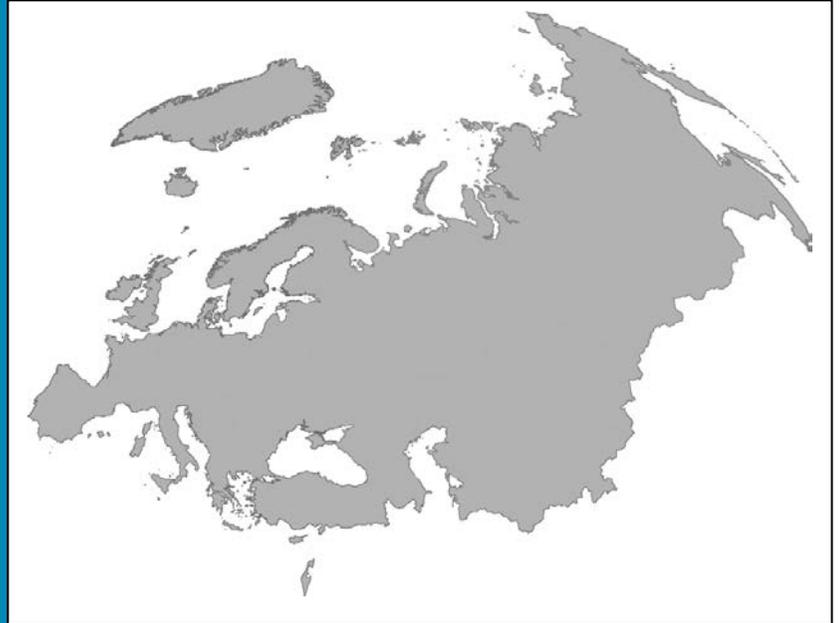




World Health  
Organization

REGIONAL OFFICE FOR **Europe**



Framework for control  
and prevention of  
soil-transmitted  
helminthiases in the  
WHO European Region  
2016–2020



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## ABSTRACT

Soil-transmitted helminthiases (STH) are among the most common human parasitic diseases. WHO estimates that over 2 billion people suffer from STH globally, including 4 million children in the WHO European Region. STH include ascariasis, trichuriasis, ancylostomiasis, necatoriasis, strongyloidiasis and toxocariasis. In 2001, the Fifty-fourth World Health Assembly adopted resolution WHA54.19 with the goal to intensify efforts on control and elimination of soil-transmitted helminths. WHO's global STH control plan for 2011–2020 aims to eliminate STH as a public health problem among school-aged children by 2020. In support for intensifying its implementation, WHO adopted a global strategy on water, sanitation and hygiene for accelerating and sustaining progress on neglected tropical diseases for 2015–2020. This document represents a regional framework for STH control and prevention. It provides an overview of the current STH situation, the scope and purpose of the work ahead, and strategic approaches to and measures against STH in the Region. It aims to assist countries in the development of national strategies and programmes based on their epidemiological, socioeconomic and environmental contexts.

### KEYWORDS

HELMINTHIASIS – PREVENTION AND CONTROL  
SOIL – PARASITOLOGY  
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## Executive summary

Over 2 billion people are estimated to suffer from soil-transmitted helminthiases (STH) globally, including 4 million children in the WHO European Region. The main species of helminth that infect people are the roundworm (*Ascaris lumbricoides*), the whipworm (*Trichuris trichiura*) and the hookworms (*Necator americanus* and *Ancylostoma duodenale*).

In 2001, the Fifty-fourth World Health Assembly adopted resolution WHA54.19 with the goal to intensify efforts on control and elimination of soil-transmitted helminths in 2001–2010. However, by 2010 only 200 million school-aged children were reached with deworming interventions out of 600 million children in need of preventive chemotherapy. WHO's global STH control plan for 2011–2020 (1) sets out the goal of eliminating STH as a public health problem among school-aged children by 2020. In 2015, to further support and intensify the implementation of the resolution, WHO released *Water, sanitation and hygiene for accelerating and sustaining progress on neglected tropical diseases. A global strategy, 2015–2020* (2).

Over the last five years and in collaboration with several partners, WHO has provided research, technical and financial support to STH control and prevention in Member States. In 2012 and 2013, regional meetings on STH control and prevention were held at the WHO European Centre for Environment and Health in Bonn, Germany. The necessity of developing a regional framework on STH control and prevention was highlighted by all participating countries and supported by WHO headquarters and the WHO Regional Office for Europe. The draft regional framework was reviewed at the regional workshop on the progress achieved with prevention and control of STH, held on 25–27 November 2015 in Tbilisi, Georgia.

This document presents the regional framework for STH control and prevention. It provides an overview of the current STH situation, the scope and purpose of the work ahead, and strategic approaches and measures against STH in the Region. It aims to assist countries in the development of national policies and programmes based on their local epidemiological, socioeconomic and environmental contexts.



## Soil-transmitted helminthiases as a public health problem

Soil-transmitted helminthiases (STH) are among the most common human parasitic diseases. STH include ascariasis, trichuriasis, ancylostomiasis, necatoriasis, strongyloidiasis and toxocariasis. All of them, except for toxocariasis, are anthroponotic diseases.

STH are common in all WHO regions, but the prevalence of STH varies significantly due to differences in socioeconomic, climate and other environmental factors such as water, sanitation and hygiene (WASH) conditions. WHO estimates that approximately 2 billion people suffer from STH globally, with the highest prevalence in tropical and subtropical regions and those with poor WASH conditions. The number of school-aged children affected by STH in the WHO European Region is estimated at over 4 million, with the highest prevalence in countries of central Asia and the southern Caucasus.

STH are transmitted through contaminated soil, food, water, hands and fomites. Thanks to improved living standards and better WASH conditions, these diseases have been gradually disappearing in many regions of the world. However, helminth infections are still an important and neglected public health problem, especially in low- and middle-income countries.

A 2013 situation analysis conducted in 12 countries of the Region identified serious barriers to the organization of an effective intervention system to control STH (3). The main barriers include high staff turnover in parasitology services, a general lack of education of medical personnel, insufficient laboratory and clinical diagnostic capacity, lack of regulatory and training frameworks, and inadequate hygiene awareness among the population.

Despite the high levels of health coverage in the Region as a whole, people still have unmet basic needs in terms of access to water supply and sanitation services. Large disparities also exist between countries. The Region met the Millennium Development Goal target for drinking-water, but failed to meet the target for sanitation (4). More than 62 million people still lack adequate sanitation facilities, approximately 1.7 million people in 11 countries practice open defecation and 14 million people lack access to a basic drinking-water source (5).

Inequalities exist within countries as well; rural populations and poor people are the most disadvantaged. For example, in countries of central Asia and the southern Caucasus, 19% of the rural population lives in homes without access to a basic drinking-water source, as opposed to only 2% of the urban population. Even more significantly, the urban–rural difference in access to piped water supply on premises is more than 50 percentage points (5).

The situation clearly indicates the need to take concerted action to close the inequality gap, further improve and sustain water supply and sanitation services, and thereby contribute to the prevention and control of STH in the Region. It is essential to link STH control and WASH programmes through greater intersectoral collaboration and the mobilization of joint efforts.

## Biology and epidemiology of STH

The following biological characteristics of soil-transmitted helminths are the most important to consider when planning and implementing STH control and prevention measures:

- staged development;
- different environmental needs at different stages of development;
- reproductive characteristics;
- individual lifespan;
- fertility and survival capacities; and
- level of adaptation to the host.

Over its lifetime, an individual helminth passes through several developmental stages. A roundworm such as *Ascaris lumbricoides* goes through six progressive stages: unembryonated egg – embryonated egg – first stage larva – developing larva – infective larva – adult. Each of these stages requires a special habitat: various human organs (gastrointestinal tract, vascular system, respiratory apparatus) as well as the environment (soil).

As parasitic organisms, helminths need certain types of hosts to survive. Worms causing STH occur only in humans and do not exist outside populated areas.

The main species of soil-transmitted helminths – hookworms (*Ancylostoma duodenale* and *Necator americanus*), whipworms, and roundworms – cannot complete their entire developmental cycle within one host. Therefore, the number of reproductive helminths in a human organism will not increase without a new infection. In this respect, STH significantly differ from diseases caused by bacteria, viruses and protozoa, in which the number of disease-causing agents increases as host immunity permits.

Human infections with *Ascaris lumbricoides* (roundworms), *Trichocephalus trichiurus* (whipworms) and *Toxocara canis* (canine roundworms) are acquired perorally; those with *Ancylostoma duodenale* (hookworms) and *Strongyloides stercoralis* (threadworms) are acquired both perorally and percutaneously; and those with *Necator americanus* (hookworms) are acquired percutaneously.

Soil-transmitted helminths are diclinous organisms. If only male worms live in a host, no eggs or larvae are excreted, making it difficult to diagnose the infection using conventional methods. If only female worms live in a host, they either do not lay eggs or lay unembryonated eggs that are not capable of further development. Detection of unembryonated roundworm eggs in faeces shows infections of low intensity. The less infective matter within the host organism, the higher the probability of developing single-sex helminths. This probability depends on the intensity of transmission.

The individual lifespan of soil-transmitted helminths in humans varies from several weeks to several years. The long lifespan of some soil-transmitted helminths compensates for their relatively slow pace of reproduction, and results in STH chronicity.

The fertility of soil-transmitted helminths is an important evolutionary characteristic. Mass propagative excretion from the host, dissemination in the environment and wide environmental contamination with infective materials is crucial to their survival as species.

STH can be divided into two groups: anthroponoses (ascariasis, trichuriasis, ancylostomiasis, necatoriasis, strongyloidiasis), which are transmitted by a human host; and zoonoses (toxocariasis), which are transmitted by an animal host.

The worms causing most types of anthroponotic STH are ancient parasites, well adapted to the defences of a human body. They cause serious pathologies only in cases where infection intensity is very high. In most cases, the acute phase of the disease (allergies) is not diagnosed and the chronic phase is a subclinical or asymptomatic parasitism. This high degree of adaptability to a host has also been crucial to species survival: subclinical and asymptomatic parasitism results in late or accidental diagnosis, prolonged propagative stages, wide contamination of the environment, and increased probability of eggs reaching infective stages and subsequently infecting people.

In contrast, worms causing zoonotic helminthiases are less adapted to human organisms and often cause severe infections, mainly allergies (echinococcosis, fascioliasis, Asiatic schistosomiasis). This is due to the fact that animal parasites (for example, *Toxocara*) are unable to develop within a human body.

The prevalence of STH varies according to age. It increases during childhood, reaches a peak at 5–15 years of age and, depending on the type of helminth, remains high or declines in adulthood.

STH transmission is influenced by a number of factors. STH affect the population of a given region unevenly, and tend to cluster among a few individuals or households within a community. This may be explained by behavioural or environmental factors leading to differences in exposure to infections, or factors related to immunity or genetic predisposition.

STH mainly affect poor households and communities and those who lack access to adequate WASH. STH are most prevalent in rural areas, but are also found in peri-urban settings such as informal settlements where population density is high, and where poverty and inadequate access to water supply and sanitation services persist. A systematic review and meta-analysis revealed that WASH is a critical component of STH control strategies: WASH access and individual practices were associated with a 33% reduction in rates of STH (5). Mass drug administration alone is therefore unlikely to interrupt STH transmission permanently.

A person infected with soil-transmitted helminths is not directly contagious. The infective matter in their excrement must undergo a lengthy developmental cycle in the environment before it becomes capable of transmitting infection to another person.

The intensity of STH is directly related to the number of parasites present in an infected individual. The number of parasites in an individual also determines the risk they pose as a

source of infection: the greater the number of helminths, the more infective matter will be passed into the environment. There is, therefore, a direct link between the intensity of infection and the intensity of transmission of STH.

The intensity of transmission also affects disease prevalence and severity. The link between these two factors is direct as well, but not commensurable – there are also backward links that serve to regulate helminth numbers.

The factors associated with a high risk of infection at the individual level have an impact at the community level as well, and those at the highest risk of helminth infection represent a serious hazard to those around them. The prevalence of STH in communities also depends on customs and traditions, habits, hygiene awareness, national cuisine and other factors. The risk of STH becoming endemic in a certain area is thus not just a sum of the infection probabilities of certain community members.

## WHO commitment and policy actions

WHO plays an active role in addressing the problems and challenges associated with soil-transmitted helminths. In this regard, the adoption of resolution WHA54.19 at the Fifty-fourth World Health Assembly in 2001 was a strategic milestone. It urged Member States to sustain and intensify STH control activities, and to set the goal of administering deworming interventions to a minimum of 75% of school-aged children at risk of schistosomiasis and STH by 2010.

WHO estimates that more than 200 million school-aged children were treated by 2010. Despite this remarkable progress, the strategy's goal was not reached. In response, WHO developed a revitalized global strategy in 2011 for eliminating STH as a public health problem in children by 2020 (1). In 2011, 30% of school-aged children were reached with deworming interventions (6). In 2012, 212 million children were treated against worms. In 2014, 396 million children were treated, representing 47% of the total number of children in need of treatment (3).

*Accelerating work to overcome the global impact of neglected tropical diseases – a roadmap for implementation* (7), published by WHO in 2012, is a comprehensive plan of control, elimination and eradication targets for 17 neglected tropical diseases – including STH – to be reached in 2012–2020.

Provision of WASH is essential to breaking the cycle of STH transmission. In 2011, the World Health Assembly adopted resolution WHA64.24 on drinking-water, sanitation and health, which highlights the importance of water and sanitation for disease control. It calls for an integrated approach to implementing safe water and adequate sanitation as primary prevention efforts along with other disease-control initiatives. It also stresses the need for an intersectoral approach to mainstreaming health and environmental issues in national policies

and strengthening institutional arrangements to prevent and reduce the incidence of sanitation- and water-related diseases.

In 2015, WHO released its third report on neglected tropical diseases – *Investing to overcome the global impact of neglected tropical diseases* (8) – along with its global strategy for 2015–2020 (2). The global strategy aims to accelerate and sustain progress against neglected tropical diseases such as STH by encouraging closer collaboration between the neglected tropical disease and WASH sectors. It emphasizes that collaboration can help to achieve the objectives of each sector as well as common goals such as health and well-being, equity and shared prosperity, and sustainability.

The 2010 Parma Declaration on Environment and Health (9) includes a time-bound European priority goal to ensure public health by providing each child with access to safe water and sanitation by 2020.

The Protocol on Water and Health (10) to the 1992 Convention on the Protection and Use of Transboundary Watercourses and International Lakes (11) is the first international legal instrument in the water, sanitation and health domain. It links the prevention, control and reduction of water-related diseases with the sustainable management of water resources. The Protocol is referred to as the primary policy platform in the Region for incrementally realizing the regional and global commitments on water and sanitation through establishing national priority targets and strengthening intersectoral action.

The 2030 Agenda for Sustainable Development (12) includes in its 17 Sustainable Development Goals (SDGs) a dedicated goal to ensure access to water and sanitation for all. SDG 6 goes beyond addressing the unfinished business of achieving the Millennium Development Goals to provide access to water and sanitation services (4); it expands the focus to include safety, equity and universality of services, to address nonhousehold settings (for example, health care and educational facilities), and to cover the entire water cycle, including safe wastewater management and reuse (13).

SDG 3 (to ensure healthy lives and promoting well-being for all at all ages) also includes the explicit target (3.3) to end neglected tropical diseases and waterborne diseases. SDG 3 and SDG 6 both have strong links to other goals, including SDG 1 (to end poverty in all its forms everywhere), SDG 2 (to end hunger, achieve food security and improved nutrition and promote sustainable agriculture), and SDG 4 (to ensure inclusive and quality education for all and ensure lifelong learning) (13).

## Regional framework for control and prevention of STH

### Scope and purpose

The ultimate goal of the regional framework is to eliminate STH as a public health problem in preschool- and school-aged children by 2020, and to reach at least 75% of the population with deworming interventions in countries where STH are a public health problem.

The objectives of the regional framework are to:

- eliminate STH in preschool- and school-aged children in countries with limited STH transmission;
- further reduce disease prevalence and infection in countries where STH are a public health problem;
- improve the health of the general population, especially of high-risk groups; and
- reduce the burden of STH-attributable diseases on public health as well as the social and economic damage caused by the infection.

The following timetable and targets are proposed for implementation of this framework.

#### **By the end of 2016:**

- ensure that a framework for STH control and prevention is developed, published and translated into Russian;
- ensure that regional guidelines for surveillance, diagnosis and treatment of STH as well as other guiding materials are developed and published; and
- strengthen intersectoral cooperation with a particular emphasis on WASH.

#### **By the end of 2017:**

- ensure that national strategies for STH control and prevention are developed/updated and published in local languages in all priority countries;
- build national capacities and mechanisms to collect, process and analyse data relevant to STH control and prevention;
- ensure that national guidelines for surveillance, diagnosis and treatment of STH are developed/updated and published in local languages in all priority countries;
- ensure that all public health staff engaged in STH control and prevention at all levels is trained; and
- ensure that coverage with preventative chemotherapy is scaled up.

#### **By the end of 2018:**

- ensure that an appropriate system for STH surveillance, diagnosis and treatment is set up in all priority countries; and
- evaluate the impact of measures applied against STH and identify progress, areas in need and challenges to be addressed.

### By the end of 2020:

- ensure the elimination of STH as a public health problem in preschool- and school-aged children in the Region; and
- ensure deworming interventions for at least 75% of the population in countries where STH were a public health problem in 2015.

## Key approaches and interventions

The main elements of the regional framework are aimed at strengthening the capacities of the public health services involved in STH control and prevention. The framework recommends that countries adopt the following objectives (see also Table 1).

1. Conduct a situation analysis.
2. Develop a regulatory and methodological framework.
3. Strengthen capacities of national centres for parasitic disease control.
4. Build capacity through education.
5. Improve disease diagnostics, treatment and prevention.
6. Improve disease surveillance systems.
7. Improve health and hygiene promotion systems.
8. Conduct operational research.
9. Strengthen intersectoral cooperation and partnerships.

**Table 1. Recommended objectives and key approaches**

Objectives		Key approaches and interventions	
1.	Conduct a situation analysis	1.1.	Conduct an in-depth situation analysis involving all key actors to define the burden of STH, contributing factors (including WASH conditions), existing capacities and challenges
2.	Develop a regulatory and methodological framework	2.1.	Develop and approve a national STH control and prevention programme
		2.2.	Develop and approve regulations
		2.3.	Develop and approve methodological materials
		2.4.	Enable sustainable financing of the national programme
3.	Strengthen capacities of national centres for parasitic disease control	3.1.	Strengthen the administrative and workforce capacities of national centres for parasitic disease control
		3.2.	Strengthen technical capacities of national centres for parasitic disease control
		3.3.	Strengthen information and analytical capacities of national centres for parasitic disease control

**Table 1 contd**

Objectives		Key approaches and interventions	
4.	Build capacity through education	4.1.	Integrate STH prevention and control into the first-degree medical education system
		4.2.	Integrate STH prevention and control into the postgraduate medical education system
		4.3.	Conduct training for specialists involved in the implementation of the national programme
5.	Improve disease diagnostics, treatment and prevention	5.1.	Improve quality of STH laboratory diagnostics and treatment
		5.2.	Improve access to STH diagnostics and treatment
		5.3.	Implement treatment and prevention interventions, including mass and targeted deworming campaigns
6.	Improve disease surveillance systems	6.1.	Create a registration, reporting and accountability system
		6.2.	Determine infection intensity among the general population and high-risk groups
		6.3.	Monitor interventions implemented by health ministries and other agencies
		6.4.	Monitor social and demographic situations
		6.5.	Monitor sanitary and environmental conditions, including effectiveness of WASH interventions
		6.6.	Monitor climate-related, environmental and phenological conditions
		6.7.	Monitor and classify foci after examination
		6.8.	Create a single, integrated database
		6.9.	Create a monitoring and evaluation system and make it relevant to the targets of the national programme
7.	Improve health and hygiene promotion systems	7.1.	Develop/strengthen a policy and implement programmes to promote safer hygiene practices
		7.2.	Develop and implement a large-scale health and hygiene promotion campaign
		7.3.	Conduct special health and hygiene promotion activities among high-risk groups, for example, among school-aged children
8.	Conduct operational research	8.1.	Train research personnel
		8.2.	Conduct scientific and practical research
		8.3.	Organize and hold research conferences, workshops, etc.
		8.4.	Publish related research articles, etc.
9.	Strengthen intersectoral cooperation and partnerships	9.1.	Scale up intersectoral cooperation with governmental agencies at all levels, and stakeholder organizations and agencies, especially with education and WASH sectors
		9.2.	Strengthen partnerships with the international community and nongovernmental organizations
		9.3.	Promote safe WASH

### **1. Conduct a situation analysis**

Conducting an in-depth situation analysis should be the first step at the country level. Information on the following topics needs to be collected:

- intensity of STH and contributing factors;
- main risk groups and how they emerge;
- routine STH surveillance system and gaps;
- existing practices for diagnosis and treatment of STH;
- availability and capacity of human resources for control and prevention of STH;
- legislation base;
- major challenges to scaling up interventions and meeting national targets; and
- costs and possible economic effects of interventions.

This information will help to identify the priorities of STH control measures, optimize the development of comprehensive interventions and increase the efficiency use of effort and resources.

### **2. Develop a regulatory and methodological framework**

Based on the findings of their situation analysis, countries should develop a national programme for STH control and prevention. The national programme should rely on a thoroughly elaborated action plan containing a detailed description of goals, targets, activities, budgets, etc. The national government (or the health care ministry) should officially adopt the programme and integrate it into the national health care policy. Adoption of the programme and relevant budget at the governmental level ensures the political and administrative commitment of all stakeholders (ministries of health; economic, financial and agricultural sectors; local authorities; public utility services; etc.) and guarantees financial support for implementation.

As a first step in this process, countries should set up a task force. Specialists from related ministries and agencies such as water supply, sanitation and education must be engaged to cover all intersectoral components essential to STH control, and to ensure an efficient and integrated approach in the future. The task force can then conduct a country-specific analysis of the STH situation, identify goals and targets, and draft a national programme in compliance with the major principles and priorities of the regional framework policy recommended by WHO. Each participant should be responsible for a particular section of the programme and should have a clear understanding of their role in its implementation. A well-coordinated programme also serves as a good rationale for mobilizing financial resources.

### **3. Strengthen capacities of national centres for parasitic disease control**

The main health interventions aimed at STH control and prevention are carried out by agencies, organizations and structural divisions of disease control and prevention centres (DCPC) and the general health care network (primary, secondary and tertiary care) of the

health care ministry. Other agencies, ministries, administrative establishments and public facilities whose functions are related to STH control and prevention should also be actively involved in the process. The lead implementation agency should be the unit of the health care ministry responsible for ensuring the epidemiological safety (or public health) of the population of the country.

A malaria control and prevention system has been effectively operating in the Region for several years. The system has proven efficient and effective in addressing serious issues at both the national and the regional level. In some countries, at the national level, STH and malaria – part of the same group of parasitic diseases – are tackled together. This creates an opportunity to build the STH control and prevention system upon existing antimalaria (parasitic diseases) services.

Given that primary care facilities work directly to address the health problems of a given community, it is important to involve them in STH control and prevention. Primary care facilities, as the first point of contact for people who are ill, can make a sizeable contribution to ensuring the overall efficiency of interventions. Several countries have been actively introducing a new cadre of medical personnel: family doctors. With a primary focus on disease prevention and health promotion, family doctors are rapidly becoming an essential link in the operational structure of national programmes.

Specialized health care facilities with laboratories can be of great assistance as well. These include infectious disease clinics, children’s hospitals, and gastroenterological, endocrine and allergy divisions of hospitals. Efforts to strengthen capacities of clinical laboratory services will clearly benefit the entire health care system.

The use of information technologies and the creation and integration of databases will also strengthen decision-making capacity for STH control and prevention in both the public health system in general and STH-specific services in particular.

#### **4. Build capacity through education**

Countries should incorporate provisions of their national programmes into the revised curricula of medical schools. This will ensure that young specialists across the entire spectrum of medical disciplines have a good understanding of the issue and follow prevention and treatment protocols. More importantly, postgraduate education systems must be harmonized. All specialists involved in programme implementation – health care managers, parasitologists, epidemiologists and their assistants, DCPC laboratory staff, infectious disease specialists working in hospitals and clinics, family doctors, general practitioners, gastroenterologists and allergists – should undergo special training as part of continuous postgraduate education.

Curricula related to STH control and prevention should be streamlined and integrated into the education process. DCPC specialists can study the topic during their specialty and continuous professional training, while other specialists can build knowledge and capacity through the postgraduate education system. Learning and teaching aids should also be coordinated and

necessary teaching facilities and resources (such as visual aids and teaching specimens) should be made available. DCPC should organize special training courses for key specialists involved in programme implementation.

## **5. Improve disease diagnostics, treatment and prevention**

Countries should develop a standard laboratory test register, treatment protocol, criteria and principles of conducting nationwide medical interventions (large-scale deworming), and an efficiency evaluation system. It is also important to improve access to medical interventions (diagnostics, treatment and deworming) and to monitor their efficiency. Finally, it is necessary to monitor the registration of anthelmintic drugs.

When the prevalence of infection is high and exceeds a certain threshold, treatment coverage (deworming interventions) should be expanded to include the entire community. This means that anthelmintic drugs should be prescribed to all community members and distributed in every household, community and public centre. Depending on the level of intensity and foci characteristics, various deworming schemes can be applied.

Mass treatment can rapidly and significantly reduce the prevalence of infection. However, since soil-transmitted helminths spend most of their independent lifecycle outside a human host, people can quickly become reinfected in the absence of improvements in environmental conditions and changes in risk behaviours.

## **6. Improve disease surveillance systems**

Good decision-making requires the ongoing collection, analysis and interpretation of evidence that can be applied to the development, implementation and evaluation of national programmes. Disease surveillance components include the examination of infection intensity in the general population and at-risk groups; the identification and classification of foci; the determination of current trends; and the monitoring of environmental contamination with infective matter.

The information needed to compile a parasite infection profile can be obtained through passive or active disease surveillance. Passive surveillance is based on the analysis of data provided by the primary care facilities (outpatient clinics, ambulatory care clinics, health centres, offices of family doctors, DCPC divisions, state sanitary and epidemiological surveillance services, etc.) that are accessed by people with STH-like symptoms.

However, because STH may be asymptomatic or may cause diverse symptoms and signs with unusual manifestations leading to misdiagnosis and medical errors, passive surveillance fails to provide a clear epidemiological picture. In order to gather reliable information about a specific epidemiological setting, infections must be identified through active disease surveillance. The following steps are particularly important.

**Determine infection intensity.** In order to determine the intensity of infection, specialists look for parasites in their propagative phases (eggs and larvae) in human faeces, regardless of

the surveillance type (active or passive). To do so, they can use a number of diagnostic tools with varying degrees of sensitivity. Qualitative diagnostic methods identify only the presence or absence of infection. A direct smear method is effective in foci with high extensity and intensity of infection.

Methods based on determining the concentration of helminth eggs in faeces are more labour-intensive, but provide more accurate results – they allow epidemiologists to specify not only whether or not a person is infected, but also the number of worms present in a human body. Quantitative STH diagnostics are particularly effective when infection intensity is low, and are essential when assessing prevention and treatment efficiency.

Stool examination using conventional techniques does not allow for the identification of all species of soil-transmitted helminths living in the intestine. Even large-scale surveys can fail to identify a high prevalence of certain STH types, such as strongyloidiasis. Special diagnostic procedures are also necessary to distinguish ancylostomiasis from necatoriasis.

During epidemiological surveys, technical errors can result from improper organization. The need to examine a very large number of stool specimens at once can reduce the quality of microscopy. Good laboratory practice thus often involves preserving faeces for planned microscopy.

Errors can also occur when the wrong people are selected for examination. A sample group should be representative, that is it should accurately represent the target population in terms of age, gender, place of residence and social and professional status. In practice, representative sampling is often replaced by convenience sampling, wherein researchers select subjects who are readily available (such as preschool- and school-aged children) but neglect to examine other populations.

Indirect methods can help enhance the efficiency of a survey. For example, people with an increased eosinophil level in their blood are more likely to suffer from strongyloidiasis and other types of STH, such as toxocariasis. Thus, their screening can be the first step in identifying strongyloidiasis and toxocariasis. These screening methods can significantly reduce the labour intensity of the examination.

Often, official ministerial data do not provide a real picture of infection intensity in specific epidemiological settings and entire regions. Surveys conducted in line with scientific principles and approaches usually reveal a higher prevalence of STH than that suggested by the general statistics of health care authorities.

**Classify foci after examination.** Foci classification after examination allows for the selection of the most appropriate STH control and prevention tools and the application of case-specific approaches. If the prevalence of infection is low, a large-scale examination is inefficient and cost-intensive (that is, the cost of every detected infection will be extremely high). In this case, it may be more feasible to focus on the examination of high-risk populations.

**Monitor sanitation and the presence of helminths in the environment.** Because the environment is crucial to STH foci formation, sanitary and helminthological monitoring is an important part of foci examination. It provides an assessment of environmental contamination with infective matter and allows for the identification and classification of epidemiological trends, the proper organization of interventions and the evaluation of their efficiency.

A given epidemiological situation is largely determined by geographic conditions, and thus the medical and geographic assessment of STH foci proves efficient. In this context, geographic information systems can provide valuable data.

Information obtained during social, demographic, climate-related, environmental and phenological monitoring can help with forecasting, mapping territories affected by parasites and determining the best operational timeframe for maximizing STH control and prevention interventions in specific regions and territories.

**Create a register of foci.** A list with the necessary epidemiological data for foci over several years helps to organize regional STH control interventions. Such a register allows for the accumulation of relevant information, the identification of ongoing trends and the planning of next steps. The active use of information technologies and their integration into existing public health information systems, statistics service and health care management information systems can help to overcome the technical challenges of database development.

**Improve medical reporting and accounting.** The situation analysis conducted by the Regional Office in 2013 (3) revealed that DCPC do not have information about the spread of certain STH types, such as ancylostomiasis and strongyloidiasis, due to a lack of relevant entries in official medical reports. In most countries, official reporting forms contain special entries for ascariasis and trichuriasis, but ancylostomiasis and strongyloidiasis are registered in the entry as “other types of soil-transmitted helminthiases”. This makes it impossible to determine infestations by a specific STH type.

One of the first steps to improving data collection is thus to revise medical reporting and accounting documentation and add fields for all STH registered in a country. The reporting form should include information on: number of cases, number of new cases, number of treatments provided and outcomes.

Disease surveillance efficiency hinges on the availability of an integrated information database. Countries should proactively introduce cutting-edge information and communications technologies used in disease surveillance, analysis and management. This will ultimately serve to improve the quality of health care facilities’ monitoring and foster evidence-based decision-making.

## **7. Improve health and hygiene promotion systems**

Health and hygiene promotion, which aims to encourage people to adopt healthy lifestyles and safe hygiene practices, is key to national programme implementation. National governments must develop communication strategies and action plans aimed at promoting

healthy behaviours that take into consideration cultural, social and environmental contexts. Hygiene promotion may include messages on hand-washing with soap, safe food handling practices, use of sanitation facilities, safe disposal of excreta, safe agricultural practices and other aspects of STH prevention and control.

Hygiene promotion can be carried out through existing networks of national, regional and local health promotion centres, or by setting up community committees composed of trained health personnel, representatives of educational institutions, elders, religious leaders and other respected individuals. Large-scale hygiene promotion campaigns that take into consideration the cultural and social contexts of their target audience can be effective tools, and can use innovative approaches to stimulate behaviour change. Depending on the context, campaigns may be directed at communities living in areas of high disease endemicity, school-aged children, farmers and other high-risk groups.

### **8. Conduct operational research**

Countries should encourage researchers to actively study STH-related issues, both in fundamental and applied research. Of great importance are the findings of studies related to the burden of STH-attributable disease, intersectoral research, analysis of factors associated with foci emergence and evolution, the social determinants of habit formation, behaviours of high-risk groups and the intensity of infection in specific populations, as well as efficiency evaluations of treatment and rehabilitation programmes.

Maintaining contact with national academies of sciences, research centres, universities and colleges is important for engaging professors and academia in research activities. The organization of conferences and seminars, the publication of research papers and the provision of incentives for research activities are all excellent ways to foster professional development. Continuous efforts to establish partnerships with field-specific institutions in other countries and to participate in international grant programmes also facilitate progress.

### **9. Strengthen intersectoral cooperation and partnerships**

The concerted and coordinated action of all organizations involved in STH control and prevention is essential for national programme implementation. Uniting efforts of the health care, agriculture, education, water and environment sectors, other ministries, agencies and organizations, and the media will ensure high efficiency in STH control and prevention interventions. Local authorities can also make substantial contributions, and the establishment of interdepartmental steering committees can institutionalize cooperation and integration.

International coordination is also necessary to disseminate information about ongoing interventions, establish a common approach, share best practices, etc. Partnerships with international and public organizations can help countries to coordinate messages and activities and to effectively allocate additional funds.

## Promoting safe WASH

The provision of adequate WASH is one of the five key interventions for controlling and combating neglected tropical diseases, including STH. Countries must make concerted efforts to improve access to water supply and sanitation services and to encourage safer hygiene practices.

Ministries of health have a key role to play in addressing the environmental aspects of STH control efforts, but the delivery of water supply and sanitation infrastructure is often the responsibility of other sectors. Close collaboration with the WASH sector is the most efficient way to improve services in disease-endemic areas.

Advocacy and capacity-building, including training, data collection and monitoring, are key areas where collaboration between STH control programmes and the WASH sector is critical. Collaboration and coordination can take place during the planning, delivery, and monitoring and evaluation of interventions. For example, jointly reviewing subnational data on STH epidemiology and access to water supply and sanitation services can help stakeholders to identify high-risk groups and thus target populations for WASH and STH control efforts. School-based programmes in countries with initiatives to promote WASH could also be linked with school-based deworming campaigns (14).

In many countries of the Region, water and sanitation governance is guided by the Protocol on Water and Health (10,11). In accordance with the core provisions of the Protocol, countries set and implement national priority targets related to broad aspects of water, sanitation and health, including access to safe water and sanitation services, reduction of water- and sanitation-related diseases, improvement of surveillance and implementation of risk-based approaches to water and sanitation.

WHO has developed a number of guidelines and tools to support countries with the development and implementation of national regulations and standards to protect public health from hazards associated with poor WASH. These include *Guidelines for drinking-water quality* (15) and its implementation tool, *Guidelines for the safe use of wastewater and excreta in agriculture and aquaculture* (16), and *Sanitation safety planning: manual for safe use and disposal of wastewater, greywater and excreta* (17). These water and sanitation safety plans recommend health-protecting measures based on risk assessment and management and provide detailed guidance for step-by-step implementation.

## Monitoring and evaluation

Countries should regularly evaluate their national programmes to be sure that they stay relevant to their goals. Monitoring and evaluation enables countries to assess progress, determine implementation status, ensure proper reporting, identify major challenges and

barriers, stimulate evidence-based planning and obtain timely feedback in order to promptly make necessary adjustments.

It is important to set out parameters for monitoring and evaluating all programme areas, including programme management, institutional development systems, regulatory framework development, prevention and treatment activities, disease surveillance and hygiene education. This information is usually obtained through the national health information system.

Regular monitoring should ensure systematic data collection and processing as well as calculated indicators and estimates. This encompasses routine progress reports on programme implementation and requires the maintenance of relevant records, regular planned surveillance and periodic special examinations.

Evaluation includes analysing, understanding and interpreting indicators for specific activities of a policy or programme, and entails periodically identifying changes in final indicators or results related to implementation. Evaluation can help to determine the value or cost of a specific approach and measure programme efficiency, and provides information about progress that can be used at the local, national or international level.

## Conclusion

The *Framework for control and prevention of soil-transmitted helminthiases in the WHO European Region 2016–2020* will facilitate the development of national policies and programmes, taking into account the epidemiological, socioeconomic and other STH-specific characteristics of certain areas.

The Regional Office and WHO headquarters will provide strategic guidance and technical assistance to countries in need of assistance with developing and implementing their national strategies and action plans, strengthening institutional capacities, improving capacities for disease management and prevention, reinforcing disease surveillance and strengthening research capabilities. The Regional Office is finalizing the package of guiding documents covering all aspects of STH prevention and control – including STH surveillance, diagnosis, treatment and prevention – which will support countries in their daily work.

Following extensive discussions, the Regional Office has developed an overview table of national programmes on STH control and prevention, collaboration with the WASH sector and the availability of disaggregated information on WASH for selected countries (see Annex 1). This table will assist the Regional Office in identifying the specific needs of countries and planning relevant support. It will be updated biannually. Countries are requested to report back on progress made on the implementation of their national programmes on a regular basis.

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## Annex 1. Overview of soil-transmitted helminthiases (STH) control and prevention status in selected countries

Country	Availability of data on STH		Availability of data on other priority helminthiases		Identified high-risk areas	National strategy						Have WASH data in high-risk areas (local level)			3 key priorities for programme managers
	National (Y/N)	Local (Y/N)	National (Y/N)	Local (Y/N)		Available (Y/N)	Funded (Y/Partially/N)	Include mass deworming		WASH included in helminth strategy (Y/N)	WASH implemented (e.g. coordination mechanism in place) (Y/N)	Sanitation	Water	Hygiene	
								Y/N	If yes, population requiring PCT <sup>1</sup>						
Armenia	Y	Y	Y	Y	Y	Under development	–	N	–	Y	Y	Y	Y	Y	<ol style="list-style-type: none"> <li>1. Capacity-building on surveillance, diagnosis and treatment of STH</li> <li>2. Strengthening surveillance system</li> <li>3. Strengthening intersectoral collaboration and partnership</li> </ol>
Azerbaijan	Y	Y	Y	Y	Y	Y	N	Y	School-aged children (1 310 000)	Y	N	N	N	N	<ol style="list-style-type: none"> <li>1. Strengthening monitoring and evaluation and laboratory diagnosis capacities</li> <li>2. Raising population awareness on prevention of STH</li> <li>3. Mass deworming campaigns</li> </ol>

<sup>1</sup> Preventative chemotherapy and transmission control

Country	Availability of data on STH		Availability of data on other priority helminthiases		Identified high-risk areas	National strategy						Have WASH data in high-risk areas (local level)			3 key priorities for programme managers
	National (Y/N)	Local (Y/N)	National (Y/N)	Local (Y/N)		Available (Y/N)	Funded (Y/Partially/N)	Include mass deworming		WASH included in helminth strategy (Y/N)	WASH implemented (e.g. coordination mechanism in place) (Y/N)	Sanitation	Water	Hygiene	
								Y/N	If yes, population requiring PCT <sup>1</sup>						
Belarus	Y	Y	Y	Y	Y	Y	Y	Partially	Contacts in true foci (approx. 50 000 people)	Y	Implemented with appropriate sanitary rules and regulations and hygienic regulations	Y	Y	Y	<ol style="list-style-type: none"> <li>1. Surveying population to identify and treat potential source of infection</li> <li>2. Monitoring the epidemiological situation based on the universal rate for all regions of the country, statistical sampling of the population and defined environment markers</li> <li>3. Raising population awareness on prevention of STH</li> </ol>
Georgia	Y	Y	Y	Y	N	N	N	-	-	-	-	Y	Y	Y	<ol style="list-style-type: none"> <li>1. Survey among children</li> <li>2. Training on diagnosis</li> <li>3. Survey in high-risk areas</li> </ol>
Kazakhstan	Y	Y	Y	Y	Y	N	-	-	-	-	-	N	N	N	<ol style="list-style-type: none"> <li>1. Identification of high-risk areas</li> <li>2. Development of the national strategy of STH control and prevention</li> </ol>

Country	Availability of data on STH		Availability of data on other priority helminthiases		Identified high-risk areas	National strategy						Have WASH data in high-risk areas (local level)			3 key priorities for programme managers
	National (Y/N)	Local (Y/N)	National (Y/N)	Local (Y/N)		Available (Y/N)	Funded (Y/Partially/N)	Include mass deworming		WASH included in helminth strategy (Y/N)	WASH implemented (e.g. coordination mechanism in place) (Y/N)	Sanitation	Water	Hygiene	
								Y/N	If yes, population requiring PCT†						
Republic of Moldova	Y	Y	Y	Y	Y	N (STH is not a public health problem in the country)	N	N (National insurance company covers deworming for children under 5 years of age)	-	There is a "Strategic Environment Assessment" national programme	Y	Y	Y	Y	<ol style="list-style-type: none"> <li>1. Provision of population with drinking-water of ensured quality</li> <li>2. Provision of access to sanitation</li> <li>3. Integrated waste management</li> </ol>
Russian Federation	Y	Y	Y	Y	Y	Y (Decree/act of the Chief State Sanitary Doctor)	Partially	N	-	Y	Y	Y	Y	Y	<ol style="list-style-type: none"> <li>1. Treatment (examination, deworming, control of efficiency)</li> <li>2. Control of water supply and sanitation</li> <li>3. Raising public awareness</li> </ol>
Tajikistan	Y	Y	Y	Y	Y	N	N	Mass deworming campaigns are implemented	Children aged 2–14 years (2 391 119)	N	N	Y	Y	Y	<ol style="list-style-type: none"> <li>1. Strengthening surveillance and diagnosis capacity</li> <li>2. Mass deworming</li> <li>3. Raising public awareness</li> </ol>

The World Health Organization (WHO) is a specialized agency of the United Nations created in 1948 with the primary responsibility for international health matters and public health. The WHO Regional Office for Europe is one of six regional offices throughout the world, each with its own programme geared to the particular health conditions of the countries it serves.

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