IMPROVING WATER AND SANITATION HYGIENE BEHAVIOURS: INTERVENTIONS FOR REDUCTION OF HELMINTH INFECTIONS IN SCHOOLS

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OPTION**:** HUMANITARIAN WASH

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SUMMARY

Helminths are a group of parasites commonly referred to as worms. They are the most common infectious agents affecting humans in developing countries (Hotez et al., 2008). The main interventions implemented to fight against them are preventive chemotherapy and Water, Sanitation and Hygiene (WASH) in schools.

The aim of preventive chemotherapy is to avoid the morbidity linked with helminth and other infections that leads in some cases to death (WHO, 2006). In practice, preventive chemotherapy requires the delivery of good-quality drugs, either alone or in combination, to the maximum people in need at regular intervals all through their lives (WHO, 2006). In general, this intervention aims at high risk groups such as communities living in endemic areas, mostly school age children or infected people (WHO, 2011). Preventive chemotherapy is generally perceived as an urgent need recommended to reduce the occurrence, extent, severity and long-term consequences of morbidity (WHO, 2006).

WASH in schools consist in providing schools with safe drinking water, improved sanitation facilities and hygiene education that encourages the development of healthy behaviours (UNICEF, 2012). It aims at improving the health and learning performance of school-aged children and those of their families and communities by reducing the incidence of water and sanitation related diseases (UNICEF, 2012). WASH in schools interventions require the involvement of several stakeholders that have roles to play for an efficient and sustainable WASH in schools. Among these stakeholders we have school children and their families, school staff, the community, the local authorities and the health staff (Adams et al., 2009).

Despite its impact on children's health, school attendance, particularly for girls, and its contribution to fostering lifelong healthy hygiene habits, WASH in schools lacks attention (GLAAS, 2014). It is therefore very important to improve WASH in schools in order to sustainably fight against helminth infections by promoting a joint approach between WASH and health actors for instance. This improvement may also be possible for example by setting monitoring systems or reinforcing those that are already existing by defining clear standards and definitions in order to register similar data on WASH in schools. It might be helpful while reporting on WASH in schools coverage trends and promoting access to WASH in schools.

ACRONYMS AND ABBREVIATIONS

APOC	African Programme for Onchocerciasis Control
DRG4	Disease Reference Group on Helminth Infections
EPG	Eggs per gram of faeces
GAHI	Global Atlas of Helminth Infections
GLAAS	UN-Water Global Analysis and Assessment of Sanitation and Drinking-Water
GNNTDC	Global Network for Neglected Tropical Diseases
GPELF	Global Programme to Eliminate Lymphatic Filariasis
HHVI	Human Hookworm Vaccine Initiative
JMP	WHO/UNICEF Joint Monitoring Programme for Water Supply and Sanitation
LF	Lymphatic Filariasis
MDA	Mass Drug Administration
MDG	Millennium Development Goal
MSAT	Mass screen and treat
NTD	Neglected Tropical Disease
OCP	Onchocerciasis Control Programme in West Africa
OEPA	Onchocerciasis Elimination Program for the Americas
Oncho	Onchocerciasis
PHAST	Participatory Hygiene and Sanitation Transformation
PPC	Partnership for Parasite Control
SCH	Schistosomiasis
SCI	Schistosomiasis Control Initiative
SSA	Sub-Saharan Africa
SSHE	School Sanitation and Hygiene Education
STH	Soil-Transmitted Helminthiasis
TDR	Special Programme for Research and Training in Tropical Diseases
UNDP	United Nations Development Programme
UNICEF	United Nations Children's Fund
WASH	Water, Sanitation and Hygiene
WHA	World Health Assembly
WHO	World Health Organization
WinS	WASH in Schools

CONTENTS

INTRODUCTION

Context and problem

The Member States of the United Nations signed in 2000 the Millennium Declaration, which have become known as the Millennium Development Goals (MDGs). To guarantee environmental sustainability, goal 7 included a target that challenged the global community to halve, by 2015, the proportion of people without sustainable access to safe drinking water and basic sanitation (WHO/UNICEF JMP, 2015). On one hand, in 2010 the global target for drinking water was already met meaning that 91 per cent of the global population now uses improved drinking water sources. But in 2015, 663 million people still lack improved drinking water sources. Indeed, in Sub-Saharan Africa the target for drinking water was not met, meaning that 68 per cent of the population uses improved drinking water source for a set target of 74 per cent (WHO/UNICEF JMP, 2015). On the other hand, the global MDG target for sanitation has been missed by almost 700 million people and in 2015, 2.4 billion people still lack improved sanitation facilities. In Sub-Saharan Africa only 30 per cent of the population now uses an improved sanitation facility for a fixed target of 62 per cent (WHO/UNICEF JMP, 2015). In these conditions many water and sanitation related diseases can become prevalent in areas where water sources are unsafe and sanitation inadequate.

This situation (unsafe water supplies and inadequate sanitation) leads to a high prevalence of soil-transmitted helminthiases (WHO, 2012a). Soil-transmitted helminthiases (STH) is a term referring to a group of parasitic diseases caused by nematode worms that are transmitted to humans by soil or food contaminated by faeces. These parasitic worms (helminths) are the most common infectious agents of humans in developing countries (Hotez et al., 2008) and tend mostly to affect pre-school aged and school aged children includind adolescents (Crompton and Nesheim, 2002). To fight against them, successful intervention depends on optimal utilization of available control measures, such as anthelmintics that are drugs used to stun or kill helminthes, and development of new tools and strategies.

Currently, many of the ongoing anthelmintic control programmes are based on annual mass drug administration (MDA). The expenditure on delivery of programmes to administer anthelmintic chemotherapy has resulted in millions of infected or exposed people being treated for helminth infections, with likely significant health benefits. However, the key drivers of present and future patterns of human helminthiases, as well as the determinants of success in

controlling such infections, are often environmental and social, making it necessary to use an intersectoral approach for control.

This approach will include not only drug distribution, but also environmental components such as improvement of sanitation and drainage, access to clean water, adequate excreta disposal and solid waste removal, and health education (WHO, 2012b).

Consequently, we need to find an adequate (sustainable and cost effective) way to reduce helminth infections especially in schools through water and sanitation hygiene behaviours improvement.

Objectives

The aim of this document is to determine, across a literature review, how to reduce helminth infections in schools through water sanitation and hygiene behaviours improvement. For that it will be useful to:

- ✓ Assess the main interventions to fight against helminth infections in schools.
- ✓ Determine the link between helminth infections and water sanitation and hygiene interventions.

This document has three mains parts. A first part dedicated to an overview of helminths, a second part which describe the mains interventions used to reduce helminth infections and then a third part which is about linkages between WASH and helminth infections. The document is closed by a conclusion containing some prospects.

I-OVERVIEW OF HELMINTHS

I. OVERVIEW OF HELMINTHS

I.1. Definitions

The agents that cause diseases fall into five groups: viruses, bacteria, fungi, protozoa, and helminths (worms). Protozoa and worms are usually grouped together as parasites, and are the subject of the discipline of parasitology, whereas viruses, bacteria, and fungi are the subject of microbiology. (Janeway et al., 2001).

Helminths are large, multicellular organisms that are visible to the eye once in the adult stage of their life cycle. They can either be free-living or parasitic. Parasitic worms are commonly found within the intestine and thus, are called intestinal parasites. They are able to live in both humans and animals (Boundless, 2015). These parasites live in and feed on hosts which allow them to obtain nourishment while disrupting the host's nutrient absorption (Crompton and Nesheim, 2002).

I.2. Classification and characteristics

Among the helminths we have the nematodes (roundworms) that include the major intestinal worms (soil-transmitted helminths) and the filarial worms that cause lymphatic filariasis (LF) and onchocerciasis, and then we have the platyhelminths (flatworms) including the flukes (trematodes), such as the schistosomes, and the tapeworms (cestodes), such as the pork tapeworm that causes cysticercosis (Hotez et al., 2008).

The classification and identification of helminths are dependent on numerous factors including body shape, body cavity, body covering, digestive tubing, sex and type of attachment organs. Tapeworms lack a body cavity and a digestive tube and are hermaphroditic. They use sukers as attachment organ.

Trematodes are characterized by an unsegmented plane for body shape. They also lack a body cavity. Their digestive tube ends in the cecum. Trematodes are hermaphroditic and have oral suckers and ventral suckers for attachment organ.

Nematodes are characterized by a cylindrical body shape and do indeed have a body cavity. Its body covering is a cuticle and the digestive tube ends in the anus. The sex of nematodes is dioecious (distinct male and female organisms). Lastly, their attachment organs range from lips, teeth, filariform extremities and dentary plates. (Boundless, 2015).

I.3. Helminth infections

I.3.1. Burden and distribution

Helminth infections are part of a group of infectious diseases that thrive in impoverished settings, especially in the heat and humidity of tropical and subtropical climates called Neglected tropical diseases (NTDs). They have been largely eliminated in some areas and are thus often neglected and affect more than one billion people in the world (WHO, 2015a).

Helminths are among the most widespread infectious agents that have affected, and still affect, human populations, particularly in developing countries and resource constrained regions of the world. It is estimated that over one billion people in developing regions of sub-Saharan Africa (SSA), Asia and the Americas are infected with one or more species of helminths (Hotez et al., 2007; Hotez et al., 2008). The morbidity associated with such infections imposes a substantial burden of disease, which helps establish and maintain a vicious circle of infection, poverty, decreased productivity, and inadequate socioeconomic development (WHO 2012b). The infections themselves may have an impact on other conditions such as malaria, HIV/AIDS, and the ability to respond effectively to a range of anti-infectious disease vaccines (WHO 2012b). The six major helminth infections identified by Disease Reference Group on Helminth Infections (DRG4) which is a group of 13 experts in helminth infections are onchocerciasis, lymphatic filariasis, soil-transmitted helminthiases, schistosomiasis, food-borne trematodiases and taeniasis/cysticercosis (WHO 2012b).

Table 1 : The major human helminthiases and their global prevalence and distribution

Disease	Major etiologic agent	Global prevalence	Regions of highest prevalence
Soil-transmitted nematodes			
Ascariasis	*Ascariasis lumbricoides* (roundworm)	807 million	Developing regions of Asia, Africa, and Latin America
Trichuriasis	*Trichuris trichiura* (whipworm)	604 million	Developing regions of Asia, Africa, and Latin America
Hookworm	*Necator americanus; Ancylostoma duodenale*	576 million	Developing regions of Asia, Africa, and Latin America (especially areas of rural poverty)
Strongyloidiasis	*Strongyloides stercoralis* (thread worm)	30–100 million	Developing regions of Asia, Africa, and Latin America (especially areas of rural poverty)
Filarial nematodes			
LF	*Wuchereria bancrofti; Brugia malayi*	120 million	Developing regions of India, Southeast Asia,
Onchocerciasis (river blindness)	*Onchocerca volvulus*	37 million	Sub-Saharan Africa
Loiasis	*Loa loa*	13 million	Sub-Saharan Africa
Dracunculiasis (guinea worm)	*Dracunculus medinensis*	0.01 million	Sub-Saharan Africa
Platyhelminth flukes			
Schistosomiasis	*Schistosoma haematobium;*	207 million	Sub-Saharan Africa
	Schistosoma mansoni;		Sub-Saharan Africa and Eastern Brazil
	Schistosoma japonicum (blood flukes)		China and Southeast Asia
Food-borne trematodiases	*Clonorchis sinensis* (liver fluke); *Opisthorchis viverinni* (liver fluke); *Paragonimus spp.* (lung flukes); *Fasciolopsis buski* (intestinal fluke); *Fasciola hepatica* (intestinal fluke)	>40 million	Developing regions of East Asia
Platyhelminth tapeworms			
Cysticercosis	*Taenia solium* (pork tapeworm)	0.4 million (Latin America only)	Developing regions of Asia, Latin America, and sub-Saharan Africa

Source: Hotez et al., 2008

I.3.2. Transmission and epidemiology

Helminths do not replicate within the human host. This fundamental aspect of helminth biology establishes a set of transmission mechanisms quite different than those for viruses, bacteria, fungi, and protozoa to ensure reproductive success (Hotez et al., 2008).

Infection of individuals with roundworm and whipworm occurs by ingestion of eggs through food, dirty hands or drink contaminated with worm eggs from infected individuals faeces; for hookworm, infection usually occurs when infective larvae in soil contaminated with faeces penetrate the skin commonly though the feet, legs or buttocks (GAHI, 2015). There is no direct person-to-person transmission or infection from fresh faeces because eggs passed in faeces need a period of maturation before the parasite eggs hatch, as infective larvae, in the soil (hookworms) or, after ingestion, in the intestinal tract (*Ascaris lumbricoides* and *Trichuris trichiura*). Infection with STH is associated with poverty, inadequate sanitation and hygiene, and certain behaviours such as defecating in the open (GAHI, 2015; WHO 2011).
People become infected with schistosomes when they come into contact with fresh water that contains parasites. Freshwater snails are intermediate hosts for schistosomes before releasing them into the water (GAHI, 2015). Spread of schistosomiasis is linked to contamination of freshwater sources from infected people urinating in water bodies and defecating in the open. As with STH, the underlying factors are poverty, lack of access to clean water and sanitation, and poor hygiene (GAHI, 2015).

Infection of people with LF occurs when mosquitoes carrying infective-stage larvae bite them. The larvae enter the skin and migrate to the lymphatic system, where they develop into adult worms over a period of 6-12 months. Once they reach adult stage, male and female worms form nests that can produce a lot of larva-stage worms over several years (GAHI, 2015). The larva-stage worms circulate in peripheral blood, from where it can be picked up by biting mosquitoes to continue the transmission cycle. The distribution of LF is strongly related to environmental factors that influence the distribution of mosquito species and is particularly prevalent in areas with hot and humid climates (GAHI, 2015).

To assess the epidemiological situation for helminth infection, prevalence, which is the proportion of persons infected with the helminth in a population (WHO, 2011), is seldom used as the only measure, because morbidity is proportional to the number of worms infecting

the host, known as the worm burden, rather than the absence or presence of infection. Prevalence is commonly combined with worm burden also referred to as the "intensity of infection", which is commonly measured by the number of helminth eggs per gram (EPG) excreted in faeces (WHO, 2012a). Based on EPG and their association with morbidity, individuals are classified into three categories of light intensity, moderate intensity, and heavy intensity infection by the WHO (2012a).

Furthermore, in the case of soil-transmitted helminths, the WHO recommends use of both prevalence and intensity of infection to classify communities into transmission categories category I (high), category II (medium), and category III (low). These transmission categories are assigned according to both the number of heavily infected people in the community using a threshold of 10% (greater or less than 10%) and the prevalence of infection using a threshold of 50% (greater or less than 50%) (Hotez et al., 2008).

Epidemiologically, human helminthiases are characterized by long-term infections with more than one helminth species. This phenomenon, known as polyparasitism, is the result of common features in ecological and environmental requirements, infection routes, host exposures and susceptibility, as well as behavioural, sociological, and economic factors that enable concomitance of numerous parasite-host systems in time and space (WHO, 2012b). A number of epidemiological studies have indicated that individuals infected with multiple species of helminth often harbor heavier infections than individuals infected with a single helminth species (Tchuem Tchuenté et al., 2003).

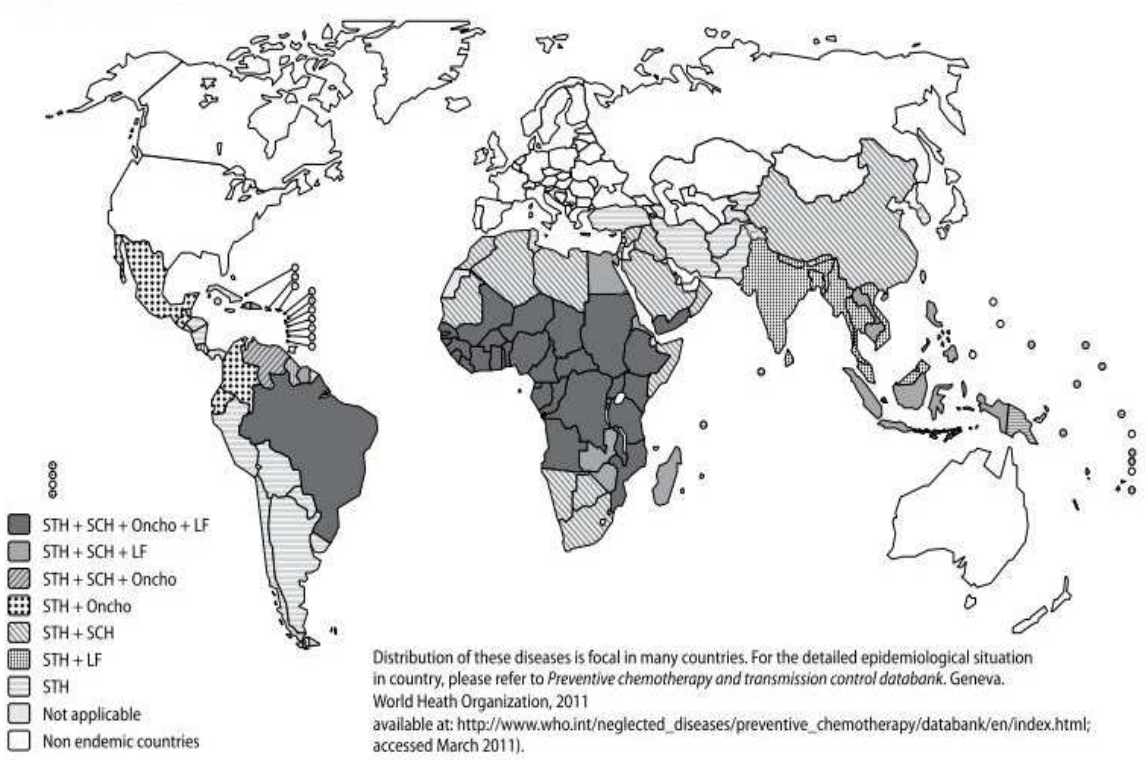

Figure 1: Geographic distribution of co-infections with helminths – lymphatic filariasis (LF), onchocerciasis (Oncho), schistosomiasis (SCH), soil-transmitted helminthiases (STH) – in 2009 (WHO, 2012b).

In the environment helminth infections distribution is dependant of crucial determinants such as climate and topography (Brooker, 2007). Helminths transmitted by vectors are limited to landscapes in which host and vector come in contact, resulting in highly focal distribution. The geographic distribution of schistosomiasis is directly related to the distribution of the appropriate susceptible snail intermediate hosts for the corresponding schistosome species (WHO, 2012b). Soil-transmitted helminths are highly affected by surface temperature (Brooker et al., 2003), altitude, soil type, and rainfall (Kariuki et al., 2004).

Infection prevalence at any time-point may be high and this, reflects a high intensity of transmission, as well as it reflects the long duration of some infections – parasites may have a long life-span, while hosts do not recover clearing immune responses, and are exposed to repeated infection throughout their lives. Further, aggregation of helminth infection, whereby a minority of persons harbours very heavy infection but the majority of the population harbours light or moderate infection, is a major factor to consider in epidemiological studies (WHO, 2012b).

Much epidemiologic research has focused on the influence of age in the intensity of helminth infection. Changes with age in the average intensity of infection tend to rise in childhood and decline in adulthood. In STH infections, the prevalence of disease is directly related to the intensity of infection and is highest in school-age children. However, in the case of hookworm infections, high intensity is generally reached in adulthood (Tchuem Tchuenté et al., 2003), aggravating iron deficiency anaemia in women of reproductive age. High intensity of infection is associated with high morbidity and the risk of severe complications, such as intestinal obstruction. In childhood, hookworm contributes to moderate and severe anaemia in school-aged children, and there is increasing recognition of a similar contribution in pre-school children (Bethony et al., 2006).

Among the biological determinants of persisting infection is the fact that parasite populations are strongly regulated within their hosts-both definitive and intermediate, including vector and snail hosts-which makes them highly stable and resilient to control interventions. Therefore, premature cessation of interventions may lead to re-emergence and eventual restoration of the parasite population to baseline levels (WHO, 2012b). Among the sociological factors contributing to this stability are those that link infection, particularly heavy infection, with chronic and long-lasting morbidity, disability, insidious and irreversible effects on health, poor school performance, impaired ability to work, low economic productivity, and premature death (WHO, 2012b). All this perpetuates the vicious circle that links helminthiases to poverty, lack of sanitation, poor hygiene, and marginalization. All of the above points are changing the learning from single to multi-disease and integrated approaches to the prevention and control of helminth infection (WHO, 2012b).

II-INTERVENTIONS TO REDUCE HELMINTH INFECTIONS

II. INTERVENTIONS TO REDUCE HELMINTH INFECTIONS

The increasing acknowledgement of the burden due to helminthiases, especially since the last quarter of the 20th century, has led to the implementation of large-scale control and elimination programmes (WHO, 2012b) which include partnerships for the control of helminthiases.

II.1. Partnerships for the control of helminthiases

Most of the helminthic diseases result from poverty and contribute to further poverty by, among other factors, impairing agricultural productivity, and effecting negative impacts on cognitive development and education (Hotez, 2009). In response to growing evidence that such neglected tropical diseases devastate the bottom billion of the world population through their effects on health, education, and socioeconomic development, the World Health Assembly (WHA) has adopted several resolutions calling for the control or elimination of these diseases (WHO, 2012b).

The resolutions aimed at the parasites themselves and/or the agents (i.e. vectors and intermediate hosts) responsible for their transmission. In 1974, the World Health Assembly passed resolution WHA27.52 calling upon the World Health Organization (WHO) to intensify research on major parasitic diseases; this led to the creation of the Special Programme for Research and Training in Tropical Diseases (TDR) in 1975, which was sponsored by United Nations Development programme (UNDP), the World Bank and WHO, and later, UNICEF (WHO, 2012b). That year also saw the establishment of the Onchocerciasis Control Programme (OCP) in West Africa. In 1993 and 1995 respectively, the Onchocerciasis Elimination Program for the Americas (OEPA) and the African Programme for Onchocerciasis Control (APOC) were initiated. In 1997, the World Health Assembly (WHA) passed resolution WHA50.29, which urged the WHO and Member States to take advantage of recent advances and opportunities for lymphatic filariasis elimination, and led to the formation of the Global Programme to Eliminate Lymphatic Filariasis (GPELF), consequently launched in 2000 (WHO, 2012b). In 2001, the WHA passed resolution WHA54.19, setting the global target of treating at least 75% of all school-aged children at risk of morbidity from STHs and schistosomiasis by the year 2010. This resolution led to the establishment of Partners for Parasite Control (PPC) by the WHO. More recently, because of the Millennium Development Goals pressure on the global public health community several new initiatives have been established, most notably the Schistosomiasis Control Initiative (SCI) in 2002, and the Global Network for Neglected Tropical Disease

Control (GNNTDC) in 2006 (WHO, 2012b). For the implementation of these resolutions the main intervention used is preventive chemotherapy.

II.2. Chemotherapy for deworming

Anthelmintic is a medicine used to expel helminths in humans. The action of the medicine kills the worms and facilitates their expulsion from the human body (WHO 2012a). Anthelmintic treatment can be distributed using a variety of treatment strategies, depending on the level of infection in a country, the overall aim of the control programme, the population groups which exhibit the highest infection levels, and the relationship between infection and disease consequences for morbidity control (WHO, 2012b). Treatment can be aimed at particular occupational or age groups such as school age children (targeted chemotherapy) most at risk of acquiring heavy infection and severe morbidity (WHO, 2011). This is the basis for school-based health programmes (deworming schools) aimed at deworming children of STHs and schistosomiasis. In this target population, treatment is administered to all eligible individuals regardless of whether or not they are obviously infected (WHO, 2012b).

In areas of substantial infections, community (mass) treatment is recommended. Other strategies include mass screen and treat (MSAT) which is a targeting selective treatment to those with obvious and detectable infection, or treating individual cases in clinical as opposed to community settings (selective chemotherapy) (WHO, 2012b). The adoption of such treatment modalities may also depend on the stage of the control programme, with mass drug administration (MDA) being implemented at its beginning, and selective treatment in the last phases (mopping-up). Those programmes which aim at eliminating the infection reservoir will tend to treat the largest number of people with the highest possible coverage (WHO, 2012b).

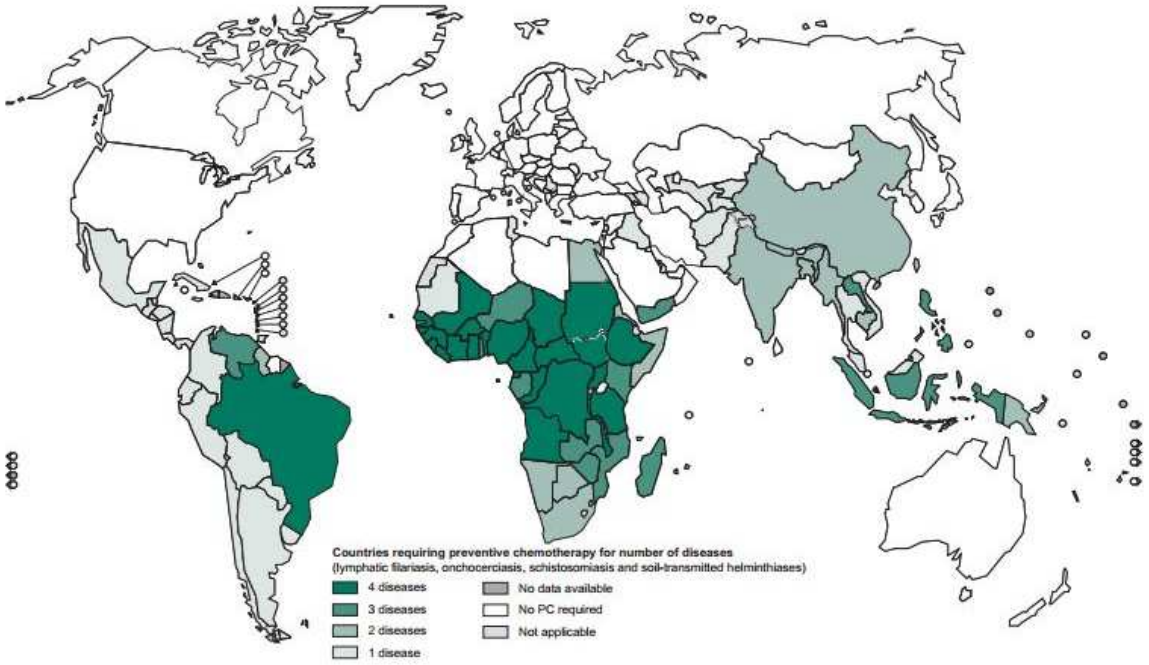

Figure 2: Countries requiring preventive chemotherapy for at least one NTD (lymphatic filariasis, onchocerciasis, schistosomiasis or soil-transmitted helminthiases) and number of those diseases in each country, 2012 (WHO, 2015b).

Although the importance of additional strategies such as raising community recognition and ownership of the diseases present in the community and their associated problems, performing environmental improvement, increasing hygiene practices and access to clean water, and sustaining socioeconomic development, is widely recognized, the main component of helminthiasis control has become the deployment of targeted treatment, or of MDA to the wider community (WHO, 2012b). The anthelmintics involved are in some cases donated by pharmaceutical companies and in other cases are affordable as generic preparations, making the MDA programmes among the most cost-effective global public health control measures. In general, the anthelmintic drugs adopted by the control programmes are safe for mass treatment of human populations and moderately to highly effective (WHO, 2012b).

MDA is being assisted by global partnerships, including the donations of anthelmintic drugs by pharmaceutical companies mentioned above, and donations of funds by foundations, governments, United Nations agencies, companies and individuals (WHO, 2012b). However, it should also be recognized that very little funding is available to support the research that is necessary for interventions to remain sustainable and bring long-lasting benefits.

Unfortunately, much of the effort is, at present, directed at short-term objectives. Mass chemotherapy as a control strategy does also need an optimization of community involvement and participation. Recognition and acceptance by the community, and their commitment to play the role that is expected of them, also pose serious challenges to achieving sustainable control programmes (WHO, 2012b). Other issues include the fact that the available drugs are limited because there is very little or no development of new drugs. This makes the existing control programmes highly vulnerable due to the fact that anthelmintic resistance may develop and spread, as is theoretically likely with MDA programmes (WHO, 2012b).

Table 2 : Major global helminthic disease control initiatives

Disease(s)	Public-private partnership	Major drug or control tool	Target date control by WHA resolution
LF	Global Programme to Eliminate LF (GPELF)	Diethylcarbamazine and albendazole; ivermectin and albendazole	2020
Onchocerciasis	African Programme for Onchocerciasis Control (APOC) Onchocerciasis Elimination Program of the Americas (OEPA)	Ivermectin	2010
Schistosomiasis	Schistosomiasis Control Initiative (SCI) Partnership for Parasite Control (PPC)	Praziquantel	2010
Soil-transmitted helminth infections	Partnership for Parasite Control (PPC) Schistosomiasis Control Initiative (SCI) Human Hookworm Vaccine Initiative (HHVI)	Albendazole or mebendazole	2010
Ascariasis, trichuriasis, hookworm, schistosomiasis, LF, onchocerciasis, and trachoma	Global Network for Neglected Tropical Diseases (GNNTDC)	Ivermectin or diethylcarbamazine; praziquantel; albendazole or mebendazole; and azithromycin	2015

Source: Hotez et al., 2008

Moreover, the long-term control and eradication of these helminth diseases will depend on increased sanitation and hygiene, improved socioeconomic development, and environmental sustainability (WHO, 2012b).

II.3. WASH in schools

WASH in Schools (WinS) aims to improve the health and learning performance of school-aged children and that of their families by reducing the incidence of water and sanitation-related diseases (UNICEF, 2012). Every child friendly school requires appropriate WASH initiatives that keep the school environment clean and free of smells and inhibit the transmission of harmful parasites (UNICEF, 2012). Positive policies are then required at all levels (national, district, local and school) to encourage and facilitate the achievement of appropriate levels of water, sanitation and hygiene in schools (Adams et al., 2009). A supportive policy environment should allow stakeholders at district and school level to establish effective governance and management arrangements in order to plan, fund, implement and coordinate improvements (Adams et al., 2009).

WASH in Schools also focuses on the development of life skills and the mobilization and involvement of parents, communities, governments and institutions to work together to improve hygiene, water and sanitation conditions (UNICEF, 2012). While there are many approaches based on changing cultural, environmental and social realities, any WASH in Schools intervention should include sustainable and safe water supply points, hand-washing stands and sanitation facilities. This intervention should also integrate life skills education focusing on key hygiene behaviours for schoolchildren (see annex 3) and using participatory teaching techniques in order to reach the families and the wider community (UNICEF, 2012). An adequate water supply, sanitation and hygiene in schools is important for many reasons.

II.3.1. Diseases prevention

Diseases related to inadequate water, sanitation and hygiene are a huge burden in developing countries. In rural areas, schools often completely lack drinking-water and sanitation facilities, or have facilities that are inadequate in both quality and quantity. Schools with poor water, sanitation and hygiene conditions, are high-risk environments for children and staff, and increase children's particular susceptibility to environmental health hazards (Adams et al., 2009).

II.3.2. Learning performance

Children's ability to learn may be affected in several ways. Firstly, helminth infections, which affect hundreds of millions of school-age children, can impair children's physical development and reduce their cognitive development, through pain and discomfort, competition for nutrients, anaemia, and damage to tissues and organs. Helminth infections force many schoolchildren to be absent from school. Poor environmental conditions in the classroom can also make both teaching and learning very difficult (Adams et al., 2009).

II.3.3. Gender and disability

Girls and boys, including those with disabilities, are likely to be affected in different ways by inadequate water, sanitation and hygiene conditions in schools, and this may contribute to unequal learning opportunities. For example, lack of adequate, separate private and secure toilets and washing facilities may discourage parents from sending girls to school (Adams et al., 2009). In addition, lack of adequate facilities for menstrual hygiene can contribute to girls missing days at school; this can even lead girls to leave school altogether at puberty. Toilets that are inaccessible often mean that a disabled child does not eat or drink all day to avoid needing the toilet, leading to health problems and eventually to their dropping out of school altogether (Adams et al., 2009).

II.3.4. The community

Children who have adequate water, sanitation and hygiene conditions at school are more able to integrate hygiene education into their daily lives, and can be effective messengers and agents for change in their families and the wider community (Adams et al., 2009). Mutually, communities in which schoolchildren are exposed to disease risk because of inadequate water supply, sanitation and hygiene at school are themselves more at risk. Further, families have to assume the burden of their children's sickness due to bad conditions at school (Adams et al., 2009).

II.3.5. Sustainable skills

The hygiene behaviours that children learn at school made possible through a combination of hygiene education and access to suitable water, sanitation and hygiene facilities are skills that they are likely to maintain as adults and pass on to their own children (Adams et al., 2009).

Many factors and stakeholders are to be considered when speaking about adequate water supply, sanitation and hygiene in schools achievement and maintenance.

II.1. Hygiene behaviours improvement

II.4.1. Enabling adequate facilities

Water and sanitation facilities are used as resources for improved hygiene behaviours. Indeed, good hygiene behaviour and the effectiveness of hygiene promotion in schools are severely limited where water supply and sanitation facilities are inadequate or nonexistent (Adams et al., 2009). Teachers cannot properly transmit the importance of hand washing if there is no water or soap in the school, or promote the proper use of toilets if they themselves avoid their use because the toilets are dirty or unsafe (Adams et al., 2009).

WASH facilities should encourage hygienic behaviours, such as using a toilet, washing hands and collecting water. These hygienic behaviours comprises several small steps and necessary preparations. If the activity is difficult, complex or time-consuming, children will skip some necessary actions, creating potential health risks (UNICEF, 2012). Therefore, facilities must be close to the schools, have sufficient capacity, with enough toilets and sinks for the number of students, be sized appropriately and simple to use, and have water and soap available at all times for hand washing as well as anal cleansing (UNICEF, 2012).

In larger schools, separate toilet facilities should be built for younger children and older children; for girls and boys, particularly adolescents; and for female and male teachers. In small schools, where different age groups use the same facilities, special provisions can be made for smaller children, such as a step in front of a pump or toilet seat, or an additional seat cover with a smaller hole (UNICEF, 2012). Facilities must also provide ways for adolescent girls to dispose of sanitary towels without interruption from young children or boys. Facilities should also stimulate children's learning and development and be age appropriate. Younger children do not possess the same ability to learn complex concepts as older children (UNICEF, 2012). Acknowledging these differences in learning styles is not only important for the development of hygiene education materials, but also for the design of facilities. Interactive learning and playful engagement encourages children to put their new habits into practice. WASH facilities are potential extensions of the learning environment, providing an opportunity for interaction and serving as powerful tools for hygiene education (UNICEF, 2012).

Besides, a successful WASH facility strikes the right balance between cost and quality; low-cost solutions must not compromise quality. The best facilities are affordable, durable and easy to use, maintain and clean. For example, there must be proper drains for excess water at wells and surfaces that come into contact with faeces or urine must be impermeable and easy to clean (UNICEF, 2012). Despite higher initial investment costs, these facilities will have longer life spans, require less maintenance, and promote better health, saving money in the long term. A well-designed facility also requires an operation and maintenance plan so that it does not swiftly deteriorate. A good operation and maintenance plan will identify who is responsible for cleaning and maintaining the facility and what costs are involved. The plan should be developed and agreed upon before the facilities are completed (UNICEF, 2012).

Overall, it is important to achieve a balance between hygiene education and ensuring that environmental health conditions are enabling and acceptable. Both education and the appropriate conditions are needed for effective health promotion (Adams et al., 2009).

II.4.2. Hygiene education

Correct use and maintenance of water and sanitation facilities is ensured through sustained hygiene promotion (Adams et al., 2009). Good education about hygiene is as important as good sanitary facilities because hygiene education allows children to learn about water and sanitation related behaviours and the reasons why these lead to good health or bad health (UNICEF, 2012). The idea is that when children understand and think together about their situations and practices, they can plan and act to prevent diseases, now and in the future (UNICEF, 2012). Therefore, hygiene education should be a core part of teacher training and refresher training should be carried out regularly to sustain knowledge and awareness (Adams et al., 2009).

However, effective hygiene education for children is not just teaching facts about health risks and bad hygiene practices. The life skills approach focuses on changing children's hygiene behaviour and the hygiene behaviour of their families and wider community with a view to improving their quality of life (UNICEF, 2012). To ensure that all aspects of appropriate hygiene behaviours are addressed, hygiene education focuses on the development of children knowledge and understanding of practical and theoretical information on hygiene that can allow them to act suitably when facing unhygienic situations (UNICEF, 2012). It is also good to notice that teaching hygiene behaviour is most successful when it focuses on a limited number of behaviours with the biggest overall health impact. Changing a single behaviour can make an enormous difference. Hygiene behaviours improvement may be promoted for example using

the sanitation and hygiene-related F-diagram (see annex 4) that shows the path by which germs can spread from person to person (UNICEF, 2012).

One of the most important hygiene behaviours to promote among schoolchildren is hand washing with water and soap (or ash) at least before eating and after using the toilet. As with other hygiene behaviours, such as correct use of toilets, this often requires helping younger schoolchildren and monitoring older ones to ensure that they correctly perform the activity (Adams et al., 2009).

Table 3 : Teaching methods that can be used for hygiene education

Methods suitable for children aged 6–8 years	Methods suitable for children aged 8–11 years	Methods suitable for children aged 12–15 years
Listening to, reading and telling stories; Reciting poems and singing songs; Performing drama/short role plays; Watching and participating in various types of puppet plays; Simple sorting games; Language and number games and assignments; Walks, simple observations; Skills demonstrations with peer observation and analysis; Movement games, competitions; Conversations and discussions; Drawing, painting, coloring, playing with clay; Doing simple hygiene tasks; Presentation to parents and family members.	Listening to, reading and analyzing, and telling stories; Quizzes; Conversations and discussions; Singing and dancing; Drawing and painting; Making various types of models; Compositions and creative writing; Brainstorming; Excursions; Performing dramas, role playing, pantomime, skills demonstrations; Peer observations and analysis; Language and maths games, such as crosswords; Competitions.	Listening to, reading and telling stories; Analyzing and writing stories; Group and class discussions; Singing and dancing; Drawing and painting; Brainstorming; Performing dramas, role playing, pantomime, skills demonstrations; Peer and family members' observations and analysis of behaviour; School/community observation and mapping or excursions; Language and maths games, quizzes and puzzles; Competitions; Doing hygiene tasks with an educational purpose such as helping younger children visit toilets and wash hands.

Source: UNICEF, 2012

II.4.3. Child participation

Child participation is a precondition for the success of any WASH in Schools intervention. Generally teachers in primary and secondary school have been trained in traditional classroom teaching approaches, in which there is little place for active participation by the students (UNICEF, 2012).

While class instruction has its place, children greatly enjoy and benefit from more participatory learning methods. These methods actively involve children in the learning process and allow them to learn from their actions and their classmates (UNICEF, 2012). Developing appropriate hygiene behavior is greatly enhanced by allowing children to fully participate. In this context, child participation can be achieved in two ways:

Firstly, through participatory teaching methods used by teachers or through special hygiene teachers in school, during school hours as part of the regular curriculum. This approach is generally more sustainable (UNICEF, 2012).

Secondly, through special youth hygiene clubs within and outside the school. Not part of the official curriculum, these clubs depend more on the motivation and enthusiasm of individuals and are thus less sustainable (UNICEF, 2012).

School children should comply with procedures for use and care of water, sanitation and hygiene enabling facilities and observe appropriate hygiene measures. They should also participate in the design and construction process and play an active role in the cleaning and maintenance of facilities (Adams et al., 2009).

II.4.4. Community commitment

Parents and community members can have important roles in keeping the school clean, safe and healthy, and encouraging children to adopt improved hygienic behaviours. Schoolchildren's families should encourage children to comply with procedures for use and care of water, sanitation and hygiene-enabling facilities at school, and develop positive hygiene behaviours (Adams et al., 2009). In addition, parental and community involvement ensures that what is learned in school is applied at home, particularly for younger children who are not in a position to change hygienic behaviours in their homes without their parents commitment (UNICEF, 2012). Therefore, it is imperative to educate all family members on the adoption of appropriate hygiene skills and get the surrounding community involved in programmes for hygiene, sanitation and water in schools (UNICEF, 2012).. To avoid confusion, the initiative should involve parents in the content of the hygiene education for their young children and urge them to reinforce the learned behaviours at home. This is especially important so the content matches up the community rules and avoids cultural taboos (UNICEF, 2012).

Depending on the characteristics of the targeted community (i.e. urban-rural, ethnic groups, social classes) and the available budget, several options for hygiene promotion activities exist. The main hygiene promotion options for parents and community are: hygiene education, mass media campaigns such as Global Hand washing Day, child-led education of their families and peers, participatory hygiene promotion such as Participatory Hygiene and Sanitation Transformation (PHAST) (see annex 2 for details on PHAST) or Community-led Total Sanitation and social marketing (UNICEF, 2012).

II.4.5. School staff participation

For WASH in Schools programmes to be sustainable and successful the involvement of teachers and school managers is required (UNICEF, 2012). Most schools have some type of health or hygiene education as part of their regular curriculum and teachers have been trained in those programmes. Developments should build upon the knowledge that exists. An important focus of teacher training should be attitude change towards WASH in Schools (UNICEF, 2012). Many children learn some of their most important hygiene skills at school, and for many this is where they are introduced to hygiene practices that may not be promoted or possible at home (Adams et al., 2009). Teachers can be effective advocates for hygiene, through hygiene education and through acting as models for schoolchildren. Contacts between the school and homes should also be used to link hygiene promotion at school and at home. That can be possible through parent-teacher meetings for example (Adams et al., 2009).

Further, hygiene education should be integrated into the school curriculum and combine basic education skills such as reading and writing using a methodology adapted to the local culture and socioeconomic circumstances and that focuses on gender equity in order to reach out to homes and communities (UNICEF, 2012). For that it is necessary to be sure that there is enough reasonably priced teaching material for all teachers and students and conditions, practices and progress should be monitored and evaluated. It is also good to practice learning in school and base education on real hygiene needs and priorities of the communities in which the children live and also to adjust education to the child development phase and age group (UNICEF, 2012).

II.4.6. Local authorities and health sector

Sustainable WASH in Schools programmes require the involvement and political leadership of ministries of education as well as related ministries such as health, local governance and water authorities (UNICEF, 2012).

Therefore, local authorities should provide resources and direction for setting, achieving and maintaining targets at school level and advocate at district or national level for adequate resources, coordinate with local environmental health services, public works departments and so on to ensure that sufficient technical support is provided (Adams et al., 2009). They should also monitor implementation of water, sanitation and hygiene guidelines in schools as part of the routine monitoring and inspection process and provide training to teachers, school directors and other school staff (Adams et al., 2009).

In addition, to support local authorities for sustainable WASH in schools interventions, health sector should provide guidance on the environmental health aspects of school design, construction and maintenance as well as they should monitor environmental health conditions and child health (Adams et al., 2009). They should also provide selected health services such as micronutrient supplements, treatments for helminth infections, hygiene promotion, vaccination campaigns or health inspections and provide training and advice for teachers, schoolchildren and parents on water, sanitation and hygiene (Adams et al., 2009).

II.4.7. Monitoring

Maintaining acceptable conditions requires ongoing efforts at all levels including the school health committee or equivalent body that should ensure regular monitoring of water, sanitation and hygiene conditions (Adams et al., 2009). The local environmental health authority should also be a major partner, providing expert monitoring and advice. For that, schools could be included in regular water-quality surveillance and control programmes for example (Adams et al., 2009).

A monitoring system should use a limited set of indicators that can be easily and regularly measured, to identify problems and correct them in a timely way (Adams et al., 2009). For example, water shortages at hand washing points may be monitored by teachers or schoolchildren according to an organized schedule, so that action can be taken immediately if there is a problem. If the school is connected to the local water distribution system, the

frequency and duration of water shortages may also be recorded, so that the reliability of the water supply can be measured over time (Adams et al., 2009).

Forms for record keeping may be developed at school level or district or national level through the education management information system for standardized monitoring reports, to allow data from all schools to be collated and compared (Adams et al., 2009). This can be useful while taking actions to improve WASH in schools.

II.2. WASH in schools advancement

Globally, 69% and 66% of schools have access to adequate water and sanitation, respectively. In least developed countries 51% and 47% of schools have respectively access to adequate water and sanitation while in developing countries 89% and 90% of schools have access to adequate water and sanitation respectively. Based on these data WASH in schools needs impetus in least developed countries (UNICEF, 2015).

II.3.1. Drinking water coverage in schools

Based on 149 countries, the global average for reported water coverage in schools was 71 per cent in 2013; a 6 per cent increase from 2008. Not surprisingly, coverage is lower in least developed countries: 43 per cent in 2008, increasing to 52 per cent in 2013. Regionally, Western Asia has the highest school water coverage, while sub-Saharan Africa has the lowest (UNICEF, 2015). Based on the available data, the greatest regional progress appears to be in Eastern Asia, South-Eastern Asia and Northern Africa, each of which achieved a 15-percentage point increase over five years. However, data quality issues associated with these estimates may limit cross regional comparison (UNICEF, 2015).

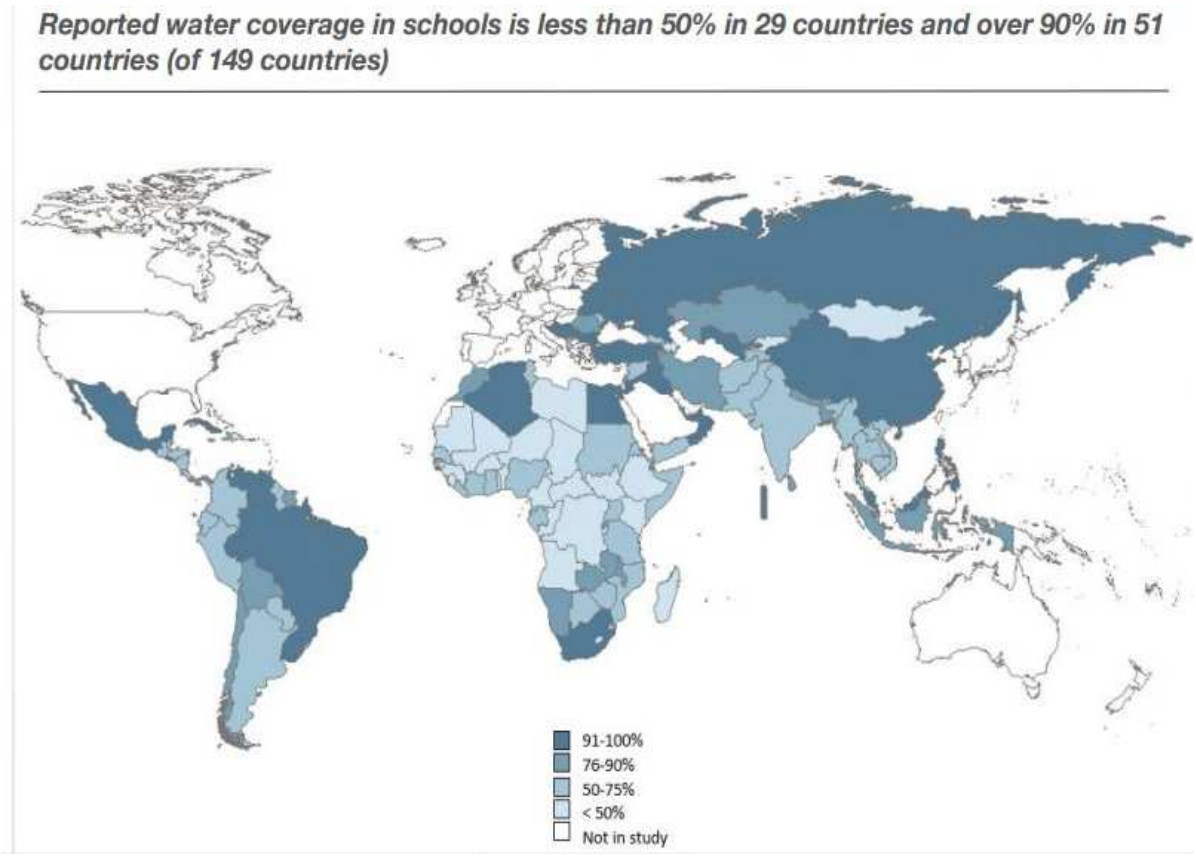

Figure 3: National school water coverage estimates (UNICEF, 2015)

II.5.2. Sanitation coverage in schools

The global average for school sanitation coverage is slightly lower than water coverage. It was 63 per cent in 2008 and 69 per cent in 2013. For least developed countries, the average proportion of schools with adequate sanitation rose 9 percentage points over the five-year period: from 42 per cent in 2008 to 51 per cent in 2013 (UNICEF, 2015). As with school water coverage, school sanitation coverage is highest in Western Asia and lowest in sub-Saharan Africa. The largest reported increase in coverage was in South Asia, with an increase of 21 percentage points from 2008 to 2013. Although data quality limits cross-regional comparison, there does appear to have been great improvements in South Asia. (UNICEF, 2015).

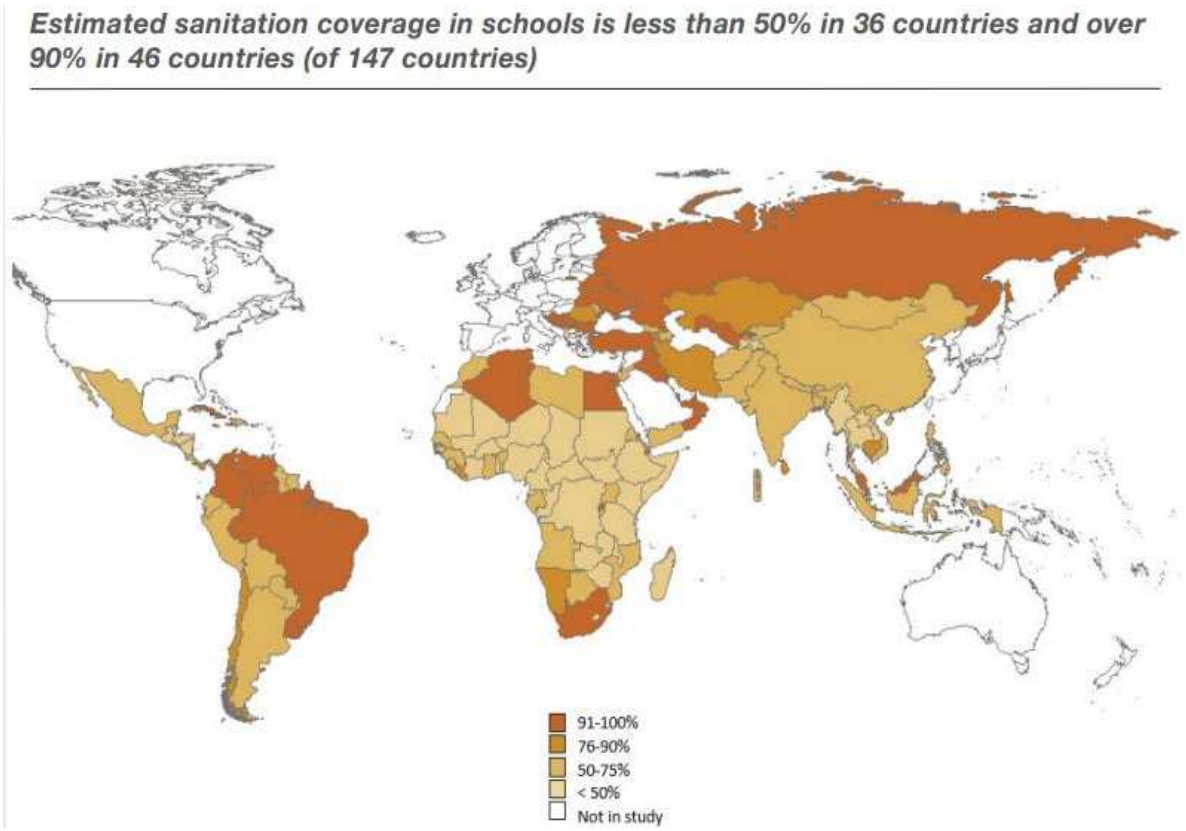

Figure 4: National school sanitation coverage estimates (UNICEF, 2015)

II.5.3. Hygiene in schools

Despite the considerable benefits of hand washing with soap, hand washing and other hygiene related indicators are rarely tracked at schools. According to UNICEF (2015), data regarding school hand-washing facilities, recorded during a study on 149 countries, were available for only 11. Available data sources are typically small-scale studies (national-level data are available for only four of the eleven countries) (UNICEF, 2015).

Of the 11 countries for which data is available, four report on the availability of hand-washing facilities and soap (Angola, Malawi, Tanzania and Uganda), five provide data on hand-washing facilities only (Afghanistan, Burundi, Costa Rica, India and Rwanda) and two do not provide details on the hand-washing indicator used during data collection (Botswana and Ethiopia) (UNICEF, 2015).

To suitably fight against helminthiases using WASH improvements, we should know where to direct actions and efforts by knowing the linkages between these infections and WASH.

III-WASH AND HELMINTH INFECTIONS

III. WASH AND HELMINTH INFECTIONS

The burden of NTDs is strongly influenced by environmental determinants of health, especially water, sanitation and hygiene. The growing political will to tackle the water and sanitation global crisis has not been set to address NTDs, even while health concerns (notably reduction of diarrhoeal disease) have been a central driver of action. In this context, the NTDs remain truly neglected, including by the WASH community and public health professionals promoting primary prevention (WHO, 2015b).

However, WHO recommends nowadays five public-health interventions to accelerate the prevention, control, elimination and eradication of NTDs. These interventions are innovative and intensified disease management, preventive chemotherapy, vector control and pesticide management, zoonotic disease management and safe drinking-water, basic sanitation hygiene services. Water, sanitation and hygiene are critical in the prevention and care for all of the neglected tropical diseases scheduled for intensified control or elimination by 2020 (WHO, 2015c).

In addition, NTD-related chronic conditions can also be exacerbated by lack of sufficient water for hygiene purposes. Those suffering from conditions caused by lymphatic filariasis, such as lymphoedema or elephantiasis, require large amounts of water to be able to wash affected limbs in order to reduce the severity of the disease and associated disability. The stigmatization and financial hardship experienced by sick persons means also that they are more likely to be excluded from access to water and sanitation services (WHO, 2015b).

III.1. Major helminthiases linkages with WASH

Foodborne trematodiases: the eggs of liver, lung and intestinal flukes are released with faeces into open water and are ingested by aquatic snails. Human infection occurs when secondary intermediate hosts (fish, crustaceans, molluscs or aquatic plants) are eaten raw. Required interventions are prevention of faecal contamination of freshwater bodies due to lack of sanitation or poor hygiene behaviour, and improving cooking habits (WHO, 2015b).

Lymphatic filariasis: the *Culex* vectors prefer breeding in organically polluted water as well as in faecal matter found in poorly constructed pit latrines. Necessary interventions include construction, maintenance and management including pit emptying and disposal of improved

latrines, infrastructure upgrading and mosquito proofing of existing systems for wastewater management. For morbidity management an access to sufficient clean water is needed to practise hygiene behaviours such as limb washing in order to reduce the severity of disease symptoms (WHO, 2015b).

Schistosomiasis: the infection occurs via eggs of worms in human faeces and urine deposited in water where emerging larvae enter freshwater snails. After development in snail, larvae forms emerge in water and penetrate skin during contact with infested water. Control measures include snail control, improved sanitation and health education and reduced contact with surface water (WHO, 2015b). This is probably the most researched disease in terms of environmental management interventions, including the provision of sanitation facilities to prevent contamination of open waters, hydraulic infrastructures and water management to eliminate snail intermediate hosts, and the provision of safe recreational waters such as swimming pools, and efforts to induce behavioural change both in terms of proper use of sanitation and avoiding contact with contaminated water (WHO, 2015b). The lessons learned indicate that none of these measures by itself will lead to sustained success, just like case detection and treatment programmes will remain without an end-point, as long as the environment and social risk factors are not tackled. Dealing with the environmental factors effectively is often economically not feasible, while lasting behavioural change has proved hard to achieve. Yet, applying a combination of measures in an intersectoral context has shown to produce lasting results in specific settings (WHO, 2015b).

Soil-transmitted helminthiases (ascariasis, hookworm, trichuriasis): the eggs are ingested through contaminated vegetables or water, or directly by children placing soil in mouth; hookworm larvae penetrate skin when walking without shoes on contaminated soil (no direct person-to-person transmission) (WHO, 2015b). Prevention requires improved sanitation and hygiene (hand-washing). Of all the NTDs, this group of infections will benefit the most from the elimination of open defecation and safe management of excreta, and transmission risks reduction will translate into improved nutritional status, increased productivity, enhanced learning capacity and reduced costs for the health sector (WHO, 2015b). The other area where WASH can contribute to the reduction of helminthiases is in the promotion of safe use of wastewater in agriculture and aquaculture. An increasingly important practice around urban centers in water-scarce parts of the world, WHO guidance on safe use practices aims to protect

agricultural workers, peri-urban communities involved in wastewater-supported agriculture and the consumers of their produce (WHO, 2015b).

Onchocerciasis: this infection also called river blindness, is caused by infection with a filarial nematode (*Onchocerca volvulus*) transmitted by infected blackflies (*Simulium spp.*) that breed in fast-flowing rivers and streams. The adult worms produce embryonic microfilariae that migrate to the skin, eyes and other organs. Microfilariae cause severe itching, disfiguring skin disease and may enter the eye, causing visual loss and blindness over time (WHO, 2015b).

Taeniasis/cysticercosis: it is a parasitic zoonosis caused by the tapeworm *Taenia solium.* Humans get infected by eating raw or undercooked pork. Millions of tapeworm eggs (invisible to the naked eye) are excreted into the environment through infected people's stool. Pigs become infected by eating human stool containing eggs or by ingesting eggs from the environment. Eggs develop into small cysts throughout the pig's body (porcine cysticercosis) (WHO, 2015b).

Humans can also become infected with *T. solium* eggs by ingesting contaminated food or water (human cysticercosis) or as a result of poor hygiene. Tapeworm larvae (cysticerci) develop in the muscles, skin, eyes and the central nervous system. When cysts develop in the brain, neurocysticercosis may result. Symptoms include epilepsy, severe headache and blindness, and can be fatal. Neurocysticercosis is the most frequent preventable cause of epilepsy worldwide (WHO, 2015b).

III.2. WASH strategy for accelerated and sustainable progress on NTDs

Providing safe water, sanitation and hygiene is one of the five key interventions within the global NTD roadmap. This strategy aims to mobilize WASH and NTD actors to work together towards the roadmap targets. It calls on WASH actors (funders and workers) to target NTD endemic areas and deliver efficient programmes that maximize the impact of WASH interventions for NTD control and elimination (WHO, 2015c). Indeed, a joint approach that addresses the causes of NTDs is likely to be more cost effective over the long term and more sustainable. It will also ensure that investments in WASH reach those most in need. Beyond the objectives of each sector, collaboration can also serve to achieve common goals such as health and well-being, equity and shared prosperity, and sustainability. The reason why collaboration is needed is clear (WHO, 2015c). The challenge now is to favor and maintain a strong working

relationship between the sectors that benefits from WASH actors practical knowledge and to refine that knowledge for better use in NTD control and elimination. Although integration is referenced in existing NTD plans and strategies, these rarely offer specific guidance on the way in which collaboration between WASH and NTD stakeholders can be strengthened and there are no monitoring mechanisms that tracks and incites collaboration (WHO, 2015c). WHO works closely with both sectors and is well placed to assemble WASH and NTD actors and provide evidence-based guidance on effective collaborative measures so that common goals may be achieved through joint planning, implementation, and evaluation of activities across WASH and NTD sectors and programmes (WHO, 2015c).

This strategy comes at an opportune moment, as the global community shifts its outlook towards an agenda of international Sustainable Development Goals (SDGs) of shared prosperity and equity. The WASH sector is focused on the SDG target of universal access to basic WASH in communities, schools and healthcare facilities by 2030 (WHO, 2015c). Achieving universal access requires a focus on the poorest and hardest to reach. These are often the same groups most affected by NTDs. Yet the target date for the NTD roadmap is 2020, ten years sooner than WASH, adding impulse to the need for WASH progress for the most vulnerable (WHO, 2015c). Progress or lack of progress on certain NTDs can therefore serve as a proxy for equity and effective targeting of WASH programmes. The strategy also contributes to global efforts to strengthen health systems, achieve universal health coverage, address the social determinants of health and ensure equitable access to resources and services that contribute to human development (WHO, 2015c).

III.3. Case study

This case study presents a School Sanitation and Hygiene Education (SSHE) experience in the Ganzourgou province in Burkina Faso and was abstracted from: Snel, M. (2004), “The Worth of School Sanitation and Hygiene Education (SSHE)”.

Initiated by the Ministry of Basic Education and Literacy, this pilot project was implemented in 26 schools. Schools were equipped with water and sanitation facilities, while capacity building and training of teachers, children and communities resulted in change of behaviour and improved living environments.

III.3.1. Objectives and implementation strategy

The main objective of the project was to bring about a noticeable improvement in the children's and the teacher's living environment, as well as better school results, while at the same time achieving greater involvement of the community in school activities. Some of the specific objectives were to:

- ✓ Improve basic health, hygiene, and sanitation conditions in the selected schools.
- ✓ Revise school curricula with the aim of integrating a life skills-based health education component.
- ✓ Strengthen capacities of educators and pupils regarding hygiene and sanitation.
- ✓ Involve families so that they will also adopt hygienic behaviours leading to improved health and living environments.

CREPA (Regional Centre for Low Cost Safe Water and Sanitation), which was in charge of the technical support of the Ganzourgou project submitted an action plan with interventions including construction of water storage tanks for drinking water and sanitation, capacity building (training), and monitoring of activities implementation.

III.3.2. Results of the project

Facilities

No behavioural changes in the field of hygiene and sanitation can occur unless safe water sources and adequate sanitary facilities are enable. To meet these practical preconditions, without which implementing action plans would be pointless, the following facilities have been built in each school:

- ➢ Water points: With UNICEF's financial aid, all schools apart of five schools were equipped with a tube well. The five schools left out were close to a village water point (situated at less than 500 m).
- ➢ School latrines: each school was provided with two latrine blocks, one for girls and the other for boys, taking into consideration the physical and cultural needs of girls, who may refuse to use the facilities if they are not separate. Special provisions for menstrual hygiene were not made, as the children are still too young. Teacher's latrines were located on their nearby premises.

- Handwashing facilities: using the latrines implies several actions such as cleansing and handling various materials. As the children are small, and likely to be in contact with faeces, each latrine block were equipped with facilities for hand washing after using the latrines.

- Drinking water posts: drinking water devices have been placed in the classrooms to allow children to drink if they are thirsty. They will also enable children to acquire certain skills such as filling up the container, handling the faucet and cleaning the container.

At the school level

Water and sanitation facilities can only be effective and bring a better living environment if they are properly maintained and regularly used. To assist children and parents in charge of maintenance, a team of female health technicians visit the villages across the project area.

- According to a timetable established jointly with the teachers, the health technicians helped the children of each school to set up a School Health Committee. The pupils in this committee are taught how to co-ordinate water, hygiene, and sanitation management activities and are given the responsibility of these tasks. The monitoring and self-monitoring activities carried out within the school framework will contribute to improve the environment, as well as personal and dress hygiene. Considering the young age of the children, each committee was assisted by two parents and supported by a master educator.

- Posters are hung in the classrooms, depicting examples of personal hygiene, hand washing and cleaning of the school premises. These pictures are not just there for decorative purposes, they are teaching aids providing practical illustrations of hygienic behaviour designed to encourage pupils to do the same.

- A cleanliness competition and a drawing contest on the hygiene and sanitation theme were held to stimulate teachers and pupils efforts towards better hygiene and cleanliness. The cleanest schools and the most dedicated teachers were rewarded, and the children who made the best drawings also received a prize.

At the community level

- The community constitutes the children's living environment. Conditions in the villages should not be out of step with conditions created by the SSHE project. Teachers and health technicians helped to set up Community Health Committees in each village. Having received appropriate training and information on water and sanitation-related diseases, these committees serve as a relay station, disseminating health messages in the community, so that the lessons learned in school can be backed up by the parents at the family level.

- To ensure that children can keep up the hygiene practices acquired in school, parents were supported financially to build family latrines. Local masons were trained to take into account the needs of the households on the one hand, and the constraints of the chosen building technology on the other hand. Five hundred latrines were to be built in the 26 selected villages.

III.3.3. Strengths of the project

The project was implemented under Ministry of Basic Education and Literacy supervision. This will make it easier to advocate the extension of the project with decision makers and the outlook is promising.

The action plans developed by the teachers are carried out as far as possible, indicating the commitment of the main school actors to the SSHE project. What is more, working with clean children is a decided advantage.

Pupils and teachers drew up hygiene and sanitation promotion messages in a participatory manner. They put these messages themselves on the latrine entrances and on the hand washing facilities.

The drawing contest generated a colorful collection of children's illustrations that can be used for making a calendar.

Personal and dress hygiene have been considerably improved, as children supervise each other. Wearing shoes is slowly becoming a common practice.

Providing a school with a water point can be a benefit for the whole village. In some communities, the first water point they had was the one constructed in the SSHE project context.

The documentary film that was made of the project will provide useful information for those who want to initiate a similar project in their community.

Point of views on the project (from a pupil and a teacher from the same school)

Pupil (Issaka Kabore from the Tinsobdogo school)

Before the project came to our school, the pupils didn't have a plan for cleaning up the classrooms and the schoolyard. Our teachers did it, but it wasn't organised.
The old latrines were badly maintain and very dirty. The doors didn't close, so the villagers and even unknown passers-by used them. Nobody wanted to get inside the latrines anymore, so the children defecated around them. There were no containers/canaris for drinking water in the classrooms.
Since the project started in our school last year, there have been many changes. With the health clubs we learned how to clean, how to use the latrines properly and maintain them, we have drinking water in the classrooms and our environment and our health has improved.

Teacher (Serge Nikiema, in charge of the second grade)

Before the SSHE project in our school, we tried as best we could to keep the classrooms and the schoolyard clean, but with the children, it isn't easy, especially with the little ones. The latrines were very dirty and disused. The fact that there was no water point on the premises didn't make things easier.
But since the project activities were launched, and with the support of the health technicians, so many things have changed in the school. You can see it in the classrooms, now we have drinking water devices, posters, and a chart for garbage disposal.
The latrines have also much improved: they are used and maintained properly; the hand washing facility is always filled with water so that children can wash their hands after using the latrines. What is more, the school has been equipped with a well, which is a great help.
I'm extremely pleased with the project, and I think we will continue and maintain what we have learned and acquired.

III.3.4. Weaknesses of the project

The implementation of the planned activities was behind schedule. The time allocated to monitoring was too short, due to holiday in June during which the school is closed.
All the water points in the schools are also used by the communities. This makes it difficult to apply the hygiene rules learned by the children.

Some activities, such as planting trees, are difficult to carry out for small children. Buckets of water for example, necessary for watering the young trees, are too heavy for them to carry. That is why two parents, either from the Parent Teacher Association or the Helping Mothers Association, have been transferred to the School Health Committee.

The presence of stray animals hampers the reforestation process.

The planned consultations between all stakeholders with the aim of setting up a data bank did not succeed. Only one party involved showed up regularly at the meetings to discuss the proposed activities.

Transferring benefits from the school to the community is also slightly behind schedule.

Some of the teachers were not very motivated, especially those whom status as state-employed teachers has not yet been clarified.

Active involvement of Parent Teacher Associations in school matters was poor. The Mothers association showed more commitment.

CONCLUSION AND PROSPECTS

Helminth infections impose a great burden on poor populations in the developing world. Preventive chemotherapy, is generally used as a public health tool to fight against helminth infections and then ameliorate the living conditions of affected people (WHO, 2006). This frequent use of preventive chemotherapy against helminth infections is due to the fact that anthelminthic medicines are available at low cost or are donated (WHO, 2012a; WHO, 2015b). However, the emergence of drug resistance in human helminthiasis is not yet proven, but drug resistance should be suspected if high coverage, high frequency anthelminthic treatment is found to have less than the expected effect on the target helminths. Hookworms are known to be at higher risk than other helminths for developing drug resistance (WHO, 2006). Preventive chemotherapy represents surely a cost-effective and easy to implement short to medium term strategy for eliminating morbidity associated with STH for instance which is one of the main helminth infections but improved access to sanitation is a long-term strategy towards the same goal (WHO, 2012a).

Consequently, new means including WASH are needed to effectively counter helminth infections. Ideally, an effective and efficient sanitation infrastructure would interrupt transmission of STH and hold up the development of morbidity (WHO, 2012a). Nowadays in addition to interventions like deworming schools (chemotherapy) which target school age children (high risk group) WASH in schools is also promoted. It involves many stakeholders and is not very easy to implement but represents a way to sustain helminth infections control by helping schools to become child friendly schools. Child friendly schools are safe and protective places that offer potable drinking water, hand-washing facilities, and clean, safe and gender-appropriate toilets. In child-friendly schools, children also learn about hygiene and how to protect themselves and their families from infectious diseases (UNICEF, 2012). This is crucial especially because WASH in schools lacks attention despite its impact on children's health, school attendance, particularly for girls, and its contribution to fostering lifelong healthy hygiene habits (GLAAS, 2014). Several actions should then be implemented to promote and/or to maintain child friendly schools. This may be possible for example by setting monitoring systems or reinforcing those that are already existing in school in order to register data on WASH in schools. In addition, clear standards and definitions can be set for similar data collection during monitoring process in order to have results that allow to report regularly on global or regional WASH in schools coverage trends and also to promote access to WinS.

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ANNEXES

Annex 1: 10 facts on tackling neglected tropical diseases with water, sanitation and hygiene

1. NTDs and access to water and sanitation are major global challenges

2. NTDs and poor WASH conditions contribute to poverty

3. Facial cleanliness and environmental improvement are key to eliminating trachoma

4. Sanitation prevents soil transmitted helminth infections

5. Breeding sites for mosquitoes are reduced through improved sanitation and water management

6. Freshwater protection from contamination reduces schistosomiasis

7. Safe water is essential to treat and care for NTDs

8. WASH improves the quality of life for people affected by NTDs

9. Progress on NTDs can be an indicator of access to WASH services

10. Closer collaboration between WASH and NTD can greatly improve the lives of populations affected by NTDs

Source: WHO, http://www.who.int/features/factfiles/wash-ntds/facts/en/ retrieved on 24/10/2015

Annex 2: PHAST in communities

It is difficult to change behaviour. Change best occurs through the use of participatory methods. Such methods enhance self-discovery and ownership in planning for improvements. They have been proven successful when traditional teaching strategies have failed. They are based on human behavioural science, adult education and field testing.

Field experience has shown that participatory methods can lead to far more rewarding experiences for the hygiene educator or health worker. Case studies have illustrated that once participatory methods are tried, they are found to be worthwhile and teachers and students do not want to return to earlier methods.

Developed by WHO in the early 1990s, PHAST is an approach that promotes hygiene, sanitation and community management of water and sanitation facilities. It is an adaptation of the Self-esteem, Associative strength, Resourcefulness, Action planning and Responsibility (SARAR) methodology of participatory learning, which builds on people's innate ability to address and resolve their own problems. It aims to empower communities to manage their water and to control sanitation-related diseases, and it does so by promoting health awareness and understanding, which in turn, leads to environmental and behavioural improvements.

PHAST uses methods and materials that encourage the participation of women, men and children in the development process. It relies heavily on the training of extension workers and the development of graphic arts materials (in sets that are called 'tools kits'), which are adapted to reflect the cultural and physical characteristics of communities in a particular area. The production of PHAST materials requires trained artists and trained extension workers.

Source: UNICEF, 2012

Annex 3: Key hygiene behaviours for schoolchildren

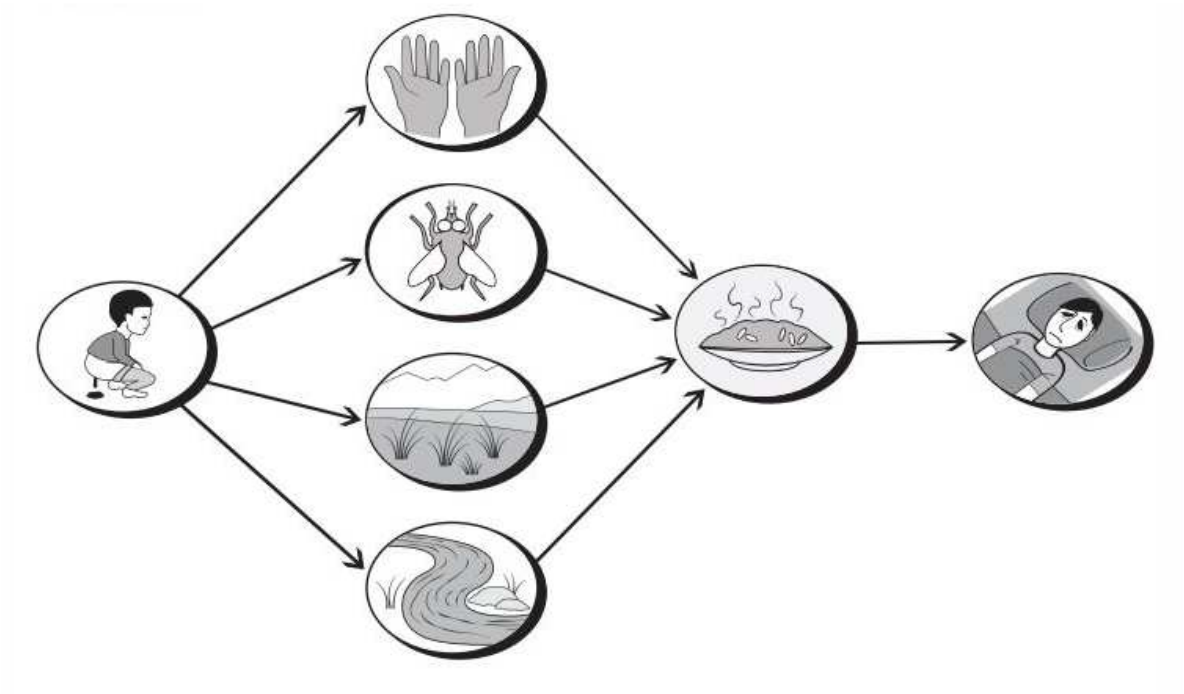
Learning goals for life skills to be developed

	Knowledge	Attitudes	Practices
Safe use of toilets and urinals: Diarrhoea and worm infections are two main health concerns that affect people on a large scale and can be improved through appropriate toilet and urinal use.	Exposed excreta are the leading cause of spreading diseases and making people sick. Behaviours can lead to worm infections	Children recognize the importance of safe use of toilets and urinals, including the safe disposal of faeces and hygienic anal cleansing followed by washing hands with soap.	Children practice the safe use of toilets and urinals, including the safe disposal of faeces and hygienic anal cleansing followed by washing hands with soap. Depending on age, children maintain and operate school toilets and urinals.
Personal hygiene: Many diseases can be attributed to poor personal hygiene.	Personal hygiene impacts diseases	Children understand appropriate personal hygiene: washing hands with soap (*see separate point)*, wearing shoes or slippers, cutting nails, brushing teeth, combing hair and the regular washing of body and hair.	At all times, children wash hands with soap, wear shoes or slippers, cut nails, brush teeth, comb hair and regularly wash the body and hair.
Hand washing with soap: Hand washing at critical moments reduces the risk of diarrhoeal diseases by 42-48 per cent and significantly reduces the incidence of acute respiratory diseases.	Hand washing with soap drastically reduces diarrhoeal diseases and acute respiratory diseases.	Children understand the importance of hand washing with soap after toilet use, before and after eating, before preparing food and after cleaning babies.	Hands are washed with soap after toilet use, before and after eating, before preparing food and after cleaning babies.
Female and male hygiene (for adolescents): Genital and menstrual hygiene is important for the health condition of women and reproductive health in general.	Menstrual blood is not dirty, unhygienic or unclean. It is simply blood and tissue sloughed from the lining of the uterus. The odour during menstruation is caused by bad hygiene of the genitals. The symptoms of bladder and kidney infections must be recognized and treated.	Both men and women see the importance of washing the genitals daily with mild soap and water. During menstruation, women use sterile pads and wipe genitals from front to back after defecation.	Both men and women wash the genitals daily with mild soap and water. During menstruation, women use sterile pads and wipe genitals from front to back after defecation.

Waste management and water drainage: Appropriate handling of solid waste and stagnant water helps in pest control and limits breeding mosquitoes and flies.	There are health risks in the non-collection of solid waste and in standing water.	Children link collection and treatment of solid waste with overall health risks. They understand the relationship between standing water and insect breeding.	Solid waste is collected and treated; standing water is drained.
Water treatment, handling and storage: Through testing and treatment, water can be made safe from faecal or chemical contamination	Where possible, communities should collect water from a safe source and store it safely. If the source is not safe, water must be treated through boiling, filtering, solar or chemical disinfection.	Communities understand the necessity of treating unsafe water through boiling, filtering, solar or chemical disinfection	If the source is not safe, children always treat the water through boiling, filtering, solar or chemical disinfection. Boiling is too dangerous for younger children.
Food hygiene: Eating healthy food is essential for the well-being and survival of each human being. Eating 'contaminated' food (also known as 'food poisoning') can be a significant source of diarrhoeal diseases.	Food hygiene and diseases are linked. Food should be stored appropriately. There are recognizable signs when food is spoiled.	Children know how to store food appropriately and recognize common signs of spoiled food.	Raw fruits and vegetables and raw meat, poultry or fish are treated and stored appropriately.
Sometimes hygiene education that focuses on WASH-related issues will be part of the wider context of health education or environmental education. In that case, issues such as malaria, HIV and AIDS, nutrition, reproductive health, environmental protection, disaster risk reduction and climate change will also be addressed.			

Source: UNICEF, 2012

Annex 4: F-diagram



Source: UNICEF, 2012

Annex 5: WASH and NTDs infographic

Source: WHO, http://www.who.int/water_sanitation_health/events/wash-ntd-infographic.pdf, accessed on 25/10/15