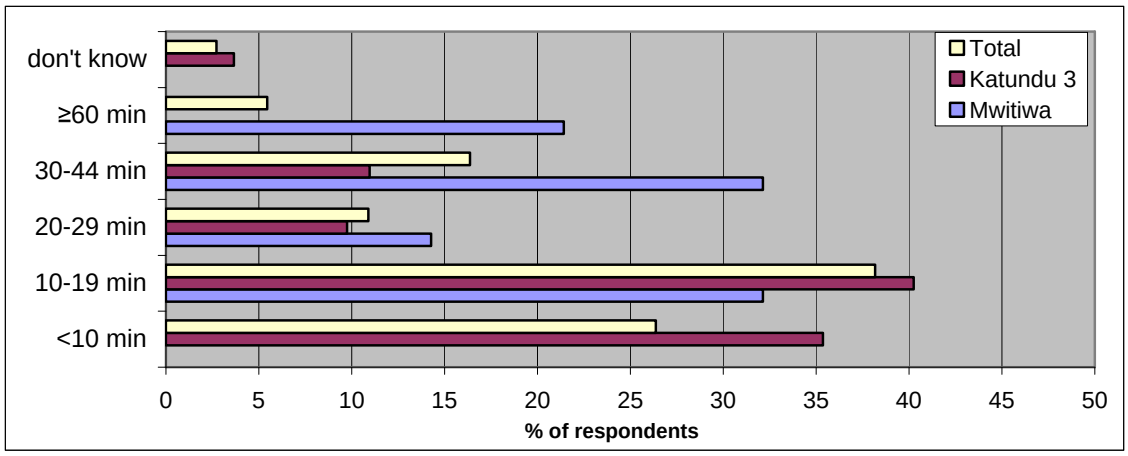

Fig.6.38 Respondents' estimated water collection time/trip (N=110)

Respondents′ self-reported estimates of water collection times are given in Fig.6.38. An important point to bring up at this point is the reliability of time estimates. After noting the discrepancies with the distance estimates to the health centres, the researchers asked women in the FGDs to estimate the times to and from the boreholes, and waiting times while there. The numbers were found to be highly arbitrary, and use more of a scale manner than actual times. For example, the first respondent would give an estimate, and the subsequent ones would give higher or lower numbers based on their knowledge of where the previous respondent′s distance from the borehole as compared to theirs. A number of trips were made by the researcher, with some of the women, to see how close their times were to the stated numbers.

In general, during the more crowded periods (early morning), the actual times for collection were (on average) double the estimates given earlier. However, during the course of the day, the discrepancies were not as stark. This is probably due to the fact that just about all women collect water in the early mornings,

while later collection trips are not quite as regimented in terms of when they occur. Another observation was the time given to walk to the Matapwata River, for larger laundry loads. In reality, the 2-hr estimate given during the FGDs was less; conceivably an hour if carrying heavy/large bundles of clothing. However, the given figure probably is representative of the lengthy journey (and the effort) needed to access and use this source.

In future, it is recommended that, rather than use traditional markers of time (minutes), it would be better to use a more familiar measurement. For example, how long it takes to collect water as compared to preparing a pot of *nsima* (maize porridge). This can then be used to estimate the actual time in minutes.

6.5.2.1 Collection vessels

The majority of observed containers used in collection were between 15 and 25L capacity (Ph.6.14); plastic buckets had smaller volumes, while the metal ones were 20-25L.

Ph.6.14 Typical water collection vessels in the two communities (Aug. 2006)

Most of the time, it was observed that the containers for collection were the same as those for storage; i.e. water was collected and stored in the same vessel. Also, during observations and FGDs, collection was usually done by more than one person. This has implications for estimating water availability/consumption at the household level, and will be discussed in section 6.5.3.2.

Ph.6.15 Child using empty engine oil container to collect drinking water, Mwitiwa (Sept. 2006)

Children were seen collecting water, although in smaller containers (often of questionable safety). For example, on several occasions, small children collected water in engine oil bottles (Ph.6.15). Even with washing, the safety of this is questionable.

6.5.2.2 Alternate sources of drinking water

Apart from the main source of drinking water mentioned earlier, 78% of total respondents said there are other drinking water sources available; 81% of Katundu but only a third of Mwitiwa respondents. The types of "alternate sources" are shown in Fig.6.39. The low figure from Mwitiwa respondents was surprising, given the how frequently women and young girls were seen washing clothes and utensils in the Bwaira stream. However, the question concerned what were perceived as drinking water sources, and the figures suggest that Mwitiwa households may use the water from the borehole for consumption purposes, but for other (e.g. washing clothes/utensils) use surface waters. This may be due to congestion at the pump, especially given its use by neighbouring communities, or even simply that is easier to wash things in the stream than to collect and transport water for other non-consumption purposes. Observation and FGDs further supported this explanation.

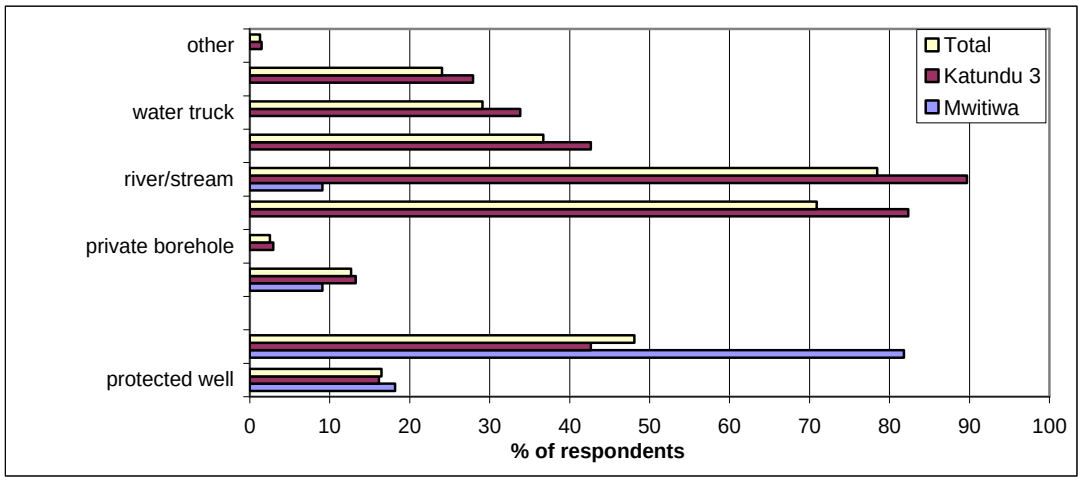

Fig.6.39 Other sources of drinking water (N=79)

Half (55.1%) of respondents said they sometimes use the alternate source(s) for drinking, with the figures almost identical in both villages. For those not using these sources for drinking, the reasons are given in Fig.6.40 below.

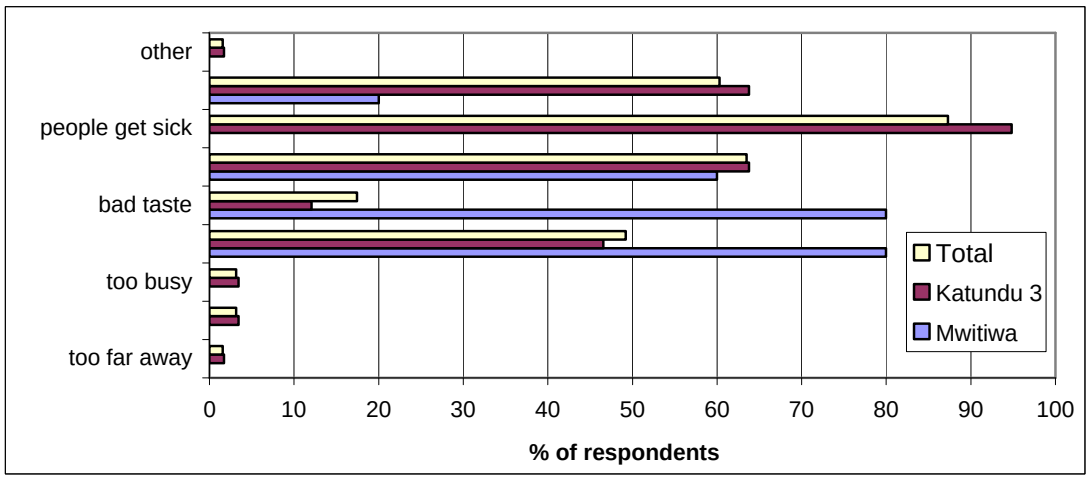

Fig.6.40 Reason for not using alternate sources for drinking (N=63)

The number of people responding to this question exceeded the number that replied they did not use the alternate sources for drinking; this question may have been interpreted to mean "what do they not like" about the water sources. Interestingly, the appearance of the water was listed by at least 60% of applicable respondents in both communities, namely in reference to the surface waters (streams/river/unprotected wells). In Mwitiwa, the most common reasons were bad smell and taste (both 80% of applicable respondents). Katundu 3 respondents were more likely to connect water quality with actual health outcomes, e.g. other people getting sick (94.8% vs. none in Mwitiwa).

6.5.2.3 Water quality & user perceptions

How users perceive the quality of their water sources had great implications for their choices to use them, and for what. KAP respondents were asked to rate a number of water sources. The list in full is presented in Appendix B, and only the results for the water sources found in the communities are presented in Table 6.3.

Table 6.4 Respondents' perceptions of quality of various water sources (N=113)

	Mwitiwa (%)	Katundu 3 (%)	Total (%)
	Borehole		
Good	86.2	75.0	77.9
Medium	3.4	23.8	18.6
Bad	6.9	1.2	2.7
Don't know	3.4	0.0	0.9
	Protected shallow well		
Good	10.3	1.2	3.6
Medium	34.5	41.5	39.6
Bad	55.2	57.3	56.8
Don't know	0.0	0.0	0.0
	Unprotected shallow well		
Good	48.3	7.4	18.2
Medium	51.7	72.8	67.3
Bad	0.0	18.5	13.6
Don't know	0.0	1.2	0.9
	Spring		
Good	0.0	0.0	0.0
Medium	17.2	14.6	15.3
Bad	82.8	82.9	82.9
don't know	0.0	2.4	1.8
	River		
Good	0.0	0.0	0.0
Medium	10.3	12.2	11.7
Bad	89.7	86.6	87.4
don't know	0.0	1.2	0.9

An interesting trend emerged with this question: people did not seem to like "protected shallow wells". Initially, this was surprising, and the raw data was examined again, and it was thought perhaps this was a recording error or the question was not fully understood by respondents… however, the trend was consisted throughout the surveys, and with all survey administrators. The issue of shallow wells was brought up during subsequent FGDs, and it quickly became clear there was significant dislike of shallow wells. Respondents said they did not like the Malda pump because it was not reliable (a point also brought up in FGDs with VHWCs), and the quantity of water at the sources tends to slow to a trickle during the dry season (this was observed). However, FGD participants said they have no problem with protected shallow wells in terms of quality, and know that they are "cleaner" than their unprotected counterparts.

Yet another reason emerged in Mwitiwa some time after the research, when funds were available for a water source improvement project. The community was asked about preferences, and [the men in] the VHWC said they wanted a borehole. When women were asked whether they would benefit more from a borehole, or a shallow well/upgraded spring *plus* the repair of their existing borehole, two men again interjected and pushed for the borehole. During a walk with the committee to examine potential sites for all the options, one of the two men blurted out "the borehole is on the other side of the village, why can't we have one on our side?" Clearly, having a borehole on "their side of the village" was more of a status symbol than a means of improving the health of the community and easing the burden placed on women and young girls. The women were again timid, and only later agreed that it would make their lives

easier to have a new improved source (protected spring) and their existing borehole fixed.

Theoretically, since the depth of Mwitiwa's shallow well is less than 3m, there maybe issues with taste/odour from contaminants. For example, gardens are planted around the protected shallow well, and fertiliser (ammonium nitrate) is applied yearly. The above results suggest that the questions were answered on the basis of convenience and comfort, rather than purely on health grounds. This basing of preference on non-health factors such as perceived status and convenience has been cited by numerous authors (Jenkins and Curtis, 2005; Moe and Rheingans, 2006).

6.5.2.4 Protecting collected and stored water

Most respondents (98.2%) report that containers are cleaned before being refilled. This was observed in Katundu 3, with many women using soap to wash the side of the containers, but was never seen in Mwitiwa. Most of the times though, "cleaning" consisted of swirling water around in the vessels, and usually rubbing the sides of the containers with the hands before discarding the water (Fig.6.16). While simply rinsing with water is unlikely to remove all contaminants present, using potentially contaminated hands may in itself re-contaminate the water. This may especially be the case where women use their *chitenje* (cloth wrap) to wipe their hands either before cleaning the containers, or after. In the latter, since the clothes themselves are frequently used to clean hands, they may serve as a source for contaminants which can be subsequently

transferred to the water (during transport: finger-dipping, Ph.6.17 and 6.18) or later when water is drawn from the storage containers. Contact between fingers and water during transport is a recognised risk factor for post-collection contamination in Malawi and elsewhere, particularly with children (Trevett, 2002; Morse, 2006; Jabu, 2007).

Ph.6.16 Women in Katundu 3 washing vessels before water collection (Aug. 2006)

Ph.6.17 Mwitiwa Woman carrying water; note finger-dipping (June 2007)

Ph.6.18 Katundu 3 women carrying water; note finger-dipping (June 2007)

6.5.3 Water storage in the house

Nearly all (99.1%) respondents store water in their houses; only one in Mwitiwa said no water is stored in the house. The most frequently used container for this was plastic buckets (Fig.6.41).

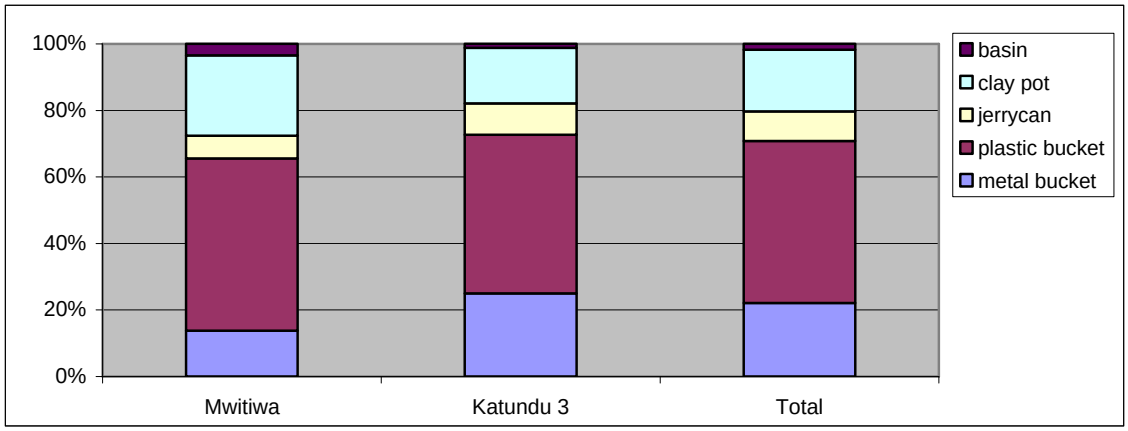

Fig.6.41 Containers used to store water in HHs (N=114)

The top three reasons cited overall by respondents for their choice of containers were: "easy to cover" (29.8%), "water stays cold" (21.1%), and to "prevent contamination" (19.3%).

To compare the perceptions on covering to reduce contamination of the water with actual practice, respondents were asked if the containers could be seen. In most of the observed cases, water storage containers were completely covered. The portion of these that were covered, partially or completely, are shown in Fig.6.42 below.

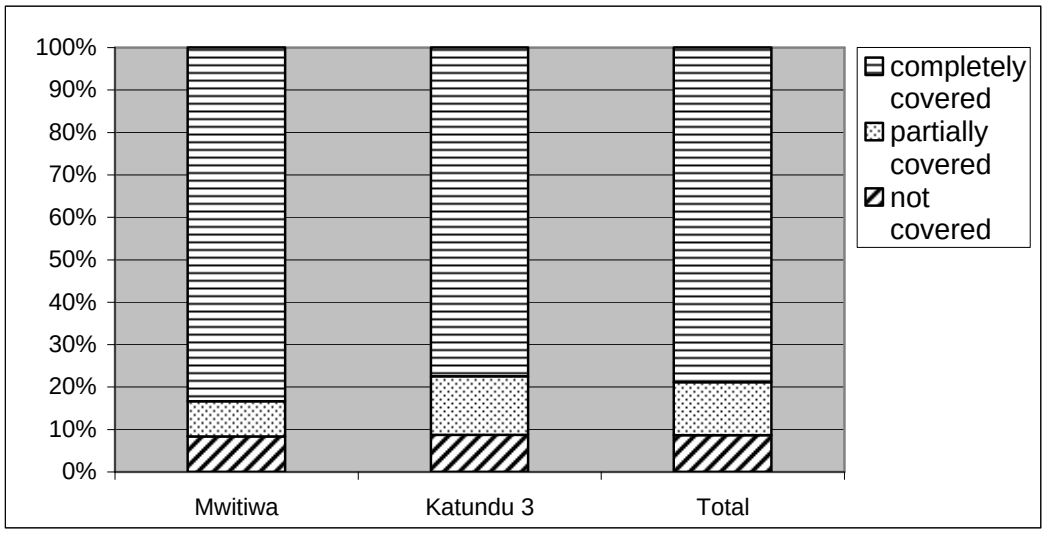

Fig.6.42 Observation of storage containers in respondent HHs (N=104)

Water storage containers in the Mwitiwa households were slightly more likely (83.3%) to be completely covered that their Katundu 3 counterparts (77.5%). The main concern for un/partly-covered containers is potential contamination by either animals/children playing, or by airborne contaminants. There could also be an element of attracting vectors such as mosquitoes and even non-insect carriers (e.g. small animals), but since the water is used within a relatively short time, actual mosquito breeding would not necessarily be a concern.

When asked how they draw water from the storage vessels, most (85.5%) reported scooping it out. Interestingly, over half of respondents in Mwitiwa (55.2%) said they poured water from the container. However, in a later question, they were asked what is used to scoop out the water, and the same (all 113 in fact) respondents said they used a cup. This is likely a case of many of them responding with what they believed was the correct answer, or the "socially

acceptable″ one. A similar trend was seen when respondents were asked whether the collected water is poured straight into the storage container after collection. Overall, 99.1% said yes (Appendix C, Table C904), and 98.2% said they washed the storage container before refilling it (Appendix C, Table C904). In reality, it was observed that most of the time the container for collection and storage of water were one and the same. Still, the nature of the responses, when it came to questions dealing with behavioural issues, may reflect what the respondents viewed as the "correct" ones.

This phenomenon has been discussed by numerous authors (Welte and Russel, 1993; Adrien, 1994; Aubert, 1998) as a consideration when designing, and interpreting data from, KAP surveys. The Fig.6.43 illustrates the observed methods of drawing water from storage containers. In Mwitiwa, more households were seen to have the different-coloured cups for the 2-cup drawing method (whereby one cup is reserved for "scooping"" water out, and pouring into the second cup for drinking; cups were provided by the NGO as part of the initial WSH programme), and over half used this system to draw water when requested to. Despite the figures, during other observations in the context of other activities (i.e. community members were not specifically asked to draw water from storage vessels), very few people were observed to practice this with their families, especially men.

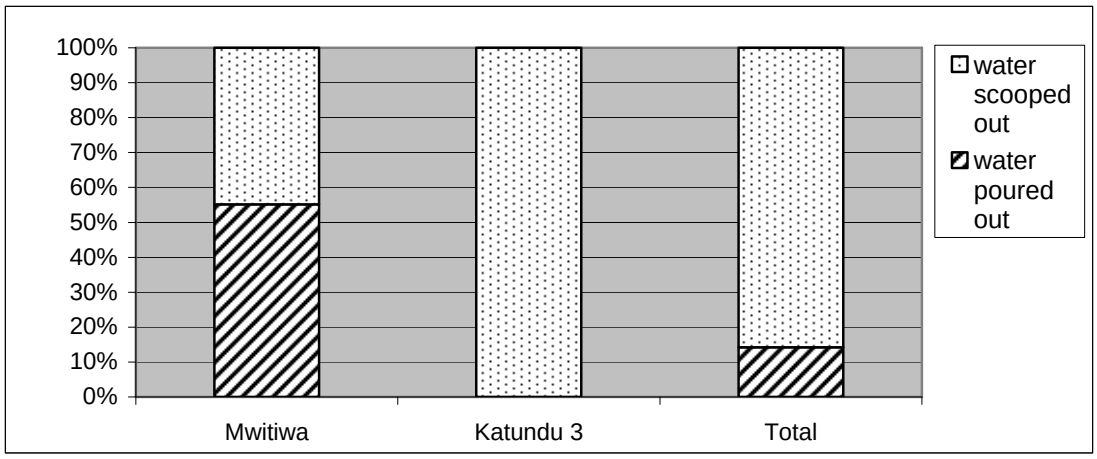

Fig.6.43 Observation: Method of drawing water from storage container (N=113)

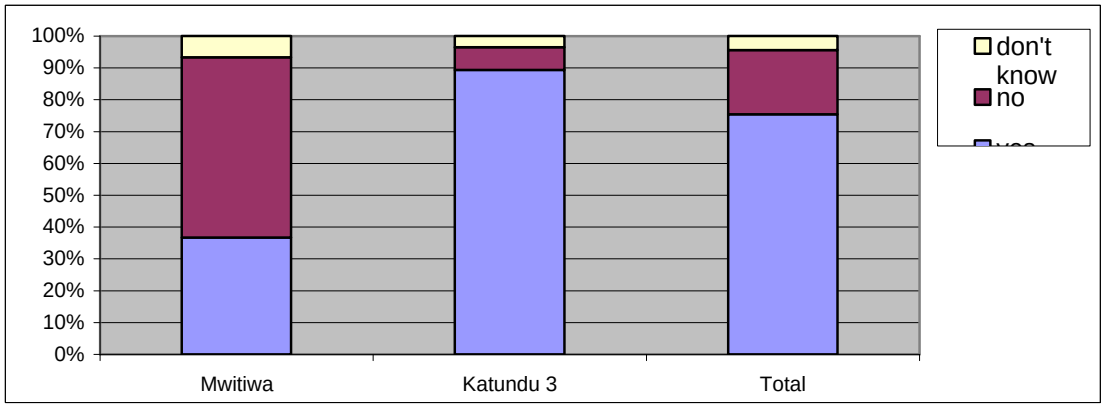

Fig. 6.44 Can clean-looking water cause sickness? (N=100)

In a separate question on measures taken in the households to improve drinking water safety, 97 respondents (85.1%) said that measures were taken in their household to improve the safety of their drinking water. Of these, less than a third (28.6%) said they use the 2-cup system for drawing water, with the proportions being the same in each village (Fig.6.45). Again, some respondents may have used (or reported using) the 2-cup system because they knew they were being observed, rather than as a true reflection of normal practice. This was

observed in several instances when the researchers were invited to have lunch within the communities; most of the time, hands were washed in a basin which was passed around. Nevertheless, the figures overall remain low, indicating that the knowledge of reducing contamination of drinking water is not necessarily being put into routine practice.

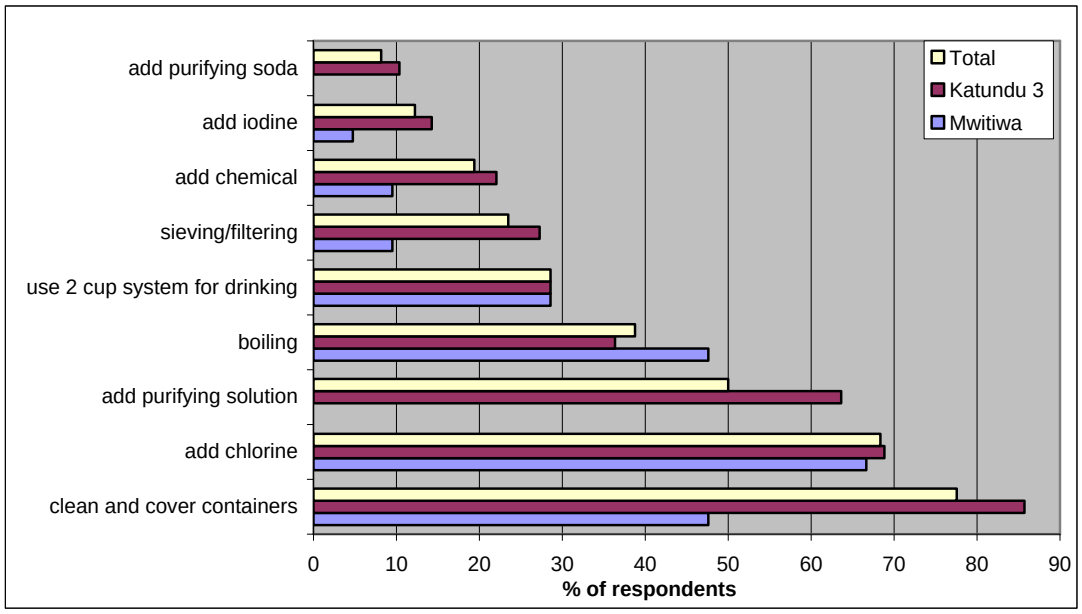

Fig.6.45 Measures taken in HHs to improve quality of drinking water (N=100)

Sieving/filtering is mainly used when water is collected from surface waters (streams), especially in Katundu 3. Women said during the FGDs that they sometimes resort to using these sources when waiting times are excessive at the protected ones (boreholes, shallow wells in Mwitiwa). Over 90% of respondents overall said they had ever added chlorine to their drinking water, and that it had a positive effect on their health.

6.5.3.1 Uses of stored water

Noting the use of surface waters by members of both communities, and to ascertain the uses of the water collected from the protected sources, respondents were asked about non-drinking water uses of the stored water. Overall, 69% of respondents said the stored water is used for non-drinking purposes; 37.9% in Mwitiwa and 79.8% in Katundu 3. This, and the actual uses of the stored water, will determine the quantity required by each household. In the communities the non-drinking uses of stored water are given in Fig.6.46.

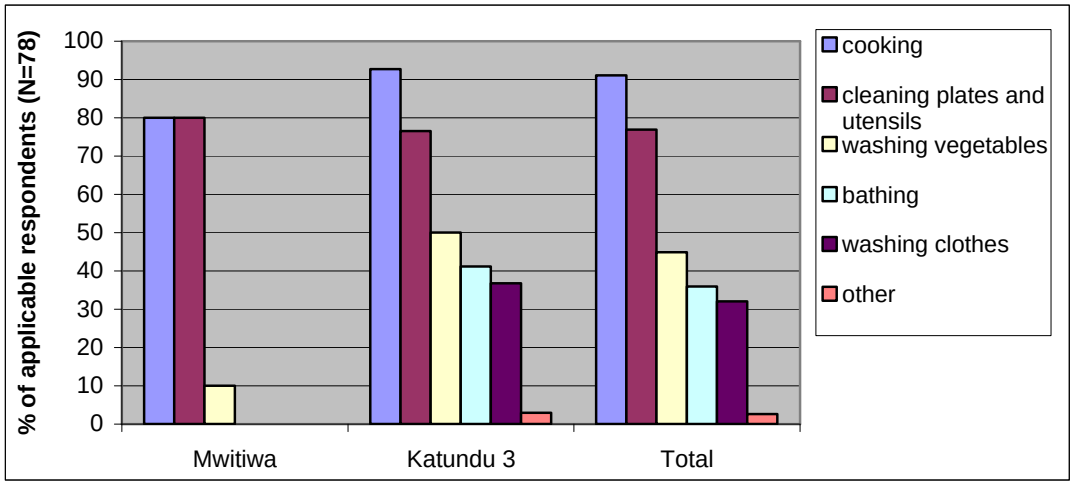

Fig.6.46 Non-drinking uses of stored water in HHs (N=78)

Nearly 35% of respondents said they used stored water to wash clothes, which would imply a greater requirement in terms of volume collected. However, in Mwitiwa, many people were seen to use the Bwaira stream for this purpose; in Katundu 3, women would frequently collect water from the boreholes, and wash

clothes on stones near these. Also, the river was seen to be used for larger items (e.g. blankets), and this was confirmed as common practice during the FGDs.

6.5.3.2 Estimating the availability of water drawn from protected sources

Recommended minimum quantity of water required, in L/person/day (L/p/d), depends on factors such as uses, climate and individual characteristics (drinking needs), most sources set the figure at 15 L/p/d for drinking, food preparation and cleanup, personal hygiene, and washing clothes (SPHERE Project, 2004; Reed, 2005). Although the figure is more commonly quoted for emergency situations, it seems to be the standard for non-emergency settings for planning community water projects. Of course, requirements should be tailored according to local usage patterns.

Using the frequency of water collection, the number of people in the households, and estimate of 20L capacity for collection vessels, the available volume (L/p/d) was estimated (Fig.6.47). However, it is almost certain that combinations of water sources are used (protected and non-protected), and this point must be factored in to WSH programmes in terms of targeting behavioural factors. One source of error in this estimation is that households where several people collect water simultaneously may have an underestimated figure, as respondents would likely respond to the number of times *they* collect water, and not necessarily the number of containers in total being collected.

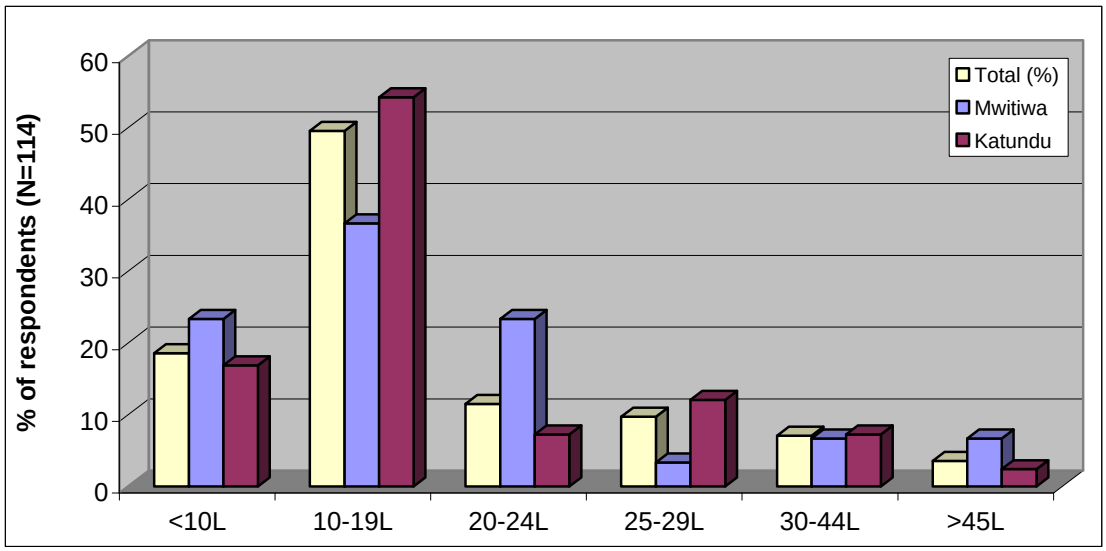

Fig.6.47 Estimated water availability in respondents HHs, L/p/d (N=114)

In these two communities, seeing that most households store water in the same vessel they use to collect it, it is recommended that the *number* of collection vessels available in the household are used as indicators in future studies in the area and around Malawi, in conjunction with collection frequency. One reason for this is that, where congestion is a problem, the actual ability to collect water may be of greater significance than the number of improved sources.

For example, a woman collecting water with her children may wait for a given length of time before reaching the pump. If she had one bucket, she would fill it up and walk home. If she had more than one bucket, she could fill them all, and take them home individually. Since the women frequently went to collect water in pairs or with children, this might be a way of increasing water consumption, irrespective of the time spent waiting. In fact, this may reduce the number of trips needed, and free up time for other activities. Any changes in number and/or

type of collection vessels a household has can also be used as an indicator of improving economic status over the course of a programme.

6.5.4 Sanitation and associated practices

The VWCCs and the women maintained that sanitation in their communities is a "big problem". Despite the VHWCs being trained in latrine construction, the biggest constraint was cited as lack of funds for cement and wiring. Latrine collapse was reportedly common during rainy reasons, and the latrines "don't last more than a year or a year and a half". This has been reported elsewhere in Malawi (Grimason et al, 2000), and is a common problem with sustaining sanitation practices in similar environments.

Both villages (especially Mwitiwa) have suboptimal sanitation coverage; the percentage of households owning a sanitation facility immediately after the WSH programme, and during the research, is shown in Table 6.4 below. Note that these numbers from 2007 were counted at the beginning of the research, not from the KAP survey.

Table 6.5 Documented sanitation coverage in 2004 and 2006

	Basic pit latrine coverage	**Improved pit latrine coverage**
Mwitiwa (2004)	101%	26%
Mwitiwa (any sanitation, 2006)	**48%**	
Katundu 3 (2004)	85%	17%
Katundu 3 (any sanitation, 2006)	**78%**	

These represent, at the closing of the NGO′s programme, the percentage of households having a basic or an improved pit latrine. "Improved" denotes a facility having either a sanplat or dome slab over the pit, while "basic" simply denoted a dug hole with some sort of surrounding structure. For Mwitiwa, the coverage of basic latrines increased from baseline of 41.4% to 101% after the programme, while the figure for Katundu 3 went from 69.7% to 85%. The baseline and 2004 figures for were obtained from the NGO′s survey data at the end of their WSH programmes in the T/A Chimaliro.

It should be noted, however, that the figures for sanitation coverage may not fully represent the true picture, as the numbers certainly fluctuate due to collapse of existing facilities. The sanitation survey in this research was carried out in late August/early September, before the rainy season in Malawi. Thus, if there was a contribution to latrine collapse from the rains, it would most likely be carried over from the previous rainy season, if new latrines were not constructed. Still,

since the sanitation facilities tend to be constructed from sand/mud bricks, and the lifetime of such facilities would not be expected to be very long; certainly not from 2004.

The observed figures were compared to the reported figures through the KAP survey (Fig. 6.48).

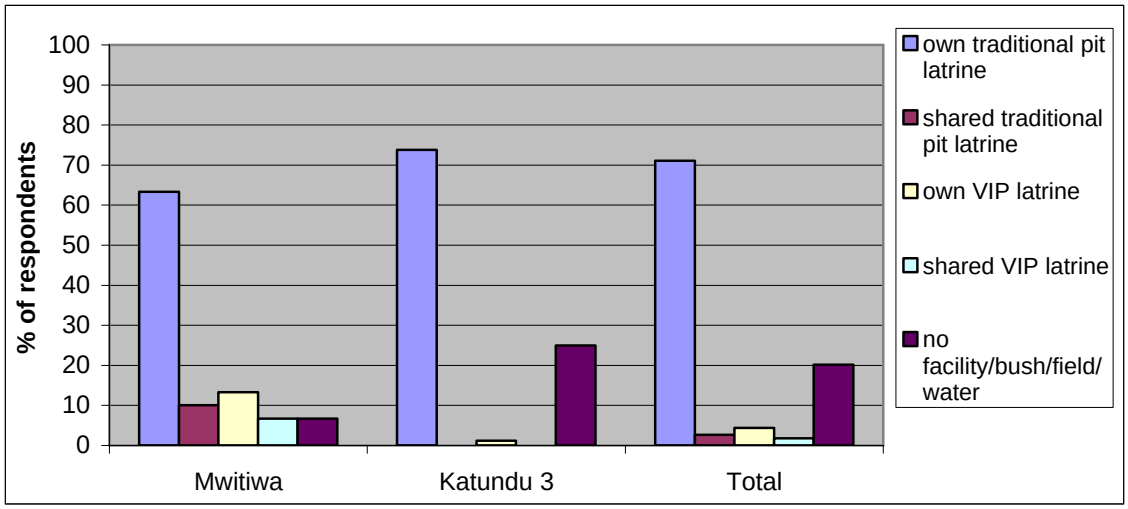

Fig.6.48 Types of sanitation facility used by respondents' HHs (N=114)

The discrepancies in Mwitiwa are clear: nearly three-quarters (73.3%) of respondents in claimed owning a latrine (basic or VIP), while observation put the figure at under half. Katundu fared better, with the observed and reported figures nearly the same (78% and 75% respectively). The difference in figures in Mwitiwa may be in part due to some shame factor in admitting that a household does not have a sanitation facility. Figures on sanitation coverage are not always truly representative of the potential health implications though. For example, latrines may have been built in response to requirements by programmes to

install a certain number of latrines in a village before a water source is put in; this was found to be the case in a study in Nigeria (Onyilo and Osaigbovo, 2003). Also, latrines may be used for reasons other than those they are intended for; in the Nigeria study, some latrines were used to store rice and grains.

Similarly, ownership does not necessarily mean exclusive defaecation in a latrine. At the end of a community let total sanitation pilot project in Zambia (Harvey and Mukosha, 2004), three communities where evidence of open defaecation was found had latrine coverages of 94%, 95% and 100%. Reasons given for this included "habit", "privacy", and not wanting to be be seen going to a latrine. The last point was brought up by women in Mwitiwa, with particular reference to being seen going to the latrine by men. Conversely, two villages in the Zambian study had no change in the latrine coverage (55% and 65%), but no evidence was found of open defaecation at the end of the project. In these, there were higher levels of sharing of facilities, so that despite a reduced overall coverage, at least some sort of safe sanitation facility was used by most.

There was some evidence of sharing among KAP respondents in Mwitiwa (16.7%), and a few FGD participants brought up the point. However, in Katundu 3, none of the women brought up sharing in the FGDs, and from the KAP survey, this practice does not seem to be popular (0%). A quarter of Katundu 3 respondents said they have no sanitation facility, or use the bush/water to defaecate, and 11.6% said they would dispose of children's stools by digging a hole for the faeces and covering it (Fig.6.49).

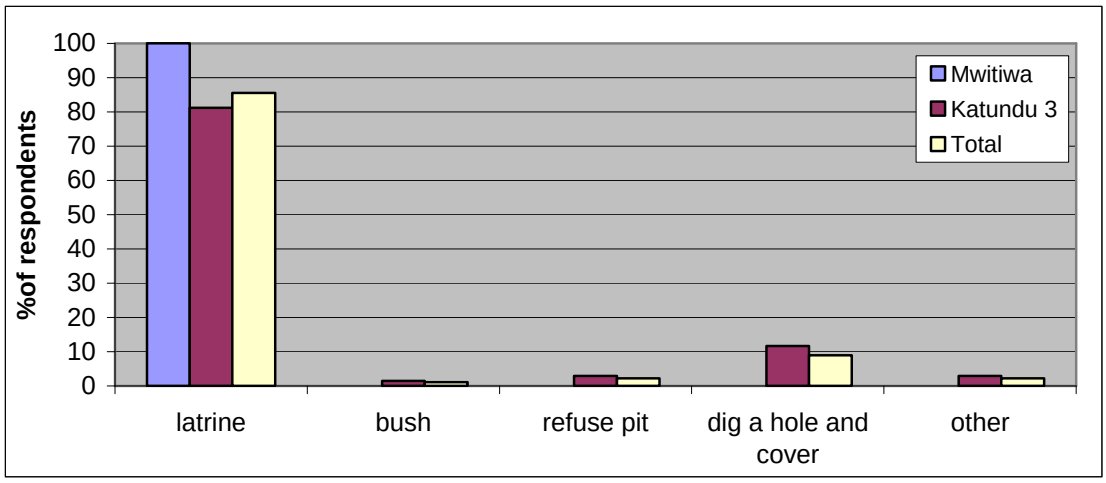

Fig.6.49 Method of disposing of children's stools (N=113)

These findings suggest that using the proportion of people practicing open defaecation may be a more sensitive indicator of the potential health (and other) impacts of a WSH programme in the area than total latrine coverage.

However, doing this would require taking into account the sensitive nature of the topic, particularly with regards to gender. This was very evident during the course of the research; women opened up and spoke freely once there were no men in the group. This is the norm in most parts of the world, and should be one of the first considerations in a WSH programme. For example, these issues should be dealt with by female field staff in the NGO WSH programme, otherwise true participation of women will almost certainly be stifled; unfortunately, the NGO employs very few female field staff. Similarly, the topic of sanitation should be broached with the women in a separate environment, i.e. separate discussion groups for men and women.

6.5.4.1 Constraints to increasing sanitation in the communities

According to the KAP respondents as well as FGD participants, cost was by far and large the biggest obstacle to owning a latrine (Fig.6.50).

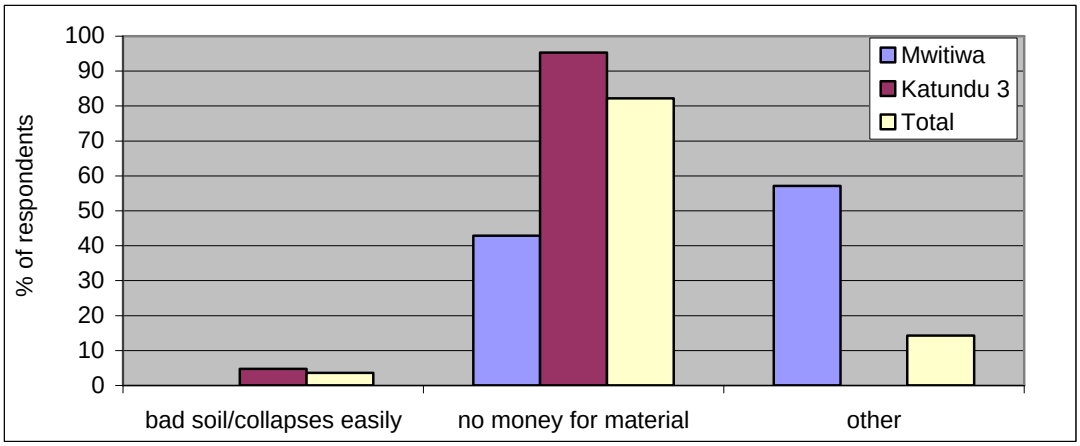

Fig.6.50 For those not having sanitation facility, main reasons (N=28)

The costs and availability of materials needed for latrine construction, as per specifications the VHWCs were trained by, were investigated. A 50kg bag of cement was, at the time of the research, priced at around MK1,200 (~£5.50 using conversion rates at the time), depending on type of cement and location of sources. Each bag of cement can be used to build around three latrines (platforms), resulting in a cost of nearly £2.00 per latrine slab. This is excluding the cost of transport to and from the shops, including hiring e.g. a *matola* to carry the cement back. Also excluded are the cost of the rest of the latrine, including materials for the superstructure, roof (if any), wires, and lining the pit (if carried out).

One would also need to travel quite far to get cement, as the researcher was unable to find any in the small trading centres around the villages (if it is available, it is sporadic). The geography is a problem for Mwitiwa, given the hilly terrain and lack of transportation means to the main roads; apart from bicycles. Thus, getting a 50kg bag of cement from Thyolo Boma or Luchenza presents logistical, financial, and time problem. The same goes for support material, such as wiring (although not necessarily the weight!).

KAP responses along with observation/FGDs suggest the participants are well aware of the importance and health implications of sanitation, although this knowledge is not necessarily translated into practice.

6.5.4.2 Implications for approaches to sanitation promotion

The topic of sanitation in both villages was somewhat of a sensitive topic, with women in Mwitiwa especially seemingly embarrassed to discuss it at first. However, this soon turned into a lively discussion of how much of a problem this is for the communities: "we need help".

One point that was consistently seen in both villages was that a household's lack of a pit latrine was seen by women as more of an "embarrassment" than a health issue, when they spoke of having to share a neighbour's latrine. The health aspect was brought up later, after lively discussion on how embarrassing it is to have to use a neighbour's facility, especially when the women bump into a male from the latter family who is either using the latrine or on the way to it.

The women's perception of sanitation access as predominantly a social issue rather than one of health improvement has implications on the best way of encouraging its prioritisation and promoting sanitation in the communities. It is well established that health concerns are generally not strong drivers of sanitation promotion (Harvey and Mukosha, 2004; Jenkins and Curtis, 2005; Moe and Rheingans, 2006; Scott et al, 2007). Although just over half (52%) of KAP respondents reported owning a radio, more than three-quarters said radio is a source of health information for them. Sharing of radios, more specifically, many people listening to one radio, was commonly observed. It is recommended that the messages be discussed on air by women, and using real-life stories. Other people serve as one of the biggest motivators for behavioural change (UNICEF, 1999), and using the media to highlight other rural community members benefiting (in all aspects, health or aesthetics) from handwashing or eliminating open defaecation could potentially have a significant impact in the research communities and beyond.

6.5.5 Hygiene

6.5.5.1 Hand-washing practices

The idea of associating hygiene and germs with diarrhoeal diseases was highlighted earlier. In a follow-up to this point, respondents were asked why they wash their hands (Fig.6.51). In Mwitiwa, 60% of respondents said they washed their hands to remove dirt. Only 20% and 13.3% said their main reason was to prevent diarrhoea and to remove germs, respectively. In Katundu 3, over

half (51.2%) said their main reason was specifically to prevent diarrhoea, followed by 23.8% "to remove germs".

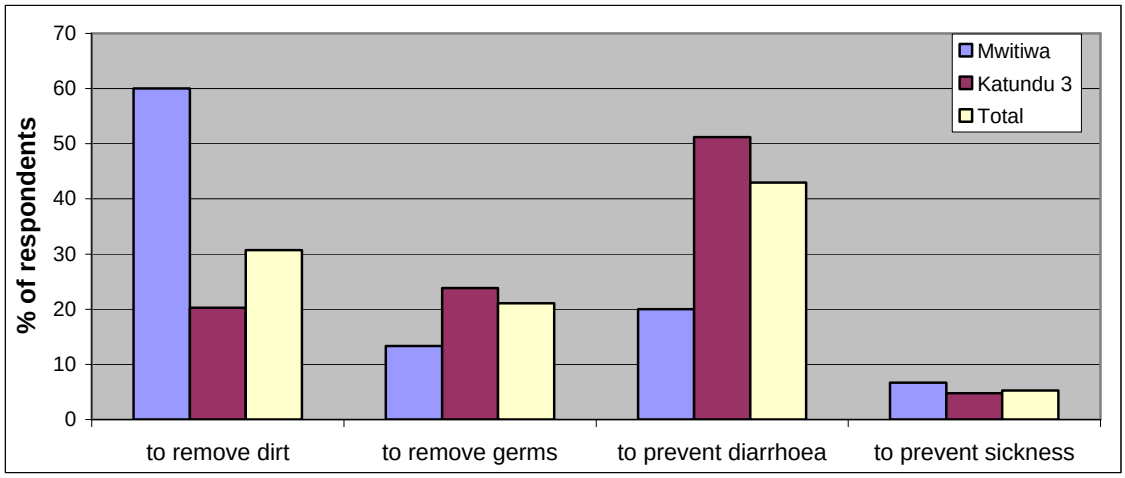

Fig.6.51 Main reason for washing hands (N=114)

The reason cited by most Mwitiwa respondents for washing hands was to remove dirt (60%); in Katundu 3, the main one was to prevent diarrhoea. As with the answers on whether clean-looking water can make one ill, and the reasons for not using alternate water sources for drinking (Fig.6.40), women in Mwitiwa appeared to rely more on tangible (visual appearance, taste, smell) indicators to judge health risks.

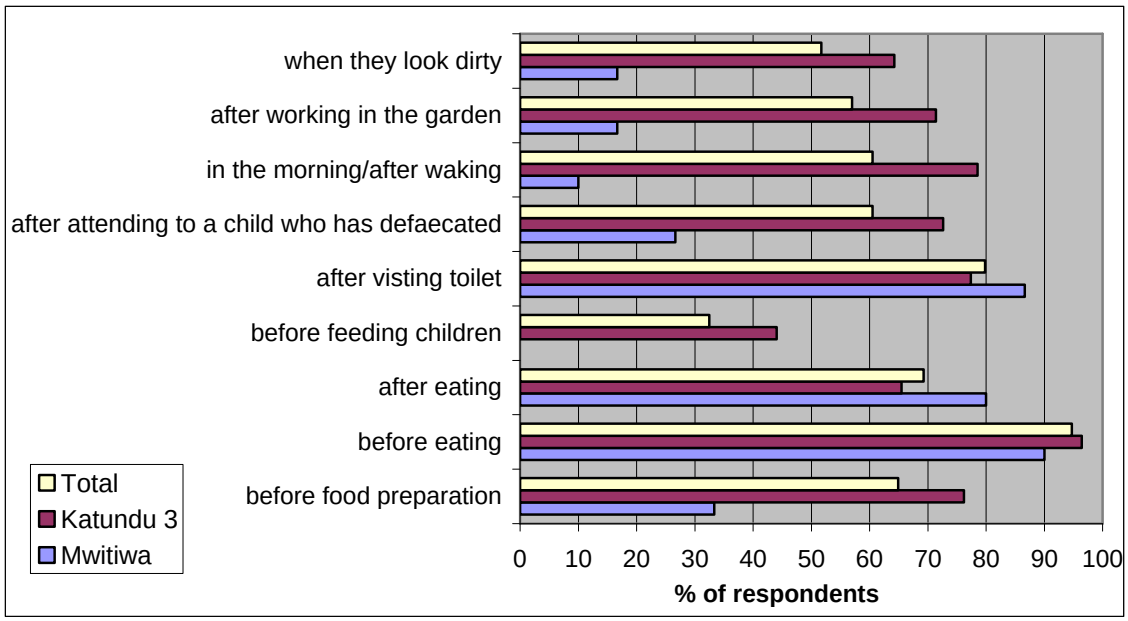

Fig.6.52 When hands are washed (N=114)

The most frequently cited time for washing hands overall (Fig.6.52) was before eating (94.7% overall). In general, respondents in Katundu 3 cited more times for handwashing than their Mwitiwa counterparts. A worrying trend in Mwitiwa is the low proportion reporting washing hands before preparing food (33.3%), after attending to a child that has defaecated (26.7%) or before feeding a child (0%). It is feasible then, to have concerns that many women are preparing food for the children and rest of the household with hands contaminated by faeces from small children. However, during the FGDs, the participants were knowledgeable about this risk.

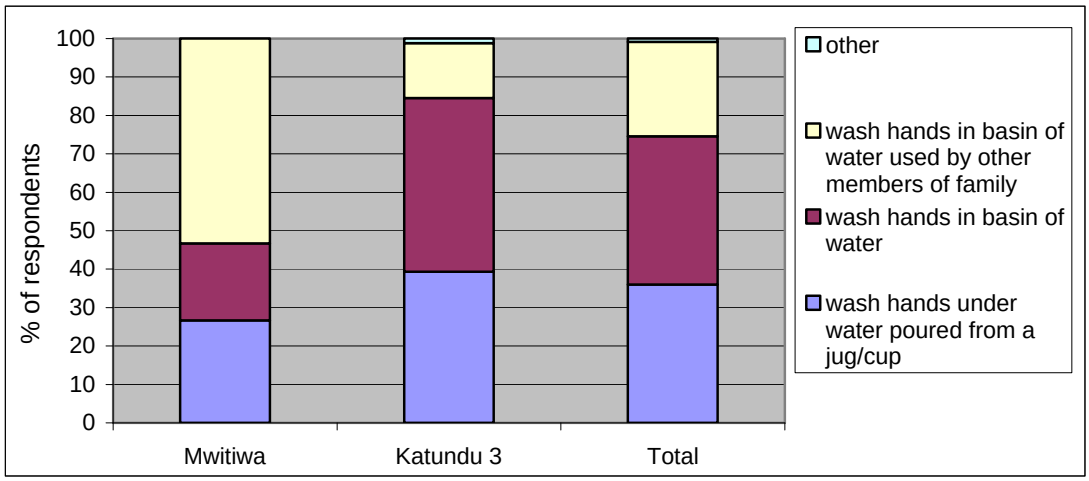

Fig.6.53 Handwashing methods (N=114)

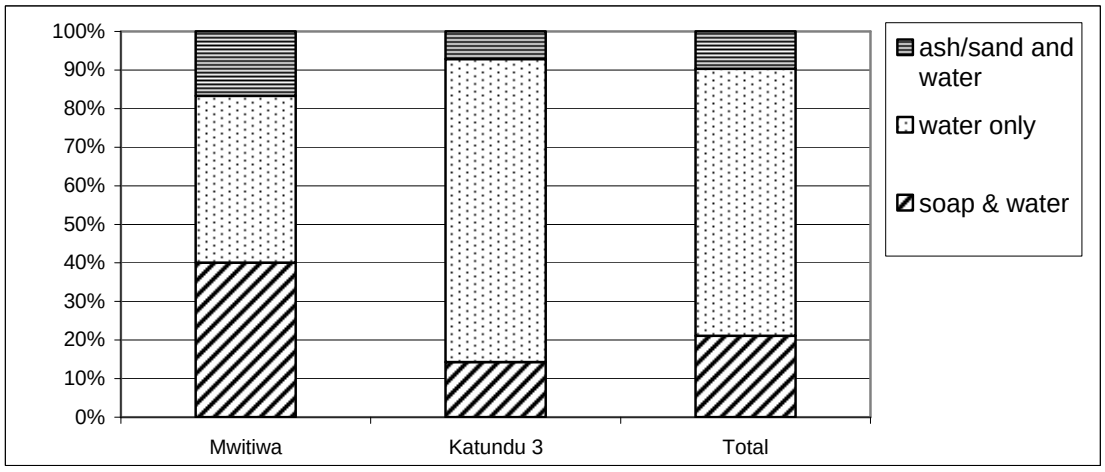

Fig.6.54 What hands are washed with most of the time (N=100)

Respondents in Mwitiwa were more likely to report washing hands with soap than their Katundu 3 counterparts (Fig.6.54); of those respondents reporting the use of soap, over 80% were observed to actually own soap (Fig.6.55). This was interesting to see, because many women in Katundu 3 were seen washing water collection containers and clothes with soap, but none in Mwitiwa. Whether this observation is related to soap being present for handwashing is not known, but it

may be that soap is preferentially used for washing e.g. water containers or clothes. Whether this may be related to the fact that "dirty" clothes may be more likely to be noticed by others than "dirty hands" is unclear (but certainly possible). It would be interesting, for the purposes of social marketing activities, to try and clarify this point.

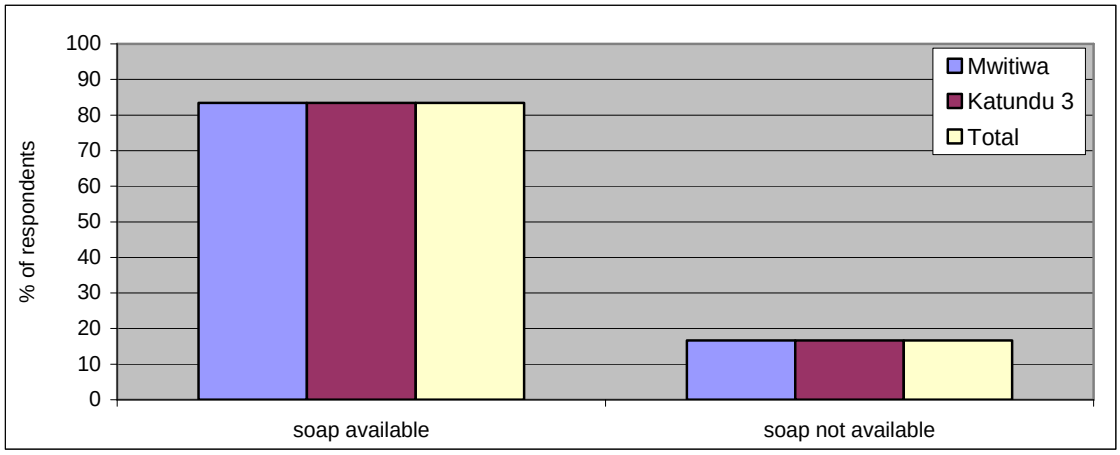

Fig.6.55 In households answering they use soap, the availability of soap at the time of survey (N=114)

6.5.5.2 Food hygiene

Overall, 83.3% of respondents (43.3% and 97.6% of Mwitiwa and Katundu 3 respectively) said they had ever received advice on food hygiene. The nature of the advice is given in Fig.6.56 below.

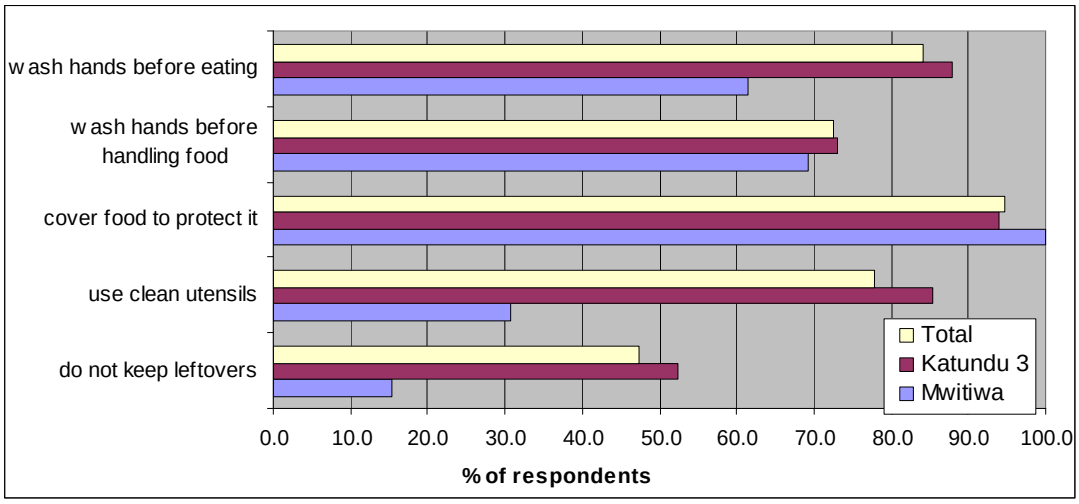

Fig.6.56 Contents of food hygiene advice (N=95)

Although 69.2% of Mwitiwa respondents said the messages on food hygiene included advice to wash hands before food preparation, only one third reported actually doing this (Fig.6.52); sources of this education are given in Fig.6.57. In Katundu 3, roughly the same proportion cited the same message as reported practicing it (73.2% and 76.2% respectively).

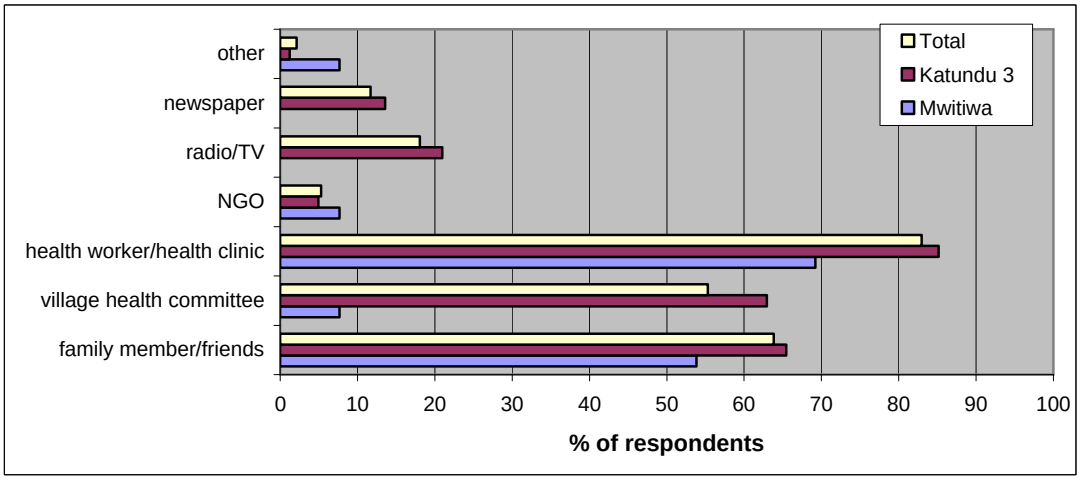

Fig.6.57 Source of food hygiene advice (N=94)

Ownership of several food/household hygiene items is illustrated in Fig. 6.58. Most households had a kitchen shelter; correlating this with the question on cooking location (Appendix C, Table C123), it appears that a "kitchen shelter" means either walls (i.e. indoor cooking) or some sort of shelter when cooking outdoors. However, the proportion of households observed to have kitchen shelters was higher than that of respondents answering that they cooked either indoors or in a covered location outdoors (46.5%, Appendix C, Table C123). This may represent a true discrepancy, or simply different understandings of the question.

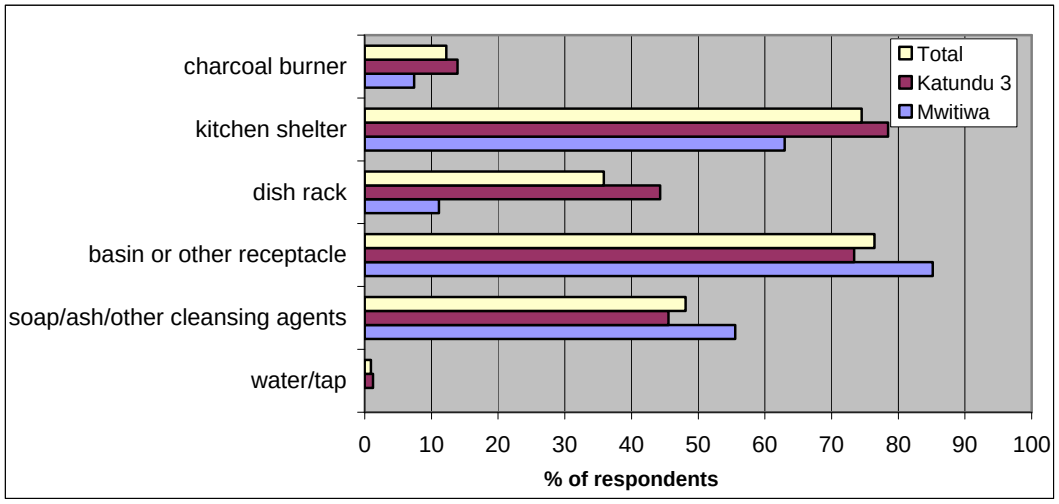

Fig.6.58 Presence of hygiene-related items in respondent HHs (N=106)

Chapter 7: Conclusions and recommendations

7.1 Summary of main findings

The International Environmental Technology Centre (2000) suggests that one of the reasons participatory approaches in development do not automatically equal sustainability is that a communities' knowledge base on a particular matter is a major influencing factor in decisions taken by the community. While this may be true to some extent, when it comes to health, it should be taken in context with changing long-standing habits and behaviour. It is clear in the two communities and elsewhere that knowledge of risk factors in WSH and health especially are not enough to affect and sustain the positive health impacts of the same. This was seen in numerous cases over the course of the research, some of which are:

- Knowledge of prevention methods for malaria, yet most of the respondent households do *not* own mosquito nets (86.7% and 66.7% in Mwitiwa and Katundu 3, respectively).

- Knowledge of the importance of safe disposal of faeces, yet 25% of Katundu 3 respondents report open defaecation, while less than half of Mwitiwa respondent households own any type of sanitation facility. This may be related to the single type of sanitation being promoted, which is evidently less preferred by many households members (either due to design but more likely expense).

- Knowledge of ways to prevent contamination of stored water in the house (e.g. 2-cup method for drawing water), yet more than three-quarters (76%) were observed to use the same utensil for drawing water from storage containers.

- Knowledge of schistosomiasis and risk/exposure factors, yet people were consistently seen to use streams/river. Use of protected sources by neighbouring communities was one of the factors involved, and highlights the importance of using participatory research to illuminate reasons for certain behavioural patterns.

- Engaging in geophagia despite knowing the potential risks of exposure to geohelminthes.

- Acknowledging receiving advice to wash hands before food preparation in Mwitiwa (73.2%) and actually applying it (33.3%)

Assuming the NGO′s WSH programme was the only one that the communities have been involved with (a fact cited by the NGO, the HSA, and the communities), awareness of health risks and preventive measures with regards to WSH are present in Mwitiwa and Katundu 3, although it would be difficult to attribute this solely to any one intervention. The figures in Mwitiwa and Katundu 3 for washing hands before (90% and 96.4% respectively) and after (80% and 65.5% respectively) eating did, meet the NGO′s handwashing targets for at least 50% for these two times. Technically, the figures for washing hands after

handling a child who has defaecated, and those for washing before food preparation, particularly in Mwitiwa, suggest more work needs to be done. This would ideally be by having the communities themselves map out and understand the faecal-oral routes of transmission of pathogens, and this is elaborated on in section 7.3.3.2.

Many times, it was suggested and/or observed that the KAP responses appeared to be what the respondent thought was the "correct" answer rather than what was actually practiced. In some of these cases, it was difficult to ascertain where the answers were an actual reflection of the respondents' practices, or whether the response what they perceived as the "correct" response, i.e. what they were "supposed" to say. This is why KAP surveys should be correlated with observations in the communities. In reality though, this just illustrates that knowledge is high on many issues, yet this is not always translated into practice; it also highlights some of the gaps between knowledge and application, and it is these which form the basis of many of the recommendations discussed in the next sections.

7.2 Distinguishing between user-dependent & independent indicators

In most development programmes, there are impact factors which are, at least to a certain extent, independent of programme beneficiaries (e.g. availability of raw materials, spare parts, refresher training, external support, number of safe water sources), those that are almost totally dependent on the users themselves (e.g. hygiene behaviour, raising funds for village committees, etc.), and those that are

a merger of both. These are important considerations both in planning and for subsequent M&E of project impacts.

7.3 Recommendations for WSH programmes in research area and similar settings

7.3.1 Building a supply-and-demand chain within the area for spare parts, raw materials, and other items

Providing "hardware" and education on WSH issues alone is not enough, and promoting/building a local supply chain is crucial in making sure impacts of WSH initiatives are sustained (UNICEF, 1999, p.10). At the time of the research, and presumably still today, the place where VHWCs can purchase spare parts for borehole maintenance and repair in Luchenza, is relatively far away and time/resource-consuming to access. Two suggestions are made to address this issue:

1) It is recommended to conduct promotion, training, and assistance in setting up income-generating activities (IGAs) parallel to or embedded within WSH programmes. The implementing NGO has programmes in place for promoting and training selected individuals in business and leadership skills, and encouraging setting up of small businesses, and these activities were observed towards the end of the research period. Merging them with WSH programme would **a)** help improve economic status of households and potentially their capacity to e.g. purchase more (and improved) water

collection/storage containers, raw materials for sanitation facility construction, etc., and **b)** allow the VHWCs to better carry out their responsibilities, partilarly if financial incentives for the committee members were agreed by the communities. In fact, if an IGA were set up exclusively for the purposes of the VHWCs (as with the dairy farming project in Katundu 3′s "Portugal" zone), this could provide for some allowance/salary for its members, as well as required consumables. It is worth mentioning that, as of mid-2009 (over 1.5 years after the completion of the project), follow-up on the Katundu 3 IGA revealed that: the dairy cow had produced a female calf, had been yielding over 15L of milk/day, funds from the sale of the milk were being banked in a transparent manner, and spare parts for the borehole were being stockpiled in the community.

2) Assess and build a demand *in the area* for spare parts for the Afridev handpump. According to the Malawi Improved Community Waterpoint Inventory database (2008) there are at least 231 functioning and 56 non-functioning Afridev handpumps in T/A Chimaliro, and it might be feasible to facilitate setting up a small business in one of the marketplaces. For example, a small business stocking spares could be set up at the Goliati or Chidothe trading centres (see Appendix A, Maps 2& 3); the path through Goliati trading centre will have a paved road through to the main highway soon. This way, transport is less of an issue, and the materials can be purchased in e.g. Luchenza and sold locally or stockpiled for sale at the trading centres. This in turn may increase the demand for materials such as e.g. cement, wire for latrine building. Doing this would involve planning and implementation

at the programme level for the entire T/A, as opposed to the individual communities, and would ideally itself be an IGA alongside the WSH programme.

By linking a demand for consumables (for waterpoints and for sanitation/hygiene related activities) with a method for ensuring easier access to supplies, this will likely become a self-propagating and long-term effect of the WSH programmes. Existing community-based organisations (CBOs, e.g. Goliati CBO) can potentially provide good meeting points for larger-scare collaboration. To provide incentives for the VHWCs′ activities, and reduce the burden their activities put on their other commitments, communities should be encouraged to discuss the issue of some compensation, however small and not necessarily monetary, for their committees. No single way is right or wrong; this should be decided by the communities and the VHWCs themselves.

However, as the research has illustrated, building a demand for the "software" components of WSH and health is a challenging matter, and recommendations for this are discussed below.

7.3.2. Choices of safe water provision

In Mwitiwa, two shallow wells and a deeper borehole were installed by the NGO in the community. These are used by two other neighbouring villages, which are larger and have less access to safe water. There is also another borehole on the border with another (which many years ago used to be part of Mwitiwa). Almost

all households in Mwitiwa are within less than 500m from a safe water source, yet the overcrowding presents a problem. Similarly, in some areas in T/A Chimaliro some boreholes are clustered near each other, with no others for large distances (see maps in Appendix A). Two potential suggestions are: vary the type of technology used, and spread the water points out to take into consideration use by multiple communities. The cost of a borehole (Afridev pump) is several times that of a shallow well with the Malda pump.

Two constraints to this are many peoples′ dislike of the Malda pump, and problems with its breakdown and repair. Discussing the issue of dislike with the communities may help come up with a way of addressing these, and using the aforementioned ways to ensure availability of spares may help. If this suggestion is feasible, more water points can be installed, easing the congestion and lessening the impact if any break down; down time which can amount to many months, as seen in both Mwitiwa and Katundu 3. Also, gravity-fed schemes in hilly areas like Mwitiwa could be scaled up and used to cover more than one community. These already exist in T/A Chimaliro, but mainly on commercial tea estates, and the NGO which implemented the WSH programmes in Mwitiwa and Katundu 3 has experience in many types of water source technologies. Finally, as was seen in Mwitiwa, unprotected springs and shallow wells often do exist, and it may be simply a (cheaper) option to upgrade a greater number of these for the price of a borehole.

7.3.3 Increasing true demand for improved sanitation and hygiene in the area

Building a demand for safe water is relatively easy, as very few communities will say no to an offer of a new borehole/shallow well/etc. Apart from the health aspect, particularly seeing that most KAP respondents linked unsafe water to diarrhoea, having a borehole especially is often seen as a status symbol. It is increasing the effective demand for sanitation and hygiene/hygienic behaviour that is the most challenging task to accomplish.

7.3.3.1 Social marketing for sanitation and hygiene

Social marketing (SM) methods have been used worldwide to promote better personal and community hygiene, and are unique in that they are demand led: using strategies to assess communities′ perceived needs, and creating demands based on these (WELL, 1998, pp.203-204). This research has highlighted how knowledge does not necessarily equal practice. In the case of sanitation, the issues of embarrassment and shame were noted to be important to the communities, as well as convenience (suggested by e.g. open defaecation). These themes can form the basis for social marketing methods, with the aim of creating some degree of "social pressure" to conform to certain behavioural changes.

Some suggestions for SM approaches in the area include:

- Radio campaigns (repeated, **sustained**). Use real-life examples with social messages; even engaging prominent figures may be helpful.

- Posters, demonstrations, etc. at rural health centres, which would have the added benefit of reaching further audiences. Chimaliro and Mikolongwe HCs appear to be particularly heavily used in general, perhaps contributed to in part by the long-term involvement of another well-known NGO (MSF) there.

- Intensify activities at primary schools in the area and scale up involvement in schools, as young children getting used to certain practices at school will be likely to note any changes in their own households. This "social pressure" of questioning the differences between their own household and others, especially their friends', may prove to be a catalyst for change (Kar, 2003). Even if little changes within their household, they are more likely to retain the awareness and practices in the future.

Sustained campaigns of e.g. hygiene and hygienic behaviour in the form of the above suggestions would serve not just to consistently reinforce the messages, but help build demand in the area, particularly when people start seeing others adopt more hygienic behaviours. Even if the messages do not reach a sub-set of the populations, diffusion of knowledge and practices from those who are impacted by them is likely to occur.

The social marketing approaches can also be used in another manner: to facilitate greater involvement of men in water and sanitation issues. Traditionally, these fields have been the responsibility of the women (particularly sanitation). It may

be possible, through the repetitive use of social marketing media, to make these issues attractive for men to get involved in. This would need to be tailored to the individual communities, and would necessitate the involvement of social scientists.

7.3.3.2 Community-led total sanitation (CLTS)

This innovative approach to improving sanitation in rural communities was developed and piloted initially in Bangladesh to eliminate open defaecation (Kar, 2003). This approach involved having the communities themselves analyse the extent to which the practice is a problem, the risks posed, and develop local solutions to address sanitation issues. Of note is that the communities where this has been carried out, in Bangladesh and later in Zambia (Harvey and Mukosha, 2007), dramatic reductions or even total elimination of open defaecation were achieved *without external* subsidies or technical support.

The focus is on social acceptability, emotions, and self-respect, rather than strictly health, as drivers for behavioural change. This includes even the language used to invoke social pressures or highlight the undesirability of poor sanitation habits. For example, the "shock factor" was used by Harvey and Mukosha (2007) in Zambia, by consistently using the term "shit" or local equivalent rather than the more "correct/polite" standard terms for "faeces" or "human waste".

Sanitation mapping in the communities includes a transect walk through the communities to identify where open defaecation is carried out, as well as visiting

households and examining the types of sanitation facilities they have. This activity targets the community's sense of pride: by walking through the entire community to observe sanitation facilities and practice, the community members cannot preferentially direct the "visitors" to those areas with adequate sanitation or without open defaecation. This "outsider inspection" has often awakened communities to the problems they come across every day. Households are also helped to calculate how much faeces they contribute to the problem over time intervals. This is also integrated with mapping out routes of faecal-oral transfer.

By having community members involved in planning their sanitation facilities, it addresses the differences in economic well-being. For example, households that can afford materials such as cement and wiring can build sanitation platforms. Those that cannot might devise other ways of improving their sanitation status; for example, it may be that grass and wood planks can be used to make a platform with a surrounding "wall" and a hole which can be easily covered. In short, the level of technology is tailored appropriate not only for the communities as a whole, but by and for individual households.

This and other forms of social marketing has a high probability of success in Mwitiwa and Katundu 3, and indeed the general area, since over the course of this research the influence of social factors was obvious in, for example, the idea of a borehole as a "status symbol", as well as the idea of not owning a latrine as "embarrassing".

7.4 HIA in planning and M&E of SWH programmes in the area

In the context of this research, the HIA was in effect a sustainability assessment exercise, focusing on determinants of health-related indicators. Health impacts of WSH projects are largely the result of changes in proxy indicators, most of which are user-dependent, e.g. reduced open defaecation, increased handwashing frequency, reduced finger-dipping, etc. These can be used alongside the "hardware" indicators to gauge the impact a similar WSH intervention has had in the communities served. The same methods used in this research can ideally be used in the planning stages of similar WSH programmes; although the *initial* phase of data collection was done over 3 months, it is feasible, with more than one person and the greater resources an NGO would have, to have it done in less time. With NGOs that have a sustained national and local presence and often operate in multiple sectors (such as the NGO in this case study), there is no need for a prolonged second phase similar to the one employed in this research. On the contrary, the observations and trends documented in this study have set a preliminary framework for future rural health programmes to use to carry out a prospective HIA, ongoing HIA for M&E, and subsequent follow-up work where possible/necessary.

The most important things to consider are: triangulation of information obtained by different methods, and correlation of these with the more qualitative information from the communities. The importance of baseline data availability cannot be overemphasized, yet in NGOs with a medium-long term presence in an area, this need not represent a financial and logistical burden; general public

health-related KAP surveys are relatively easy to administer and can be used in several different projects in an area. The aforementioned inherently means that the idea of a "one size fits all" programme should be abandoned as much as possible, as no two groups of people are identical, or have identical health-related indicators. Some suggested indicators (apart from those already used by NGO, see section 4.4) for monitoring future similar projects include:

- Number of collection/storage containers
- Volume of water collected daily (estimated by containers + collection frequency + number of household members involved in water collection)
- Frequency/patterns of use of unprotected source
- Indicators of the practice of open defaecation
- Presence/use of soap for handwashing
- Handwashing times/methods (more than just related to eating or defaecation)
- Anyone in household suffered diarrhoea *in the past week*; importantly, *who* suffered diarrhoea.

Relatively short and easily administered KAP surveys should be used as part of an HIA in such programmes, targeting knowledge of WSH-related health, behaviour (e.g. handwashing); not only as baseline data for planning, but also after specified time intervals (e.g. 6 months) over the course of/after the programme as a M&E exercise. These surveys can be administered by community members themselves, with simple training, as was seen in this research. However, and especially at the planning phase, the surveys should

always be designed and correlated with information from other forms of participatory assessment (FGDs are particularly useful when conducted in a locally acceptable manner). As part of the HIA, the community should also feel they have the power to make changes if necessary; for example, if using cement is a problem for whatever reason, they can be encouraged to come up with their own ideas of stopping open defaecation practices.

Two final recommendations at a programme level are: incorporate respiratory infections into health education, and increase numbers of female field staff. RTIs were found to be a problem, whereas knowledge of these and associated risk factors was almost non-existent; education on these matters can easily be incorporated into existing health education modules. However, once again, the challenge would be to bridge the gap between knowledge and practice (this is where concomitant social marketing activities become invaluable).

The need for more female field staff to work with the communities was evident in this particular programme. Especially when it comes to sanitation, these and associated issues are often embarrassing to discuss for women, who are usually the biggest target groups. In this case, the NGO employed very few female field staff (a point confirmed by several employees at the Blantyre head office). A simple example was the difference in women's participation in the FGDs with the VHWC and later women separately in Mwitiwa.

7.5 Potential constraints

A number of potential constraints emerge in applying HIA methods in NGO-implemented WSH programmes in the study area and beyond. First is the capacity (financial, time, and human) to undertake the studies and act upon findings. For this reason, HIA must be relatively simple to integrate into the existing framework of the NGOs′ work, but there must be willingness on the implementing agencies to commit to concrete M&E activities. For this reason, simple KAP surveys and FGDs can be used, as they are relatively simple to administer but can shed light on some important points which will certainly affect the outcomes, health and otherwise, of the programmes.

The second potential constraint comes from donors themselves. Funders typically want concrete (usually quantifiable) results within an established time frame; focusing on "hardware" satisfies this preference. For this reason, it is suggested to use KAP surveys to try to quantify some aspect of behavioural change, which can be presented as changes over the lifetime of the programme. It is however, up to the NGOs and implementing agencies to push for "software" indicators to be given high importance in the eyes of the donors. This will be a challenge if proposals for funding are developed on a reactive basis to calls for proposals by funders, as is the case with this particular NGO. Finally the above points tie into the need for NGOs and implementing agencies to recognise M&E, and by extension then HIA, as a tool for effective planning and project management, and not as simply "more baggage". This is more likely to happen if HIA is seen by donors and NGOs as an integral part of their existing M&E

practice. This way, the benefits of HIA as a *process* and not a separate *outcome* of their efforts can be realised.

7.6 Conclusions

This research investigated, to the author's knowledge for the first time, the impact of an NGO's past water, sanitation and hygiene (WSH) programme on health-related processes in Thyolo district, southern Malawi. It also explored potential inputs that other disciplines can add to similar WSH programmes in order to bridge the gap between changes in user-dependent and user-independent determinants of population health. Importantly, this was done using simple methods that would not be expected to fall beyond the means and expertise of NGO teams that are, for the most part, largely operating within a limited sector. The combination of methods enabled a continuous feedback system to accommodate for dynamic changes in findings representing the multifactorial nature of health; these generated a compilation of both quantitative and qualitative results tailored to the communities.

The combination of qualitative and semi-quantitative methods applied during this research was relatively simple, inexpensive (by typical HIA standards), and highly adaptable. The utility of the methods used in this research can be taken even further to determine what projects to carry out in the area; for example, merging of income-generating activities and WSH components of the NGO activities in this particular Traditional Authority, and potentially expanding each. Additionally, the participatory methods used in this highly descriptive

HIA proved themselves to be catalysts for discussions of unanticipated but related issues, as well as potential ways to address user-dependant factors. In effect, the result is a combination of an HIA and a highly targeted needs assessment, as well as a data synthesis tool for wider sets of health determinants.

As with a large proportion of NGO WSH programmes, the focus in this particular setting was on the "hardware" (technological and associated) aspects, with the "software" (behavioural) components largely confined to health education. The latter, in isolation, is known to be an inefficient motivator for the behavioural changes needed to maximise the health benefits of WSH programmes. In populations heavily dependent on groundwater sources for daily needs, appropriate technology to expand access to safe water is crucial, as are the means to maintain or replace them in the longer term. In this study, the major problems with safe water access were not necessarily with the applicability of the water and sanitation technologies themselves, but with accessing the required "consumables" (funds, spare parts, and expertise) to ensure their continuity and that of their associated health impacts.

To partially address the "hardware" issues associated with safe water access, several options are proposed, depending on which of two directions is to be taken. The first direction would be scaling up the *true* population/water-point ratio by increasing the number of points. Since clearly all current ones are being used by at least two different communities, this would entail considering the numbers in the surrounding areas in planning of water points. Since funding constraints must be considered, it would be reasonable to consider combinations

of technologies. For example, at least two shallow wells/springs can be upgraded for the same cost of one borehole. Communities invariably use surface waters at least seasonally and year-round for specific things (e.g. laundry), and it is worth upgrading some of these where feasible; even if the yield drops for 2-3 months annually, there will be an overall increase in access to safe water. The main obstacle here is the communities' dislike of the Malda handpump (for shallow wells); however, this could be partially addressed by improving maintenance capacities and confidence of the communities. In the case of sanitation, it is recommended to increase community members' ability to build/replace latrines through means discussed below, as well as consider alternate forms of human waste disposal. This would involve extensive community consultation, but would likely generate [a] locally-acceptable means of isolating human faeces from known exposure pathways.

The second potential direction would be improving capacity to sustain the technology itself. In the case of water points, the main constraints were lack of funds and expertise (due to defaulting VHWC members) to access/purchase spare parts and properly install them. This is where integrating the NGO's existing IGA interventions with the WSH programme would be beneficial. Specifically, select (preferably) VHWC members can be supported in setting up small businesses dealing with spare parts (from Luchenza) in the nearby trading centres, and/or materials for latrine construction. As already mentioned, there are over 200 functioning water points with Afridev pumps in T/A Chimaliro, and so a potential market may already exist. The income generated can be put towards maintaining the water points, promoting sanitation, microfinance, and

even VHWC refresher training or hiring outside technical experts for complicated repairs. These measures would help address some of the barriers in sustaining the technologies themselves, as well as added benefits from extra income for households or entire communities.

As for the "software" side, significant gaps were uncovered between knowledge of health-related practices, and actual application of this knowledge; an observation that was not confined to WSH-related issues. Most of these discrepancies are almost exclusively user-dependant factors (e.g. handwashing practices and mosquito net ownership). Clearly, action needs to focus on affecting behaviour changes conducive to better health status. One of the most promising methods to accomplish this is through social sciences approaches, particularly with regards to sanitation. Social marketing and CLTS has demonstrated its efficacy in communities as near as Zambia; the NGO in the research area can spearhead this in the area as well as Malawi as a whole. However, in order for this to even be approachable, more female field staff *must* be involved at the community level. Similarly, indicators such as time and distance to water sources should be based on community-relevant tasks, rather than asking for minutes or hours; as was evident in this research, these are very subjective measures.

It is important to acknowledge the importance of the NGO-donor relationship, which is one of the biggest obstacles to implementing the findings of this research. Donors usually want quantitative indicators, and within a short timeframe. The most sustainable true health impacts in WSH interventions are

seen over time, and the numbers for indicators that are measured and currently reported certainly fluctuate over time. Addressing this would involve proactive measures from the NGO to campaign for a change in donor mentality towards accepting a wider range of monitoring and evaluation indicators of the impacts of their funding. Concrete suggestions on how to accomplish this are beyond the scope of this research, but should be examined in depth in the future. Nevertheless, some of the approaches in this research, as well as the recommendations for alternate indicators, do in fact provide quantitative data that can be collected at intervals and presented in reports to donors (as well as in funding applications).

This research has identified several areas, related to environmental and public health, in need of further investigation in the area and across Malawi. These include applicability of alternate methods of disposing of human wastes, including (but not limited to) ecological sanitation and community-led total sanitation. The former would also be expected to have direct economic impacts; it has been piloted elsewhere in Malawi, but not in the research area.

Along with the aforementioned, social network analysis methods would be useful to map potential pathways for social marketing approaches within the village communities and in the wider area. These may also have an added benefit of keeping the issues and their advocates consistently in the sight of governmental and non-governmental groups that play a role in dictating development in WSH sectors; it is possible that this may serve to exert pressure

on these players to afford the issues a higher priority on political/institutional agendas.

Research is also needed into determining indicators of socioeconomic status/well-being unique to the individual communities (e.g. livestock, bicycle ownership), for subsequent use in HIAs; alongside (or in place of monetary figures) if necessary. This is to get out of the habit of using monetary indicators, as in many areas other sources of "wealth" carry more significance.

Methods are also needed to engage men more in the responsibilities of the household's health; it is unreasonable (although the norm) to place these burdens exclusively on the women, as their time/energy is already heavily burdened and finite. Unfortunately, this is implicitly reinforced in many development programmes. This recommendation may involve social marketing targeting the male population, and needs further research.

The health impacts of geophagia, which although widespread, has to the author's knowledge not been studied in any depth in Malawi. Studies elsewhere, although limited, point to a negative effect on (particularly child) health. Thus, the issue requires investigation, if only from a public health perspective.

Although normally overlooked, the safety of some water collection vessels used by small children to carry water needs further investigation, at least in the research area. On numerous occasions over the course of this research, children were observed filling empty [vehicle] engine oil containers with drinking water

for transport to the house. The probability of there being traces petroleum/non-petroleum derivative compounds still in the containers, is unknown; all containers seen had been "rinsed with water" upon acquiring, which would not be expected to remove significant amounts of any (hydrophobic) residues. Similarly, tiny amounts of residual oil ingested would probably not be harmful, but the cumulative effects might be different. How much of a risk this practice actually represents is unknown, but warrants further investigation (at least a literature review), due to the fact that it is mainly very small children involved.

Social sciences and economic approaches to investigating potential angles for encouraging and/or pressuring donors to take the longer-term vision of environmental and public health-related programmes are also needed. For example, education and marketing into driving factors influencing donor funding and subsequent programme planning could be a start, followed by more detailed business-oriented and strategic research into methods of influencing larger donors to take a more beneficiary-focused attitude (including more on-the-ground involvement if necessary).

To conclude, health impact assessment is versatile set of adaptable tools for use prospectively, concurrently, and/or retrospectively to maximise the positive impacts of an intervention while minimising the negative ones. While it has been shown elsewhere (mainly in large international groups, or in developed countries) to be valuable in anticipating health impacts of programmes already in various stages of planning and implementation, it also has exciting potential for use at the community level in NGO WSH programmes in rural Malawi (and

similar settings elsewhere), in order to actually extract/synthesise data on the situation-specific indicators of health. As with any public health intervention however, or any development project for that matter, there needs to be a will (for whatever reason it may be) to keep the focus trained on the true endpoint, i.e. the improved health of the population. Without this, and the subsequent willingness to act on findings, the impact of research, advocacy, and funding is severely diminished; an unfortunate fact which has been borne out over the past decades in the fields of water, sanitation, and general public health in those populations least able to cope with the consequences.