Schistosomiasis remains a major public health problem with almost 240 million people, and more than 90% of them living in sub-Saharan Africa, requiring preventive chemotherapy. Schistosomiasis in humans results from infection with parasitic blood flukes of the genus Schistosoma. Six species of schistosomes cause infection in humans. While the disease is now predominantly in Africa, it also occurs in the Americas, the Eastern Mediterranean region, the Southeast Asian region and the Western Pacific.

Infection is acquired when parasitic larvae penetrate the skin of people exposed to infested freshwater. Early infection may be characterized by dermatitis. Followed by a systemic acute phase caused by the migration of the juvenile worms through the circulatory system. In later phases, parasite eggs from adult worms cause penetrate the mucosa of the urogenital tract and the intestine. In such organs, acute inflammation progressively becomes chronic, and hyperaemia, abnormal growths such as polyps and internal haemorrhage are gradually replaced by fibrosis and thickening of the tissues. Bladder cancer is a late-stage consequence of S. haematobium infection, while embolization of eggs from the intestine to the liver through the portal system is typical of infection with the other Schistosoma spp., and is responsible for progressive liver fibrosis, portal hypertension and ascites.

Progress is being made in the control of schistosomiasis as in 2010; 34.8 million people were treated for schistosomiasis in 30 countries. Access to the drug of choice, praziquantel has been improved through a donation of up to 250 million tablets per year, until schistosomiasis is eliminated. It is thought that transmission has been interrupted in 19 countries, but this requires confirmation. In the World Health Assembly resolution WHA65.21, Member States called for intensified control interventions and initiation of elimination programmes where possible. The resolution also called for guidelines ttoward elimination as well as procedures for the verification of interruption of treatment.

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PROGRESS REPORT 2001–2011 AND STRATEGIC PLAN 2012–2020

SCHISTOSOMIASIS

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World Health Organization

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PROGRESS REPORT 2001–2011
AND STRATEGIC PLAN 2012–2020

World Health Organization

WHO Library Cataloguing-in-Publication Data

Schistosomiasis: progress report 2001 - 2011, strategic plan 2012 - 2020.

1.Schistosomiasis - prevention and control. 2.Schistosomiasis - epidemiology. 3.Schistosomiasis - drug therapy. 4.Program evaluation. 5.Health programs and plans. I.World Health Organization.

ISBN 978 92 4 150317 4 (NLM classification: WC 810)

Printed in France.

WHO/HTM/NTD/PCT/2013.2

Contents

Section 1

Introduction

1.1 Schistosomiasis

Schistosomiasis is the disease resulting from infection with parasitic trematode worms of the genus *Schistosoma*. The main species of schistosomes infecting humans are listed here according to the chronological order in which they were first described: *S. haematobium* (1852), *S. japonicum* (1904), *S. mansoni* (1907), *S. intercalatum* (1934) and *S. mekongi* (1978) (*1*). *S. malayensis* (1988) has also been described and found in Malaysia but its public-health significance is still undetermined. *S. guineensis* was separated from *S. intercalatum* in 2003 (*2*). While the adult worms of all species reside within the blood vessels of the mammalian hosts, *S. haematobium* is responsible for urogenital schistosomiasis; the other species mainly affect the intestine and the liver.

Schistosomiasis is acquired when free-swimming parasitic larvae (cercariae) penetrate the skin of people exposed to infested freshwater. The clinical picture of schistosomiasis includes an early phase characterized by a dermatitis in the area where the cercariae penetrate the skin; a systemic acute phase caused by the migration of the juvenile worms (schistosomula) through the circulatory system; and finally, and most notably, an organ-specific chronic phase produced by the eggs laid by adult female *Schistosoma spp*. in the mucosa of the urogenital tract and the intestine. In such organs, acute inflammation progressively becomes chronic, and hyperaemia, abnormal growths such as polyps and internal haemorrhage are gradually replaced by fibrosis and thickening of the tissues. Bladder cancer is a late-stage consequence of *S. haematobium* infection, while embolization of eggs from the intestine to the liver through the portal system is typical of infection with the other *Schistosoma spp*., and is responsible for progressive liver fibrosis, portal hypertension and ascites.

1.2 Evolution of the strategic approach to control schistosomiasis

The two pillars of schistosomiasis control have historically been represented by interventions targeting (i) the parasite within the human final host and (ii) the snail intermediate host, with the aim of decreasing morbidity and reducing transmission. The first attempts to control schistosomiasis employing such measures were made in the early 20th century in Egypt and Japan, respectively (*3*, *4*). In 1920, Egypt implemented the first mass treatment intervention in adults and children alike using intravenous tartar emetic, a derivative of antimony, which had been successfully tested in the Sudan two years before (*5*). Following these examples, a number of national programmes started controlling schistosomiasis using treatment and/or snail control, often combined with provision of health education messages (*6*). Since its establishment in 1948, the World Health Organization (WHO) has recognized the public-health relevance of schistosomiasis and has developed a number of documents providing guidance and support to countries willing to embark on disease control interventions (*Annex 1*; *Annex 2*). Schistosomiasis control strategies have evolved as a function of the availability of new tools, and thus shifted from snail control to chemotherapy with the availability of safer medicines such as niridazole, metrifonate, oxamniquine and praziquantel (*7*). In addition, with the development of single-dose oral administration (e.g. of oxamniquine or praziquantel), the cost effectiveness and feasibility of large-scale preventive chemotherapy could be considered and assessed.

In the 1970s, research in Saint Lucia showed that chemotherapy was more cost effective in controlling schistosomiasis than snail control or provision of water supplies (*8*). Other research conducted in the 1970s–1980s suggested that most morbidity from schistosomiasis was due to heavy-intensity infections and that those with heavy infections should be targeted for treatment (*9–11*). Heavy infections could be detected in the field using urine filtration and the Kato-Katz techniques (*12*). In appreciating the high disease burden caused by schistosomiasis in sub-Saharan Africa and the lack of resources for adequate provision of water and sanitation in the endemic countries, a WHO Expert Committee recommended in 1985 that control programmes adopt morbidity control through chemotherapy as the main strategy for schistosomiasis control (*13*) while recognizing that access to potable water and adequate sanitation remains a challenge in many developing countries (*14*). With praziquantel as the drug of choice in the treatment of schistosomiasis and with the new strategy for morbidity control, pilot control programmes were undertaken in sub-Saharan Africa. Unfortunately, these proved unsustainable without external funding (*15, 16*). Some success was achieved with larger programmes that were able to scale up preventive chemotherapy for schistosomiasis control, as in China (*17, 18*) and Egypt (*19, 20*). In recent years, the significant reduction in the price of praziquantel, together with increasing advocacy and provision of resources for control of neglected tropical diseases (NTDs), has resulted in renewed launching of schistosomiasis control programmes in sub-Saharan Africa (*21–24*).

1.3 Resolution WHA54.19 on schistosomiasis and soil-transmitted helminth infections

Even though WHO has recommended large-scale distribution of praziquantel to at-risk populations living in endemic areas since the 1970s and 1980s (*7*, *13*, *25*, *26*), it was only in 2001 that the 54th World Health Assembly officially endorsed chemotherapy as the key public-health strategy to combat schistosomiasis (*Annex 3*) (*27*). Resolution WHA54.19 on schistosomiasis and soil-transmitted helminth infections urged Member States (i) to sustain successful control activities in low-transmission areas in order to eliminate schistosomiasis (and soil-transmitted helminth infections) as a public-health problem; (ii) to give high priority to implementing or intensifying control of schistosomiasis (and soil-transmitted helminth infections) in areas of high transmission; (iii) to monitor drug quality and efficacy of these control activities; and (iv) to ensure access to essential medicines against schistosomiasis (and soil-transmitted helminth infections) in all health services in endemic areas for the treatment of clinical cases and of groups at high risk of morbidity such as women and children. The goal of these activities would be to achieve a minimum target of regular administration of chemotherapy to at least 75%, and up to 100%, of all school-age children at risk of morbidity by 2010 (*28*).

Resolution WHA54.19 also recognized the importance of complementary public-health interventions, thus urging Member States to promote access to safe water, sanitation and health education through intersectoral collaboration as means of reducing transmission.

School-age children (aged 5–14 years) in endemic areas were the primary target of preventive chemotherapy interventions. This was justified by the fact that children are at highest risk of infection. Because of their recent exposure to infection and consequently the early stage of their chronic lesions, children would also benefit most from treatment interventions. Treatment during childhood therefore prevents chronic morbidity in later years (*29*).

Resolution WHA54.19 considered both schistosomiasis and soil-transmitted helminth infections. As school-age children are the main target population for both diseases, large-scale interventions using a combination of anthelminthics have frequently been co- implemented at field level. This entailed the co-administration of praziquantel and albendazole, or mebendazole, to the same people; a regimen that had been shown to be safe (*30*, *31*).

1.4 Recommendations on morbidity control

Following the adoption of Resolution WHA54.19, WHO convened an Expert Committee in 2002 with the aim of developing operational guidelines to translate the recommendations of WHA54.19 into concrete action (*27*). The identified strategy had a goal of control of morbidity to be achieved through large-scale distribution of praziquantel to populations at risk, using defined thresholds of prevalence as criteria for selecting the appropriate interval of re-treatment. From an operational perspective, schools were identified as the most efficient delivery channel as they

represented an excellent entry-point to reach children of school age. In countries where school enrolment was low, community-based interventions have also been implemented with the aim of reaching children not attending classes.

In 2006, the operational details of the strategy against schistosomiasis were revised and made more comprehensive (*32*). As new research had shown that light and moderate infection intensities, rather than only heavy infections, can cause significant morbidity (*33*), it was realized that not only those with heavy infection should be targeted for treatment. Therefore, the target population was expanded to include all adults in high-risk areas (where prevalence of infection in school-age children is 50%), as well as special risk groups – such as people occupationally exposed to risk of infection – in moderate-risk areas (where prevalence of infection in school-age children is 10% but <50%).

Other high-risk groups for schistosomiasis are women of childbearing age, including pregnant and lactating women. They are at increased risk of developing morbidity due to schistosomiasis and should not be excluded in large-scale treatment campaigns (*34*).

There is increasing evidence that preschool-age children in highly endemic areas are at a similar risk of schistosomiasis infection and morbidity as their school-age siblings whose role might also be as their caregivers (*35*, *36*). It is currently recommended that very young children be treated individually in health facilities as part of the national control programme. This is because there is currently no appropriate formulation of praziquantel suitable for mass administration to this age group.

The 2006 guidelines also formalized the concept of coordinated use of anthelminthic medicines, by which control and elimination interventions against the four main helminth infections – lymphatic filariasis, onchocerciasis, schistosomiasis and soil-transmitted helminthiases – can be progressively integrated based on the consideration that these medicines can safely be co-administered (*37–41*) and that the diseases are largely co-endemic.

Since 2001, millions of doses of praziquantel have been co-administered with albendazole or mebendazole with the aim of simultaneously controlling morbidity due to schistosomiasis and soil-transmitted helminthiases. In areas where schistosomiasis and onchocerciasis are co-endemic, praziquantel has also been co-administered with ivermectin. In 2006, WHO recommended the triple administration of praziquantel, albendazole and ivermectin to populations previously subjected to separate mass treatment for lymphatic filariasis, onchocerciasis, schistosomiasis or soil-transmitted helminthiases (*32*).

While the current recommendations based on thresholds of prevalence of infection (*Table 1.1*) remain valid for achieving control of schistosomiasis-associated morbidity and elimination of schistosomiasis as a public-health problem, a more intensified strategy is required in areas where the aim is that of interrupting transmission. In residual foci of transmission, a “final push” approach is therefore needed. Such an approach is described in section 3.2.

Table 1.1 Recommended treatment strategy for schistosomiasis[a]

Category	Baseline prevalence among school-age children	Action to be taken[b]	
High-risk community	50% by parasitological methods[c] (intestinal and urogenital schistosomiasis) or 30% by questionnaire for history of haematuria	Treat all school-age children (enrolled and not enrolled) once a year	Also treat adults considered to be at risk (from special groupsd to entire communities living in endemic areas)
Moderate-risk community	10% but <50% by parasitological methods (intestinal and urogenital schistosomiasis) or <30% by questionnaire for history of haematuria	Treat all school-age children (enrolled and not enrolled) once every 2 years	Also treat adults considered to be at risk (special groupsd only)
Low-risk community	<10% by parasitological methods (intestinal and urogenital schistosomiasis)	Treat all school-age children (enrolled and not enrolled) twice during their primary schooling age (e.g. once on entry and once on exit)	Praziquantel should be available in dispensaries and clinics for treatment of suspected cases

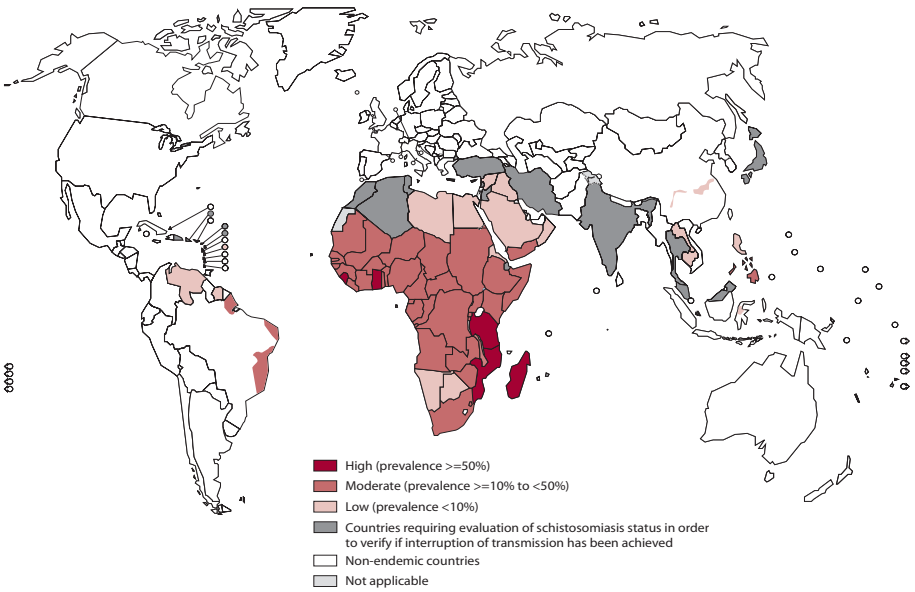
[a] Source: *Preventive chemotherapy in human helminthiasis* (*32*).
[b] Equivalent to: **high-risk community** – all school-age children and adults require preventive chemotherapy annually; **moderate-risk community** – 50% of school-age children and 20% of adults require preventive chemotherapy annually; **low-risk community** – 33% of school-age children require preventive chemotherapy annually.
[c] For urogenital schistosomiasis, detection of haematuria by chemical reagent strips gives results equivalent to those determined by urine filtration.
[d] Special groups: pregnant and lactating women; groups with occupations involving contact with infested water such as fishermen, farmers, irrigation workers or women in their domestic tasks, to entire communities living in endemic areas.

1.5 Countries, areas and population groups eligible for preventive chemotherapy

According to the latest recommendations (*32*), all countries where transmission of schistosomiasis is documented are eligible for preventive chemotherapy interventions distributing praziquantel, as there is no minimal threshold of prevalence of infection below which this intervention is not recommended. *Figure 1.1* shows the geographical distribution of the disease worldwide in 2010.

Within such countries, only endemic areas should be targeted for treatment. The ideal administrative level at which the decision should be made is that of the community or sub-district: this consideration is based on the fact that schistosomiasis is typically a highly focalized disease. However, for practical reasons, the district is often chosen as the implementation unit, because selecting the community or the sub-district as the implementation unit would require having community-level or sub-district-level data. This can be very expensive and time-consuming to collect especially in large or highly-populated countries. Often it is also not cost-effective, as the cost of praziquantel and its distribution can be lower than that of epidemiological surveys. In addition, planning for outreach public-health interventions and supervision is usually done at district level.

Figure 1.1. The geographical distribution of the disease worldwide in 2010.



Within target areas, the population groups eligible for preventive chemotherapy vary according to the levels of prevalence of infection detected. The primary target group is represented by school-age children, among whom peaks in prevalence and intensity of infection are usually detected and the most significant improvements in terms of reduction of morbidity after treatment are observed (*42*). Adults can also be considered eligible for preventive chemotherapy interventions in areas where prevalence of intensity is moderate (≥10% but <50%) or high (≥50%), and also depending on their occupations or risk factors for infection.

The level of prevalence of infection in an area is used to determine the frequency of treatment (interval of re-treatment). In areas of high prevalence, the recommended frequency is once a year, with longer intervals for moderate and low-prevalence areas. After achieving successful morbidity control, a number of countries have adjusted the risk thresholds downwards with the aim of enhancing the impact, and have focused control activities on "hot spots" of transmission (*17*).

1.6 From control to elimination

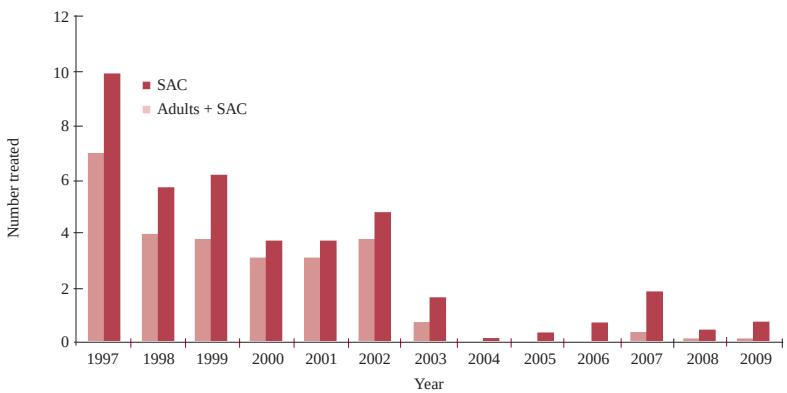
Even though the aim of the WHO strategy for schistosomiasis developed in 2001 and updated in 2006 is to control morbidity, a number of endemic countries have intensified their control efforts so as to achieve significant reductions in transmission. Examples of such countries are Burkina Faso, Cambodia, China, Egypt, Mauritius and Morocco (*43–45*). The national programmes of these countries have usually combined snail control through the use of molluscicides or environmental management and large-scale use of praziquantel, and have produced a reduction in the size of the endemic area and/or the prevalence of infection from pre-intervention levels. Evidence gathered in Egypt is discussed in detail in *Box 1*.

Box 1. Scaling up schistosomiasis control in Egypt: from morbidity control towards the interruption of transmission

The Egyptian government, through the Ministry of Health and Population, established the National Schistosomiasis Control Programme in 1977. This followed years of implementing separate projects in different areas of the country. A national survey completed in 1983 showed that the prevalence of *Schistosoma haematobium* was 35%, while that of *S. mansoni* was 38.5% (A. Haggag, personal communication). The control programme was re-launched in 1988 with a large-scale information, education and communication campaign and treatment free of charge with praziquantel for those found positive following parasitological diagnosis. This campaign successfully attracted many people to primary health-care facilities for diagnosis and treatment.

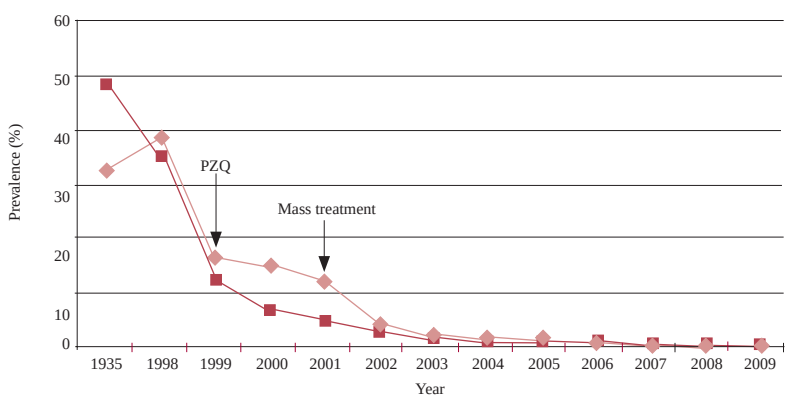
In surveys conducted in 1996, it was found that 1146 villages had a prevalence of schistosomiasis infection higher than 10%; in 492 villages, the prevalence of the infection exceeded 20%. In order to achieve greater impact from chemotherapy and to reduce transmission further, mass treatment without individual diagnosis was carried out in schools and villages from 1997 onwards. The prevalence threshold for mass treatment was initially set at >20% in school-age children (SAC). Mass treatment was carried out for the first 5 years and thereafter there were fewer treatments carried out only in foci or "hot spots" of transmission (see figure below[a]).

Progression of schistosomiasis treatments in Egypt



The thresholds for mass treatment were progressively reduced from ≥20% in 1997 to ≥3% in 2003. A total of 9.9 million people were treated for schistosomiasis through mass treatment in 1997, and this number progressively reduced to 680 000 people treated in 2009. A total of 38.2 million children and adults were covered with mass treatment between 1997 and 2009. During this period, a further 9 million people were diagnosed and treated through primary health-care facilities as part of the monitoring and surveillance system where outpatients, a 10% sample of the population and SAC are screened for infection. In 2003, only 20 villages in the whole country had a prevalence of infection ≥3% and <5%, and were considered hot spots of transmission. Initial (1996) prevalence of infection of 5% for *S. haematobium* and 11.9% for *S. mansoni*, decreased to 0.4% and 0.3%, respectively, in 2010 (see figure below).

Schistosomiasis control in Egypt



	1935	1983	1988	1993	1996	2000	2004	2005	2006	2007	2008	2009	2010
S. *haematobium*	48	35	11.9	6.6	5	3	1.6	1.4	1.2	0.9	0.6	0 5	0.4
S. *mansoni*	32	38.6	16.4	14.8	11.9	4.2	1.9	1.6	1 5	0.6	0.6	0.4	0 3

This evidence from the Egyptian national programme shows that widespread administration of praziquantel to all those eligible for preventive chemotherapy, SAC and adults, at the beginning of a control programme results in significant reductions in morbidity, prevalence and intensity of infection, as well as transmission, as has been noted in Brazil, Burkina Faso, China, Uganda and elsewhere (*17*, *18*, *47–49*).

While preventive chemotherapy had a significant impact on schistosomiasis in Egypt, it was complemented by snail control, provision of potable water and improved sanitation. The Egyptian government made significant investments to improve infrastructure in rural areas, with >90% of households having tap water as of 2008 (*50*). Agricultural and irrigation practices that minimize schistosomiasis transmission were adopted. Snail control, using niclosamide, was carried out in all endemic areas of the country at the beginning of the control programme; as for chemotherapy, by 2009 snail control was limited to hot-spots of transmission. Indices of schistosomiasis infection in snail intermediate hosts declined significantly during 1997–2010.

[a] Figures adapted from data and presentations from the Ministry of Health and Population, Arab Republic of Egypt, 2011

The actual impact of the large-scale use of praziquantel – when implemented alone – on transmission rates has been a subject of debate. Over the years, population-based treatment has increasingly been regarded as a public-health tool capable of decreasing and interrupting transmission of some helminth infections. Efforts to eliminate lymphatic filariasis globally and onchocerciasis from the Region of the Americas, in fact, rely on large-scale distribution of anthelminthics such as ivermectin, diethylcarbamazine and albendazole. For schistosomiasis control, mass treatment employing different medicines has been advocated for many years, and evidence has shown that its large-scale use is capable of decreasing schistosomiasis transmission rates through reduced environmental contamination by eggs discharged by infected people (*6*). This impact is more evident with urogenital than with intestinal schistosomiasis (*46–48*).

1.7 Aim of this document

Measures to control schistosomiasis have been implemented for a significant number of years. This document aims to report the progress made since 2001 and delineate the strategic directions for the future. The achievements accomplished in the past 10 years in terms of performance of the different control programmes and their impact on morbidity and transmission of schistosomiasis are discussed. The obstacles met and the challenges for the future are also presented.

Based on the successful experience and new evidence accumulated over the past years, this document formalizes the need for all endemic countries to push control of schistosomiasis a step further than recommended up to now, thus achieving elimination of schistosomiasis as a public-health problem and eventually the interruption of its transmission. Definitions and criteria are provided here for each progressive step; they are expected to assist countries in monitoring their progress towards the final goal.

Attention is dedicated to regional highlights with the aim of providing detailed information on the status of schistosomiasis across the world, and discussing the priorities and the need for each WHO region.

Finally, by recognizing the key role of preventive chemotherapy in achieving the different goals set by this document, estimates are provided on the yearly number of people requiring treatment with praziquantel and on the projected needs for the period 2012–2020 and beyond.

Section 2

Progress report 2001–2010

The aim of this section is to outline the progress made in expanding large-scale distribution of praziquantel to people eligible for this intervention in the 10 years since the adoption of resolution WHA54.19 in terms of both performance and impact (*28*).

Availability of epidemiological information on geographical distribution and burden of schistosomiasis in a given country is the key preliminary step to identify target areas and population and to define the modalities of implementation of preventive chemotherapy interventions with praziquantel. Such data can also be used to generate operational maps showing the levels of endemicity of different areas within a country, as well as the different type of interventions that are needed in such areas.

Some data are nowadays available from all the countries where schistosomiasis is transmitted thanks to field surveys conducted by different institutions for research and control purposes. In some of these countries, however, data need to be updated and integrated by complementary surveys; on the contrary, in other countries information is sufficient to start large-scale control interventions; finally, in other countries, large-scale control interventions are already under way and new epidemiological information is being generated by the monitoring and evaluation components of such programmes with the aim of providing feedback to the implemented activities.

Some high-burden countries, such as the Democratic Republic of the Congo, Ethiopia and Nigeria, still have significant gaps in epidemiological data and need extensive mapping exercises to facilitate scaling up of much-needed preventive chemotherapy interventions.

Once a preventive chemotherapy intervention has started, coverage is the key and basic indicator that should be monitored. This will allow tracking the progress towards the goal set by resolution WHA54.19, that is, of providing regular administration of praziquantel to target population groups. WHO is committed to monitoring coverage of preventive chemotherapy interventions directed against schistosomiasis and other helminth infections through a non-stop process of data collection, compilation, cleaning and analysis

carried out in collaboration with Member States and partners. This information is then published on a dedicated, open-access databank hosted by the WHO web site.[1]

As the goal set by the strategy developed by WHO and its partners against schistosomiasis was control of morbidity, a set of additional indicators was defined to monitor the progress made towards the achievement of this goal. These indicators are prevalence and intensity of infection. Intensity of infection, in particular, can be considered as a proxy for schistosomiasis-attributable morbidity. This is the case for most helminth infections, as the number of worms infecting an individual (worm load or worm burden) and the damage they cause, are directly linked. WHO recommends the inclusion of a monitoring and evaluation component in any schistosomiasis control programme, and suggests collecting these indicators regularly (at least every 2 years). Financial and technical resources should be regularly allocated to monitoring and evaluation activities so as to allow appropriate feedback to programme managers. It is suggested that between 5% and 10% of the control programme budget should be set aside for monitoring and evaluation.

Coverage is primarily a performance indicator, while prevalence and intensity of infection are impact indicators. However, when resources are limited and a proper evaluation of prevalence and intensity cannot be realized, coverage can be considered as a proxy indicator for measuring the progress towards control of morbidity. This is because relevant evidence exists showing that administration of praziquantel produces a decrease in morbidity associated with schistosomiasis. As such, if an individual receives and swallows praziquantel, he or she will experience a reduction in morbidity. If done effectively, actively-determined coverage can therefore be used as a proxy impact indicator.

The last part of this section is dedicated to the challenges that still need to be overcome if control and elimination of schistosomiasis are to be achieved.

2.1 Performance

Data preceding 2001 had suggested that the number of *Schistosoma*-infected persons was 193 million and that the number of those at risk of infection (that is, people living in endemic areas) was 652 million (*51*).

Given that resolution WHA54.19 and the public-health strategy that followed in 2001 were mainly directed towards school-age children, and that the frequency of treatment was less than once a year in areas where prevalence of infection was <50%, the number of people eligible for preventive chemotherapy at a given point in time would have been considerably lower than 652 million. Recent estimates based on recommendations on morbidity control suggest that the number of people requiring treatment every year is approximately 237 million (*Annex 4*). Further persons living in areas of residual transmission might be eligible for intensified preventive chemotherapy in countries that aim to interrupt transmission of schistosomiasis (see *section 3.2*).

In 1981, the countries that had national control programmes were the Bolivarian Republic of Venezuela, Brazil, China, the Dominican Republic, Egypt, Iraq, the Islamic

[1] The PCT [preventive chemotherapy and transmission control] databank: http://www.who.int/neglected_diseases/preventive_chemotherapy/databank/en/index.html

Republic of Iran, Morocco, the Philippines, Puerto Rico, Saint Lucia and Tunisia. Mali started its activities in 1982. In these countries, large-scale distribution of praziquantel was one of the possible public-health measures implemented, but often not the only or the main one. As a result of such efforts, all these countries significantly reduced transmission rates and schistosomiasis-associated morbidity. Some of them reached a low-endemicity status, while others were not able to consolidate their achievements, with the consequence that levels of infection returned to pre-intervention levels.

After resolution WHA54.19 was adopted in 2001, control programmes gradually redirected the strategic focus of their interventions towards preventive chemotherapy, and an increasing number of countries resumed implementing large-scale distribution of praziquantel.

Although limited information is available on numbers of people treated in the period spanning from the 1980s to the early 2000s, a slow but steady expansion of coverage was registered, such that in 2006, 15 countries were implementing preventive chemotherapy, reaching a total of 12 359 288 people. In 2007, the number of countries increased to 17 (14 258 741 people were treated). In 2008, this rose again to 20 countries and 18 261 346 people treated; in 2009, 26 countries and 19 959 579 people treated; and 30 countries and 34 803 697 people treated in 2010.

The figures above show that, during the past 5 years, when endemic countries began systematically reporting data on schistosomiasis treatment to WHO, there has been a significant scaling-up in preventive chemotherapy for schistosomiasis, and that the number of people treated almost tripled between 2006 and 2010. However, this number still represents only 13% of the people requiring preventive chemotherapy for schistosomiasis.

More promising is the progressive increase in the number of endemic countries that are implementing treatment programmes. In 2010, 51% of endemic countries had schistosomiasis control programmes, up from 27.5% in 2006. It is also encouraging that, of the 10 most endemic countries, all in WHO's African Region and accounting for 67.4% of the number of people requiring treatment for schistosomiasis, 7 had treatment programmes in 2010. Unfortunately, the national treatment coverage in these 7 countries was only 6.1% of the 110.5 million people requiring treatment. The range in coverage was 4% in Nigeria, the country estimated to account for 24.5% of the global population requiring preventive chemotherapy, to 27.5% in Ghana.

The significant increase in the number of people treated for schistosomiasis was due in large part to the advocacy and increased resources allocated to the control of neglected tropical diseases. This started in 2003 with the Schistosomiasis Control Initiative funded by the Bill & Melinda Gates Foundation, the subsequent interest of major development partners and the donation of praziquantel by Merck KGaA. Several bilateral agencies and partners have also pledged resources for implementation and for praziquantel. Additional praziquantel and resources will be required to scale up schistosomiasis control. While 52[1] countries have populations requiring preventive chemotherapy for schistosomiasis, Brazil, China and Egypt have sufficient resources and technical capacity for widespread implementation. Some 40 countries in the African Region, 3 in the Eastern Mediterranean Region and 1 in the Western Pacific Region will require technical and financial assistance to scale up schistosomiasis control.

[1] With the inclusion of the Republic of South Sudan.

Figure 2.1 shows the number of countries in which people were treated for schistosomiasis and coverage globally, and by WHO region (*Figure 2.2*) in 2006–2010.

Figure 2.1 Reported number of people treated for schistosomiasis, and treatment coverage globally, 2006–2010

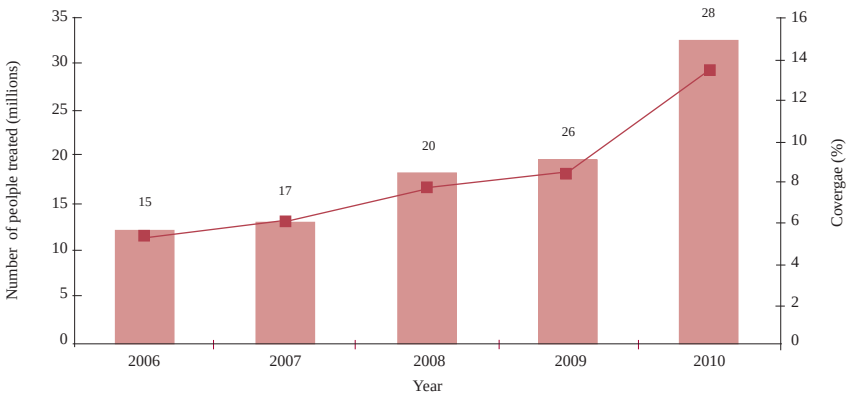
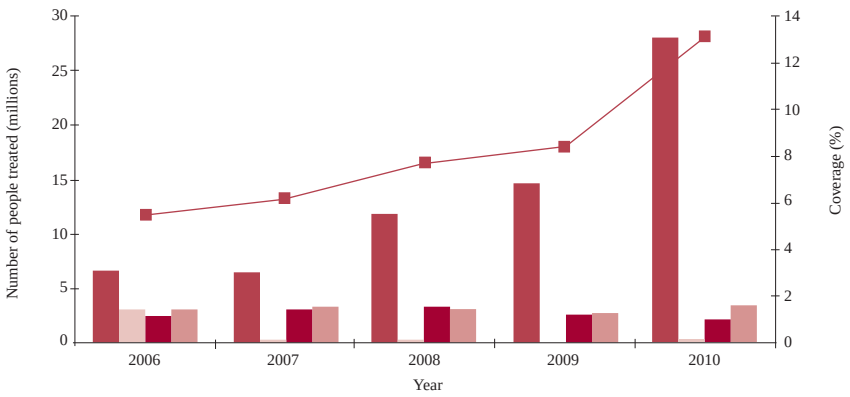


Figure 2.2 Reported number of people treated for schistosomiasis and treatment coverage by WHO region, 2006–2010



	2006	2007	2008	2009	2010
AFR	6696140	6481371	11805750	14735638	28535607
AMR	154394	123905	76306	30418	41336
EMR	2510000	3173329	3309815	2551316	2852874
WPR	3010071	3296960	3069475	2642207	3373880
Coverage (%)	5.47	6.16	7.71	8 39	13.1

2.2 Impact

A large number of studies carried out in schistosomiasis-endemic countries around the world have confirmed the effectiveness of the preventive chemotherapy approach by showing that regular treatment with praziquantel results in decreased infection indicators and reduced morbidity associated with any form of schistosomiasis. After a single administration of praziquantel (40–60 mg/kg), the observed parasitological cure rate (measured as interruption of egg

excretion) is usually between 70% and 100%. Among those people who are not cured, egg counts and circulating antigen concentrations are usually reduced by more than 95%. Epidemiological, clinical and imaging studies, with follow-up periods ranging from weeks to months, have shown a post-treatment reduction of the number of pathological conditions associated with schistosomiasis (*52–54*). The impact of treatment at regular intervals has been shown to go beyond that of isolated administration of praziquantel and to be significantly associated with a progressive reduction of disease-associated indicators. The main outcomes include the control of existing morbidity and the prevention or reduction of the risk of developing new lesions; reduced mortality, improvements in cognitive functions, especially among children, and increased work productivity. The impact of preventive chemotherapy with praziquantel may also be associated with a reduced risk of acquiring or transmitting infection with the human immunodeficiency virus (HIV) because of the prevention of the development of genital lesions associated with *S. haematobium* (*29*).

The main outcomes of preventive chemotherapy interventions with praziquantel among persons affected by different forms of schistosomiasis are summarized in *Table 2.1*.

Table 2.1 Observed impact of preventive chemotherapy with praziquantel among people affected by schistosomiasis

Species	Observed impact
All species	Reduced prevalence of infection Reduced intensity of infection Reduced prevalence of anaemia Reduced mortality Reduced pain Improved physical fitness Improved linear growth (height) Improved weight status Improved nutritional status Improved cognitive functions Increased worker productivity Increased appetite Increased skin-fold thickness Increased lifespan (i.e. higher average age of death)
S. haematobium	Reduced haematuria Reduced microhaematuria Reduced bladder wall abnormalities (polyps, masses, ulcers) Reduced upper urinary tract abnormalities (e.g. hydronephrosis) and obstruction Reduced genital lesions Reduced incidence of bladder cancer
S. intercalatum *S. japonicum* *S. mansoni* *S. mekongi*	Reduced prevalence of diarrhoea Reduced prevalence of abdominal pain Reduced prevalence of bloody diarrhoea Reduced hepatomegaly Reduced splenomegaly Reduced periportal liver fibrosis Reduced portal hypertension

In some settings, preventive chemotherapy has been successfully integrated with complementary public health measures such as environmental management, provision of water and sanitation and snail control thus achieving a more pronounced and sustained impact on transmission rates and consequently on infection and associated morbidity.

More recently, evidence collected in Burkina Faso and Uganda indicates that, after large-scale distribution of praziquantel, infection indicators remain at very low levels for a longer time than previously expected (*47, 48*). This has been shown to occur particularly in areas where preventive chemotherapy has achieved high coverage rates, thus reducing simultaneously contamination of the environment with parasite eggs by infected people. This finding suggests that praziquantel is not only effective in achieving control of morbidity but also in reducing transmission. Such consideration opens the possibility of achieving interruption of schistosomiasis transmission through large-scale treatment of the human host, although additional measures may also be needed to do so more efficaciously and rapidly.

2.3 Challenges

A number of obstacles still limit the scaling up of schistosomiasis control activities in a number of endemic countries. They need to be overcome in order to achieve control and elimination of schistosomiasis. Among the challenges are:

2.3.1 Political commitment

- To raise the political commitment for control and elimination of schistosomiasis
- To secure adequate financial resources
- To improve access to praziquantel (*Box 2*)

2.3.2 Coordination

- To enhance in-country coordination
- To promote international coordination

2.3.3 Communication

- To increase understanding of the public-health importance of schistosomiasis
- To improve awareness on disease control and elimination interventions being implemented by affected populations and through leadership in endemic countries
- To encourage programme ownership by the communities targeted by the intervention
- To overcome occasional negative reactions to the intervention by the target communities
- To improve understanding of concurrent dietary requirements by target individuals during preventive chemotherapy

Box 2. The availability of praziquantel

Praziquantel is the only medicine recommended by WHO for the treatment of all forms of schistosomiasis and is regarded as the medicine of choice in both clinical practice and public-health interventions.

Despite the significant cost reductions that have followed patent expiry, praziquantel remains one of the most expensive anthelminthics on the market. A tablet of praziquantel costs approximately US$ 0.07, and the average treatment costs US$ 0.25. A number of studies have shown that drug costs represent the most significant proportion of the overall expenditures incurred by a schistosomiasis control programme.

In addition, the quantity of praziquantel currently available in the international market is not sufficient to meet the requirements of all schistosomiasis-endemic countries.

It is evident that these two constraints have represented – and still represent – limiting factors to the full-scale implementation of activities aimed at tackling schistosomiasis.

The recent commitment made by DFID, Merck KGaA and USAID to donate significant amounts of praziquantel to schistosomiasis-endemic countries will boost the number of active control programmes around the world, in addition to increasing their geographical and treatment coverage.[a]

The expansion of the Merck KGaA praziquantel donation from 25 million tablets per year to 250 million tablets per year will allow for the treatment of all school children requiring treatment, and go a long way to meeting the praziquantel gap.

[a] Table 2 adapted from a report of a WHO informal consultation on expanding schistosomiasis control in Africa (*55*).
* The amount of funds required to purchase praziquantel for 2010 had not yet been determined at the time of the meeting.

Table 2: Five-year summary of projected PZQ demand based on known donor financing and in-kind donations

Donor agency	Number of PZQ tablets donated per year (million)				
	2010	2011	2012	2013	2014
USAID	60*	104 −138	104 −138	104 −138	104 −138
DFID	40	40	40	40	40
Other	10	10	10	10	10
Total donor financed PZQ supply	110	154 −188	154 −188	154 −188	154 −188
Merck Germany (in-kind donation)	20	20	20	20	20
Total including Merck donation	130	174 −208	174 −208	174 −208	174 −208

2.3.4 Technical capacity

- To strengthen technical capacity
- To promote technical support to countries
- To provide guidance on sustaining or scaling down preventive chemotherapy when elimination is approaching

2.3.5 Monitoring and evaluation

- To increase information on the geographical distribution of schistosomiasis
- To use standard indicators and methods for monitoring and evaluation
- To ensure adequate reporting and response to adverse events following treatment
- To monitor the potential development of resistance to praziquantel
- To provide sufficient resources for monitoring and evaluation
- To improve programme data reporting

2.3.6 Operational guidance

- Operational issues requiring further attention in ongoing control programmes, such as:
  - inappropriate diagnostic tools in low-transmission settings;
  - underestimated burden of schistosomiasis (*Box 3*);
  - optimization of frequency of treatment;
  - schistosomiasis in preschool-age children;
  - HIV and schistosomiasis;
  - (micro) haematuria without schistosomiasis;
  - inadequate tools for snail control and water management

2.3.7 Complementary public-health interventions

- To increase guidance on implementation of complementary public-health interventions
- To improve technical capacity and resources for vector control

Box 3. Underestimation of the public-health burden of schistosomiasis

While the scientific community has reached a consensus on the geographical extent of schistosomiasis-endemic areas, and the number of people who are infected or at-risk of infection, the debate on the magnitude of the public-health burden of morbidity and disability from schistosomiasis is ongoing. The main point relates to the "correct" attribution of burden when symptomatology and pathology are manifest in people affected by more than one infection or disease.

Nevertheless, scientists agree that the burden of morbidity, disability and mortality (expressed in DALYs [disability-adjusted life years]) attributable to schistosomiasis has been considerably underestimated in the past. In particular, studies have recognized the importance of counting in the co-occurring "subtle" morbidity (that is, pathological conditions beyond those readily attributable to schistosomiasis, such as malnutrition, anaemia, chronic diarrhoea and chronic pain that result in reduced fitness and therefore in poor school performance and reduced work productivity) (*56*).

It is evident that an underestimate of the burden of schistosomiasis poses a limit to the implementation of disease control efforts as it reduces the public-health importance of this disease in the public-health arena.

Section 3

Endemic countries and their classification

The number of countries in which schistosomiasis is endemic was first reviewed by a WHO Expert Committee in 1991 (*57*). In total, 78 countries and territories had been listed as endemic (*Annex 5*), of which 42 were in the WHO African Region, 10 in the WHO Region of the Americas, 16 in the WHO Eastern Mediterranean Region, 1 in the WHO European Region, 3 in the WHO South-East Asia Region and 6 in the WHO Western Pacific Region.

Three additional countries and one territory can be added to the list, resulting in a comprehensive database (*Table 3.1*). The additional countries and territories are: Eritrea, which gained its independence in 1993 (in the African Region); Montserrat, which was included in a previous list (1985) (*13*) but removed in 1993, and whose epidemiological status remains uncertain (in the Region of the Americas); South Sudan, which separated from Sudan in 2011 (in the Eastern Mediterranean Region); and Djibouti, in which a focus of *S. mansoni* was reported in the 1990s (*58*) (also in the Eastern Mediterranean Region). The list below includes all countries where schistosomiasis has been documented since the beginning of the 20th century, for a total of 78.

3.1 Status of countries endemic for schistosomiasis

Based on available information to date, it has been determined that 52[1] countries currently require implementation of preventive chemotherapy; 7 countries require updating of their schistosomiasis status for planning and implementation purposes; and 19 countries require evaluation of their schistosomiasis status in order to verify if interruption of transmission has already been achieved (*Table 3.1*).

Details on populations requiring preventive chemotherapy in the 52 endemic countries are provided in *Annex 4*.

[1] Estimates of populations requiring preventive chemotherapy officially show 51 countries (*Annex 4*). This is because the populations in South Sudan and Sudan will not be separated until the official border line between the two countries is established.

Table 3.1 Status of schistosomiasis-endemic countries in the WHO regions[a]

Group	Countries and territories
Countries requiring preventive chemotherapy	**African Region**: Angola, Benin, Botswana, Burkina Faso, Burundi, Cameroon, Central African Republic, Chad, Congo, Côte d'Ivoire, Democratic Republic of the Congo, Equatorial Guinea, Eritrea, Ethiopia, Gabon, Gambia, Ghana, Guinea, Guinea-Bissau, Kenya, Liberia, Madagascar, Malawi, Mali, Mauritania, Mozambique, Namibia, Niger, Nigeria, Rwanda, Sao Tome and Principe, Senegal, Sierra Leone, South Africa, Swaziland, Togo, Uganda, United Republic of Tanzania, Zambia, Zimbabwe **Region of the Americas**: Brazil, Venezuela (Bolivarian Republic of) **Eastern Mediterranean Region**: Egypt, Somalia, South Sudan, Sudan, Yemen **South-East Asia Region**: Indonesia **Western Pacific Region**: Cambodia, China, Lao People's Democratic Republic, Philippines
Countries requiring updating for planning and implementation purposes	**Region of the Americas**: Saint Lucia, Suriname **Eastern Mediterranean Region**: Iraq, Libya, Oman, Saudi Arabia, Syrian Arab Republic
Countries requiring evaluation in order to verify if interruption of transmission has been achieved	**African Region**: Algeria, Mauritius **Region of the Americas**: Antigua, Dominican Republic, Guadeloupe, Martinique, Montserrat, Puerto Rico **Eastern Mediterranean Region**: Djibouti, Iran (Islamic Republic of), Jordan, Lebanon, Morocco, Tunisia **European Region**: Turkey **South-East Asia Region**: India, Thailand **Western Pacific Region**: Japan, Malaysia

[a] Source: http://www.who.int/neglected_diseases/ntddata/sch/sch.html

3.2 Progression towards elimination of schistosomiasis

It is desirable that schistosomiasis-endemic countries progressively scale up their objective from control of morbidity to elimination as a public-health problem, in order to eventually achieve interruption of transmission. *Figure 3.1* presents the recommended overall steps of a national programme for control and elimination of schistosomiasis. *Table 3.2* shows the progression of objectives in terms of recommended interventions, targets and timelines.

Figure 3.1 Programmatic steps to control and eliminate schistosomiasis

Table 3.2 Progression towards elimination of schistosomiasis

GROUP	1. Countries eligible for control of morbidity	2. Countries eligible for elimination as a public-health problem	3. Countries eligible for elimination (interruption of transmission)	VERIFICATION	4. Countries that have achieved elimination
Goal	Control of morbidity	Elimination as a public-health problem	Elimination (interruption of transmission)		Post-elimination surveillance
Recommended intervention	Preventive chemotherapy Complementary public-health interventions, where possible	Adjusted preventive chemotherapy Complementary public-health interventions strongly recommended	Intensified preventive chemotherapy in residual areas of transmission Complementary public-health interventions essential		Surveillance to detect and respond to resurgence of transmission and to prevent reintroduction (schistosomiasis should be made notifiable)
Target	100% geographical coverage and at least 75% national coverage Prevalence of heavy-intensity infection <5% across sentinel sites[a]	Prevalence of heavy-intensity infection <1% in all sentinel sites	Reduction of incidence of infection to zero		Incidence of infection remains zero (no autochthonous cases)
Group progression (1 to 4)	Up to 5–10 years from joining the group	Up to 3–6 years from joining the group	Up to 5 years from joining the group		Until all countries have interrupted transmission

[a] In countries where a single site (community, village) remains with a prevalence of heavy-intensity infection 5%, the area pertaining to that site can be considered as a separate implementation unit (IU) such that all other IUs in the country can move ahead to the next group (independently of the delayed IU).

Existing recommendations on frequency of treatment and target populations (*Table 1.1*) were developed with the aim of controlling morbidity associated with schistosomiasis and might not be sufficient to achieve the interruption of transmission.

As a programme progresses through its different stages, it is expected that activities are gradually reorganized such that more robust means are deployed in progressively smaller areas of residual transmission. Such a "final push" approach relies on both preventive chemotherapy and the implementation of complementary public-health interventions.

When control of morbidity is achieved, it may be therefore appropriate to adjust preventive chemotherapy to the new epidemiological conditions by lowering the prevalence risk thresholds envisaged in *Table 1.1*. And beyond the stage at which elimination as a public-health problem is achieved, a more aggressive strategy might be required in order to attain the more ambitious goal of interrupting transmission: such intensified preventive chemotherapy consists of implementing the distribution of praziquantel at a frequency that is higher, and/or to population groups that may be different than those contemplated in *Table 1.1*.

Complementary public-health interventions include health education for behavioural change, provision of safe water and sanitation, environmental management and snail control. They are strongly recommended in areas approaching elimination as a public-health problem and essential when interruption of transmission is aimed at.

The implementation of preventive chemotherapy in conjunction with health education, access to clean water, sanitation improvement, environmental snail control and focal molluscicide is referred to as the PHASE approach in the Regional Strategic Plan on Schistosomiasis developed by WHO's Regional Office for Africa.

3.3 Resolution WHA65.21 on the elimination of schistosomiasis

The progress in schistosomiasis control reported in previous sections and the fact that 19 formerly endemic countries have not reported autochthonous cases in more than ten years suggest that the interruption of schistosomiasis transmission, and therefore elimination of the infection are feasible.

The World Health Assembly, at its 65th session, noted the progress made in schistosomiasis control and called on all endemic countries to intensify control interventions and strengthen surveillance. In adopting resolution WHA65.21, the Member States also requested the World Health Organization to mobilize resources required to support integrated and multi-sectoral control programmes and for countries to initiate elimination campaigns.

Resolution WHA65.21 also called for the development of guidelines for endemic countries to embark on elimination programmes and means for documenting progress. The resolution also recommended elaboration of procedures to evaluate the interruption of transmission and to certify that transmission of schistosomiasis has been eliminated. The Secretariat was requested to report on progress towards the elimination of schistosomiasis to the Executive Board and The World Health Assembly every three years.

Section 4

Strategic plan 2012–2020

4.1 Background

Over the decades, several countries have implemented schistosomiasis control successfully. In Brazil, Burkina Faso, Cambodia, China, Egypt, Morocco and Uganda, large-scale treatment has resulted in the significant reduction in indices of infection and morbidity. After a successful vertical programme in Brazil, the schistosomiasis control programme was devolved to local health services. In Cambodia, China, Egypt and Morocco, programmes were implemented through the primary health-care systems but with central direction, and with significant reduction of transmission or its interruption as the aim. In Burkina Faso, Uganda and other countries that scaled up preventive chemotherapy, the full impact of control efforts is now ready for evaluation to determine if the approaches taken are reducing transmission. Few other countries have undertaken large-scale preventive chemotherapy for schistosomiasis such that the goal to regularly treat at least 75% of school-age children by 2010 globally has not been attained. The major impediment to schistosomiasis control has been the limited access to praziquantel. Lastly, many endemic countries do not have the public-health infrastructure or the necessary resources to implement schistosomiasis control.

With the current interest in control of neglected tropical diseases, and the opportunities for integration, this is the appropriate time to lay out a framework for scaling up schistosomiasis control. The strategic plan outlined here can guide governments and their ministries of health and education, as well as their development partners.

4.2 Vision, goals and objectives

The vision of the Strategic Plan contemplates a world free of schistosomiasis (*Table 4.1*).

Table 4.1 Vision, goals and objectives of the schistosomiasis Strategic Plan

Vision	A world free of schistosomiasis
Goals	To control morbidity due to schistosomiasis by 2020 To eliminate schistosomiasis as a public-health problem by 2025 To interrupt transmission of schistosomiasis in the Region of the Americas, the Eastern Mediterranean Region, the European Region, the South-East Asia Region and the Western Pacific Region, and in selected countries of the African Region by 2025
Objectives	To scale up control and elimination activities in all endemic countries; To ensure an adequate supply of praziquantel and resources to meet the demand

Three goals have been set to achieve this vision: to control morbidity due to schistosomiasis by 2020 in all endemic countries; to eliminate schistosomiasis as a public-health problem by 2025 in all endemic countries; and to interrupt transmission of schistosomiasis in all endemic countries in the Region of the Americas, the Eastern Mediterranean Region, the European Region, the South-East Asia Region and the Western Pacific Region by 2025. Some countries, but not all, in the African Region will also have interrupted schistosomiasis transmission by 2025.

The first goal will be achieved when the targets of 100% geographical coverage, 75% national coverage and <5% prevalence of heavy-intensity infections are achieved in all schistosomiasis-endemic countries. The second goal will be achieved when the prevalence of heavy-intensity infections is <1% in all endemic countries. The third goal will be achieved when the incidence of schistosomiasis is reduced to zero.

In order to accomplish these goals, the operational objectives of the Strategic Plan must be met. These include scaling up activities aimed at controlling and eliminating schistosomiasis in all endemic countries, and ensuring that an adequate supply of praziquantel and resources is available to all countries.

School-based delivery of chemotherapy is an effective way to reach children of school age. In some settings, school-age children and adults can also be reached through community-based interventions. Several preventive chemotherapy programmes are ongoing and should be used to scale up schistosomiasis control in an integrated manner. The Carter Center-assisted health programmes have integrated schistosomiasis treatment into ongoing control programmes for lymphatic filariasis, onchocerciasis and soil-transmitted helminthiases (*59*).Where there is infrastructure for primary health care, such as in China, Egypt, Morocco and Saudi Arabia, schistosomiasis treatments can be efficiently delivered through this system.

Whatever channel for preventive chemotherapy is used, it should be supported by a monitoring and surveillance system that allows assessment of impact as well as identification of remaining foci of high transmission.

While preventive chemotherapy is the most important component in schistosomiasis control, other operational components, such as health education for behavioural change, provision of safe water and sanitation, environmental management and snail control, are necessary for a comprehensive control programme. Health education can ensure that populations understand, and are compliant with, control interventions, as well as to practise preventive behaviours. Potable water is a basic need and reduces contact with schistosome cercariae-infested water bodies. Adequate sanitation can reduce contamination of water and transmission to the snail intermediate hosts. With successful morbidity control in the human host, these other components become important to move towards the interruption of schistosomiasis transmission. Snail control through environmental management and chemical control becomes feasible when transmission foci can be clearly delineated and treated.

4.3 Control of morbidity

The most rapid and cost-effective means to prevent and reduce morbidity due to schistosomiasis is through chemotherapy with praziquantel. The phased scale-up of schistosomiasis treatment in countries with populations requiring preventive chemotherapy proceeds as follows:

- initiation of large-scale treatment in areas where schistosomiasis is transmitted: the challenge will be to scale up treatment to 100% geographical coverage of endemic areas;
- praziquantel should be administered at least according to the recommendations described in *Table 1.1* (such guidelines, which represent a minimal package of interventions, can be adjusted by national health authorities based on local considerations);
- where 75% national coverage has been achieved for a number of years, but where transmission remains high, the frequency of treatment and the need for other complementary control components should be re-examined.

As discussed earlier, there is overwhelming evidence on the benefits of treatment for schistosomiasis in terms of control of morbidity. Treatment with praziquantel has consequently resulted in reductions in hospital admissions and mortality due to schistosomiasis (*49*, *60–68*).

Sustained coverage of at least 75% of people requiring preventive chemotherapy for several years will result in a progressive decrease of prevalence and intensity of infection such that only a small proportion (<5%) of people will have heavy-intensity infections. Below this threshold, control of morbidity will be achieved in the target population. *Table 4.2* provides details on the thresholds of egg density used for classifying the intensity of schistosome infections.

Table 4.2 Classes of intensity of schistosomiasis infection[a]

Organism	Light-intensity infections	Moderate-intensity infections	Heavy-intensity infections
S. mansoni[b]	1–99 epg	100–399 epg	400 epg
S. haematobium	<50 eggs/10 ml	–	50 eggs/10 ml

[a] Source: *Prevention and control of schistosomiasis and soil-transmitted helminthiasis. Report of a WHO Expert Committee* (*27*).
[b] Applies also to other species that cause intestinal schistosomiasis.

A number of challenges have to be overcome before control of morbidity is achieved.

The first is the implementation rate. For example, as mentioned, among the 10 most highly endemic countries, only seven have recently initiated control programmes; and in such countries, the estimated national coverage is very low. Significant mapping gaps exist, especially for intestinal schistosomiasis, and limit the scaling-up of disease control measures. Nonetheless, efforts to improve both coverage and mapping are on-going.

Another challenge to scaling up schistosomiasis treatment is the availability of, and access to, praziquantel. It is estimated that 657 million praziquantel tablets would be required to treat the estimated 237 million people requiring preventive chemotherapy in 2011. However, only 110 million tablets were pledged by the main donors. Experience from Egypt, among other places successfully scaling up praziquantel treatments, demonstrates that generous use of praziquantel to ensure almost universal coverage for the first few years will result in a significant reduction in the amount of praziquantel required for subsequent rounds of treatment (*see Figure 6.1*).

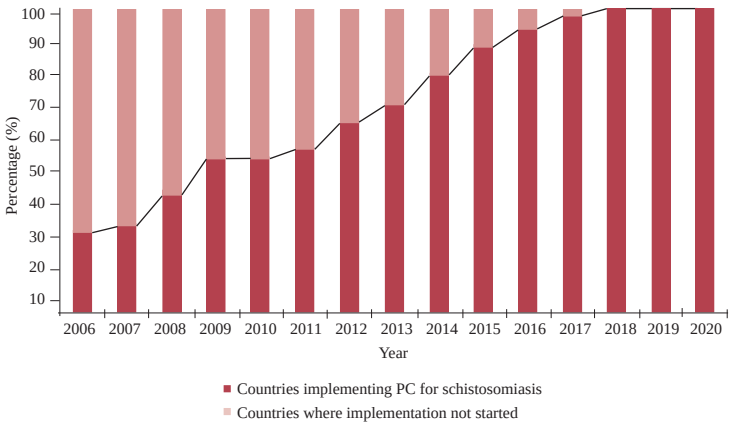
Along with access to praziquantel, there is a need for additional resources to support implementation in the field. Of the 10 highly endemic countries, only Cameroon, Ghana, and Uganda had substantial support for schistosomiasis control in 2010. In Nigeria, the Carter Center provided support to integrated programmes in Delta, Edo, Nasarawa and Plateau states, where 1.33 million school-age children were treated for schistosomiasis in 2010. A similar number of children were treated in seven other Nigerian states, with support from the Federal Ministry of Health.

In 2010, 26 of the 51[1] countries where large-scale treatment for schistosomiasis is required were implementing treatment programmes. It is expected that the number of countries implementing programmes will gradually increase, with all countries initiating programmes by 2018 (*Figure 4.1*). This milestone year will coincide with a reduction of three countries that should have interrupted schistosomiasis transmission.

In order to assess progress in implementation of schistosomiasis control, it is essential to have a robust monitoring and evaluation system that will detect changes

[1] In 2010, South Sudan was not independent from Sudan.

Figure 4.1 Proportion of countries implementing preventive chemotherapy (PC) for schistosomiasis among those where PC is required, 2006 and 2020



in prevalence of infection and morbidity indicators, as well as foci of persistent transmission. Such a system can be used to follow up school-age children, especially those enrolling into the first class of primary school. Where there are special at-risk populations, such as fishermen or irrigation workers, these groups can be followed up periodically.

The frequency of monitoring and evaluation should be in line with the following principles:

- Monitoring and evaluation is important to optimize interventions;
- The use of sentinel sites allows to keep the cost of monitoring and evaluation justifiable compared with the implementation budget;
- The frequency of monitoring and evaluation has to be adjusted in function of the nature of transmission; in stable situations, it can be less frequent; in unstable situations, it should be more frequent.

There is a trade-off between the cost of implementation, the cost of praziquantel and the cost of monitoring and evaluation. It is however possible to put in place a simple but robust monitoring and evaluation system. For example, Burkina Faso established a system based on 16 schools distributed in each of the regions that provided valid data to assess national progress in implementation (*69*). Monitoring and evaluation is an essential component of any preventive chemotherapy programme and should be budgeted for at the planning stage.

In countries with effective primary health-care services that have had success in implementing a schistosomiasis control programme, the monitoring and evaluation component can be managed by the local health facilities. Provision should be made to supply primary health facilities with praziquantel for the treatment of those diagnosed with and/or symptomatic for schistosomiasis during the periods between large-scale preventive chemotherapy campaigns. With competent laboratories at the primary health-care level, monitoring and evaluation activities can be organized effectively.

4.4 Elimination of schistosomiasis as a public-health problem

Where schistosomiasis morbidity has been controlled through preventive chemotherapy, attempts should be made to further reduce the prevalence of heavy-intensity infections to very low levels (<1%) in order to eliminate schistosomiasis as a public-health problem. The implementation of complementary public-health interventions in conjunction with preventive chemotherapy is strongly recommended in order to achieve this goal. It is expected that areas with residual transmission of schistosomiasis will become progressively smaller in size, and that the focality of transmission will gradually increase. In such hot spots, a more comprehensive approach (preventive chemotherapy and complementary public-health interventions) should be concentrated, and it may be appropriate to adjust the recommendations on preventive chemotherapy described in *Table 1.1* to the new epidemiological conditions by lowering the threshold for mass treatment so that all those infected or with at-risk water contact receive treatment (*70*, *71*). In areas where animal reservoirs contribute to transmission, it is necessary to treat the animals or to prevent them from contaminating the environment with parasite eggs (*72*, *73*). In such epidemiological settings, monitoring and surveillance are important to ensure that all transmission foci are identified, and appropriate interventions undertaken.

4.5 Interruption of transmission

Countries achieving morbidity control and elimination as a public-health problem through preventive chemotherapy should embark on programmes to interrupt transmission; that is, reducing incidence of infection to zero. The implementation of a more comprehensive approach is essential at this stage; recommendations described in *Table 1.1* are no longer appropriate, and preventive chemotherapy will need to be intensified; that is, the target population expanded, and the frequency of treatment increased, if necessary with intervals of retreatment shorter than 12 months. In some situations, provision of potable water to prevent at-risk water contact, adequate sanitation to reduce contamination of water bodies and snail control to eliminate the vector may become the more important operational components for interrupting transmission. Strengthened surveillance will be essential to identify all transmission foci and concentrate control efforts there.

In low-transmission areas, there will be mostly light infections for which parasitological diagnostic techniques will likely be insensitive. There will be a need to use new diagnostic tools and/or algorithms and techniques that can assist in identifying hot spots of transmission for intensified intervention (*74*).

Transmission could possibly be interrupted in all countries where transmission is low and highly focal, provided that additional investments are made in surveillance, sanitation and provision of water, to complement preventive chemotherapy. For example, while morbidity control may have been achieved in Burkina Faso, as prevalence and intensity of infection are now low in most regions (*47*), it remains to be determined if interruption of transmission can be achieved through complementary interventions.

4.6 Verification of elimination of schistosomiasis transmission

In several countries considered endemic for schistosomiasis, there have been no new cases of schistosomiasis reported for more than 10 years. In other countries, morbidity has been successfully controlled and transmission interrupted as a consequence of intensified efforts. In both of these situations, it will be important to confirm the interruption of transmission by establishing a dedicated verification process. These countries can then be removed from the list of endemic countries. With this in mind, the status of schistosomiasis in low-transmission areas was recently reviewed in an Informal Consultation, with recommendations made on tools and strategies for monitoring, criteria to determine interruption of transmission and validation of elimination (*75*).

In WHO's African Region, no new cases of schistosomiasis have been detected in school-age children from Mauritius since 1991, indicating that the disease can be considered eliminated from the island (*76, 77*). There have also been no reports of cases from Algeria. According to the WHO Regional Office for the Americas, there have been no cases of schistosomiasis reported from Antigua, the Dominican Republic, Guadeloupe, Martinique, Montserrat and Puerto Rico. Several countries of WHO's Eastern Mediterranean Region appear to have interrupted schistosomiasis transmission. These include Jordan, the Islamic Republic of Iran (*78*), Morocco (*79*) and Tunisia (*80*). No cases have been reported in the past 50 years from Turkey in the WHO European Region. Only Japan and Malaysia in the Western Pacific Region appear to have eliminated schistosomiasis. For all of these countries, there should be confirmation of transmission status and determination as to whether these countries should still be considered endemic. In response to the changing needs of countries as expressed at the Informal Consultation, the following requirements have been identified:

- Guidelines for confirming interruption of transmission will be produced and disseminated;
- Countries with low or no transmission will be assisted to evaluate transmission status;
- A process for the expert review of data from countries not reporting acute schistosomiasis cases for at least 10 years will be initiated; a system for confirming interruption of transmission will be put in place.

The status of schistosomiasis in a number of countries will be reviewed to verify the interruption of transmission. Where elimination is confirmed, countries will no longer be considered endemic for schistosomiasis.

4.7 Post-elimination surveillance

While the implementation of public-health measures can be scaled down as interruption of schistosomiasis transmission is confirmed, surveillance should be progressively strengthened in all previously endemic areas with the aim of detecting and responding to resurgence of transmission and to prevent reintroduction from regions where the disease is still endemic.

While the monitoring and evaluation activities of an ongoing control programme are mainly organized through sentinel sites for the assessment of the progressive decline in infection indicators, surveillance should be more widespread, systematic and sensitive, with the aim of detecting any new case of infection. Ideally, it should be integrated in routine health systems. For example, schistosomiasis should be made a notifiable disease so that any infected individual is duly reported to the national authorities and the appropriate action is taken.

Surveillance is an essential component of an elimination programme. It extends beyond – in most places for many years, while the threat of resurgence or reintroduction exists – all the interventions that have led to interruption of transmission.

4.8 Strategic approaches to address challenges to schistosomiasis control

WHO has devised strategic approaches to address the challenges of controlling schistosomiasis. Sections 4.8.1–4.8.7 below present for each challenge the strategic approaches, strategic actions and responsible parties.

Strategic approach	Strategic action	Responsible parties
Raising political commitment for control and elimination of schistosomiasis	Develop communication strategies addressing key audiences (United Nations, donor and development agencies, NGOs, government ministries, private sector, and other stakeholders)	WHO, headquaters regional and country offices
	Develop a comprehensive national policy on schistosomiasis control, with key complementary control components included	Ministries of planning, health, education, agriculture, water supply and sanitation, other in-country stakeholders
	Document health, economic and educational benefits of schistosomiasis control	Academic and research institutions
	Advocate for improved water and sanitation, with a link to water development projects	WHO and partners
	Advocate for adequate financial resources	WHO and partners
	Advocate to increase access to praziquantel	WHO and partners

4.8.1 Political commitment

Limited engagement and involvement of senior policy-makers and planning departments in endemic countries may result in a lack of political commitment that results in little national investment in control of neglected tropical diseases and of schistosomiasis. This is reflected in the fact that control of neglected tropical diseases is rarely mentioned in development plans or poverty reduction strategies of endemic country governments. Thus, in many countries, the need for schistosomiasis control is perceived as externally driven and limited to the health and education sectors.

WHO will take an active role in the development of effective communication strategies aimed at decision-makers in national governments (ministries of planning, health, education, agriculture, etc.), the donor community and other partners. Such a strategy will reinforce advocacy on the importance of neglected tropical disease control and build political commitment for schistosomiasis control. The advocacy will highlight the development of and health benefits to the groups targeted for preventive chemotherapy and the countries.

With political commitment assured, schistosomiasis and neglected tropical disease control should be included as national policy in all planning and development documents, as well as government budgets. As resources may be limited, investments could be reflected in development, rather than recurrent, budgets. National policies on schistosomiasis control should stress the importance of regular preventive chemotherapy as a key intervention that should be complemented with improved sanitation, water supply and health education. The national policy on schistosomiasis control should be widely disseminated at all levels to promote implementation.

When control of neglected tropical diseases including schistosomiasis is embedded in national planning and policy documents, this confirms government ownership of the control programmes. In both China and Egypt, external loans were used to scale up schistosomiasis control as part of national development; these governments also allocated significant national resources to complement the loans (*81, 82*). The fact that schistosomiasis control is a government priority has ensured that control efforts are sustained.

With political commitment, schistosomiasis and neglected tropical disease control becomes government policy. Where control of neglected tropical diseases is included in national planning and development documents, it can be expected that, wherever possible, budgetary allocations will also be made. It would also be easier to discuss with donors and partners about possible support when neglected tropical diseases are prioritized in policy documents. China and Egypt could get development loans at concessionary rates for schistosomiasis control as this was priority in terms of public health, as well as for agricultural and water development.

Additional documentation on the health, education and economic benefits of schistosomiasis control will strengthen the evidence base and make for better advocacy to national authorities and their development partners. Researchers in academic and other institutions are best placed to build this evidence.

There is also need to ensure the engagement of the private sector and donors in schistosomiasis control. The major limitation to scaling up schistosomiasis control was access to praziquantel. However the pledge by Merck KGaA for the expansion of the praziquantel donation to 250 million tablets per year until schistosomiasis is eliminated addresses this gap. WHO and development partners will work with the pharmaceutical industry to ensure production and provision of the required amount of praziquantel. Better diagnostic techniques, in humans and snails, and appropriate technologies for water and sanitation will require private–public collaborations to be developed and deployed for schistosomiasis control. With the availability of praziquantel, it will also be important to ensure that resources for implementation are available. Where integration is possible, there will be synergies and cost-sharing with the other preventive chemotherapy programmes.

In successful control programmes, provision of water and sanitation were essential. Potable water reduces at-risk water contact, while sanitation limits the contamination of water resources with human waste, and thus reduces transmission. However, water and sanitation are the responsibility of sectors other than health and education. It is therefore essential to advocate for investment in these services and infrastructure in the areas endemic for schistosomiasis. It is also important that planners of water resources development projects take into account health aspects to design appropriate interventions and to target human settlements such that disease transmission can be prevented or minimized. In addition, in planning preventive chemotherapy interventions for schistosomiasis control, there is need to take into account where water and sanitation projects are implemented or planned.

Strategic approach	Strategic action	Responsible parties
Enhancing in-country coordination	Create an NTD steering committee involving all stakeholders (e.g. governments, NGOs through a national NTD steering committee)	Ministry of Health
	Develop national plans of action for integrated NTD control	Ministry of Health and other in-country stakeholders
	Promote intersectoral coordination through government departments and networks at regional and country level	WHO, ministries for health, agriculture, education, water supply, sanitation, and development, NGOs
Promoting international coordination	Conduct annual review of national programmes by Regional Programme Review Groups	WHO
	Coordinate the global schistosomiasis control programme	WHO
	Coordinate drug supply	WHO, drug donors, NGOs and governments

4.8.2 Coordination

Coordination of partners and stakeholders at global, regional and country levels is essential to control schistosomiasis. Several partnerships and initiatives have successfully advocated for, and ensured, the scaling up of control of lymphatic filariasis, onchocerciasis, soil-transmitted helminthiases and trachoma. It is important that schistosomiasis control is fully adopted in the advocacy and implementation plan for control of neglected tropical diseases. Schistosomiasis is a perfect fit for the control of these diseases, as praziquantel can be safely co-administered with albendazole and ivermectin for the control of lymphatic filariasis, onchocerciasis and soil-transmitted helminthiases (*37–39, 83*). Azithromycin to control trachoma can be alternated with these treatments for a comprehensive and integrated preventive chemotherapy control programme.

At country level, implementation of schistosomiasis control activities should be integrated with other activities to control or eliminate neglected tropical diseases as well as other existing activities for health, education, water and sanitation, and irrigation. This requires intersectoral coordination among all the stakeholders that can be best facilitated by the establishment of a Neglected Tropical Diseases Steering Committee, with responsibility for developing a national plan of action for integrated control of these diseases and for the coordination of the different partners. With many actors supporting neglected tropical disease control interventions at country level, coordination is important to avoid duplication of activities and to ensure efficient use of available resources.

At regional level, coordinated annual review of the disease control programmes amenable to preventive chemotherapy, including schistosomiasis, will give an overview of progress in implementation and integration as well as of the resources required for control of neglected tropical diseases at country level. Such a review could use the programme to eliminate lymphatic filariasis as a model, where Regional Programme Review Groups assess progress and drug requirements of the national elimination programmes. This expansion of the mandate of such groups will encourage further integration and alleviate the reporting burden of programme managers. It would also allow for better planning of drug shipments to national control programmes in line with timing of interventions.

Support with technical assistance to countries will also be coordinated at regional level. Expert groups will be established to provide a resource for deployment to countries, as required.

Progress in implementation of the schistosomiasis control programme will be monitored at the global level in conjunction with WHO regional offices. Coordination at these levels will also allow for timely ordering and shipment of drugs required for preventive chemotherapy in line with production as well as requirements for use at country level. This will further support integrated

implementation at the operational level. WHO plays a pivotal role in facilitating and coordinating the drug donations and acts as liaison between endemic countries and donors.

Strategic approach	Strategic action	Responsible parties
Enhancing in-country coordination	Create an NTD steering committee involving all stakeholders (e.g. governments, NGOs through a national NTD steering committee)	Ministry of Health
	Develop national plans of action for integrated NTD control	Ministry of Health and other in-country stakeholders
	Promote intersectoral coordination through government departments and networks at regional and country level	WHO, ministries for health, agriculture, education, water supply, sanitation, and development, NGOs
Promoting international coordination	Conduct annual review of national programmes by Regional Programme Review Groups	WHO
	Coordinate the global schistosomiasis control programme	WHO
	Coordinate drug supply	WHO, drug donors, NGOs and governments

4.8.3 Communication

It is important to ensure that local authorities, leaders and communities targeted for preventive chemotherapy are properly informed of planned interventions. This will ensure that public-health campaigns are understood, misunderstandings and rumours minimized, and compliance guaranteed.

To ensure that communities are ready for preventive chemotherapy interventions, it is important to have a communication strategy. The available media channels should be used. As for other components for preventive chemotherapy, an adequate provision for resources should be made for communication and social mobilization.

During large-scale treatment interventions, it is possible that some of those treated will experience adverse events for a number of reasons. It is important to inform populations that the medicines administered kill parasites and that, in a few people, especially those with heavy infections and/or those previously untreated, transient but manageable side-effects may occur. It is also important to ensure that the local health services are prepared to respond to adverse events that may occur during campaigns, whether these events are due to or only coincident with the implemented interventions.

After the campaigns and interventions, it will also be important to provide feedback to local authorities, institutions and communities on the results and the continuing activities.

Strategic approach	Strategic action	Responsible parties
Strengthening technical capacity	Build capacity on implementation, including planning, resource mobilization, monitoring and evaluation, and quality assurance across ministries of health and education	WHO, Ministry of Health, Ministry of Education, NGOs, partners, academic and research institutions
	Develop operational tools, guides and manuals for use at all levels to facilitate implementation	
Promoting technical support to countries	Establish regional pools of experts to provide country assistance	
	Establish a technical expert group on schistosomiasis control and elimination at global level	

4.8.4 Technical capacity

There is little technical capacity at the national and lower levels for planning and implementation of national neglected tropical control programmes. Programme managers and other national personnel involved in the planning, implementation and monitoring of integrated neglected tropical disease control programmes should be regularly trained to upgrade their skills. Operational tools, guidelines and manuals that support national staff and facilitate implementation of the national programmes should be available at all levels in schistosomiasis-endemic countries. Guidance is required on mapping, outreach activities to include difficult-to- reach populations, and adjusting control approaches with successful implementation. Where successful control of schistosomiasis morbidity is achieved, high transmission may continue in some foci. In such areas, there may be a need to complement preventive chemotherapy with interventions for transmission control. In most highly-endemic countries, there is no longer capacity for snail control; this will be rebuilt, with adequate equipment and resources.

While integration of preventive chemotherapy programmes will result in cost savings and synergies, enabling integration is difficult, especially where there are vertical programmes. As well as building capacity to plan and implement integrated programmes, it will be important that disease-specific knowledge and field experience are not lost.

Tools, guidelines and manuals to support integrated neglected tropical disease control will be developed. Currently, national programme managers are burdened with filling in multiple drug application forms, annual reporting forms, and progress reports for different drug donation programmes, donors and partners. These drug applications and progress reports are submitted at different times depending on the programme. Consolidation and rationalization of such requests and reporting would reduce the administrative burden on programme managers and facilitate the expanded review process of Regional Programme Review Groups. Similarly, a

single template of a standardized national plan of action for integrated control of neglected tropical diseases should be developed and disseminated to guide national programmes and also to facilitate review of the plans by donors and Regional Programme Review Groups.

A pool of experts on schistosomiasis to provide technical support to the countries will be established in each region. In addition, a technical expert group on schistosomiasis will be established at the global level to address technical issues that arise during implementation of programmes. The establishment of National Professional Officers in selected endemic countries will facilitate implementation.

Strategic approach	Strategic action	Responsible parties
Mapping and assessing the public-health significance of schistosomiasis	Advocate for continued mapping and re-assessment of burden of schistosomiasis	WHO, Ministry of Health, Ministry of Education, partners, academic and research institutions
	Establish systems for routine monitoring of control, and implementation and updating of atlases and databases	
Generating standard indicators for monitoring and evaluation	Harmonize existing guidelines (SCI, RTI, WHO-HQ, WHO AFRO) for monitoring and evaluation	
	Increase accuracy of collection of: • process indicators • performance indicators (including coverage and its validation) • impact indicators (health, education and socioeconomic outcomes)	
Ensuring adequate reporting and investigation of adverse events following treatment	Adopt the existing guidelines on reporting of serious adverse events	
	Respond to, and investigate, adverse events	
Monitoring the potential development of resistance to praziquantel	Develop standard operating procedures to monitor drug efficacy of praziquantel	
	Design a standard system to monitor efficacy of large-scale use of praziquantel and put in place	
Securing an adequate budget for monitoring and evaluation, and for surveillance	Make a provision for sufficient resources for monitoring and evaluation, and the progressive transition to surveillance	
Ensuring real-time reporting of data from the peripheral to central level	Engage new communication technologies	
Incorporating reporting of schistosomiasis cases into the Health Management Information System	Dialogue with health systems (Health Management Information System)	

4.8.5 Monitoring and evaluation

The WHO PCT Databank and the Global Health Observatory provide a platform to report and disseminate information on progress in schistosomiasis control. The numbers of people treated as well as national coverage are presented. The system depends on the timely reporting by national programmes; it has become routine for lymphatic filariasis and soil-transmitted helminthiases control programmes, but needs reinforcement for schistosomiasis.

Many people are treated for schistosomiasis in health facilities, and the data from these treatments should be captured and reported at national, regional level and global levels.

Coverage is the most important process indicator reported annually by each Ministry of Health; summaries are prepared by the regional offices. As many actors implement preventive chemotherapy programmes, not all data are captured or reported to the respective health ministry. A recent survey showed that considerable amounts of data on interventions carried out by some nongovernmental organizations were not reported to the PCT Databank. Accuracy of reported data should be validated.

There is a need to update reporting systems, taking advantage of modern technologies. Mobile phones are ubiquitous, even in the most remote places. Mobile phone technology should be used to report data from the field, as well as to provide feedback on the programme from the central and supervisory levels.

In addition to coverage data, managers of neglected tropical disease control programmes need a set of additional process indicators to be able to manage the different aspects of the control programme (such as training, drug procurement and development of health education material, among other tasks).

Praziquantel remains efficacious in the treatment of schistosomiasis (*84*, *85*); however, its effectiveness is sometimes lower for *S. mansoni* than for *S. haematobium* (*86*). Twice a year treatment for *S. mansoni* may increase effectiveness (*86*). While schistosome resistance to praziquantel is not currently a problem in the field (*87*), vigilance is required, and programme managers should have the tools and methods to assess the situation. It is unclear whether scaling up schistosomiasis treatments will increase selection of parasite strains that may be resistant to praziquantel. Standard operating procedures for monitoring praziquantel efficacy will be developed and deployed such that there is capacity in regional laboratories. At this point, there is no laboratory means for determining praziquantel resistance and we must rely on the post-treatment documentation of reduced drug efficacy, i.e. low egg reduction rate. The relevant protocol will need to be established within control programmes.

Better documentation of the impact of control programmes, not only in terms of health and nutrition but also in terms of educational achievement, is required. This is of particular importance for donors and other stakeholders in order to justify the expansion and scale up of investments in schistosomiasis control. The collection of these indicators may be difficult and expensive, and may not be needed in all control programmes; however, it would be important to standardize impact assessment

Strategic approach	Strategic action	Responsible parties
Clarifying current operational uncertainties that hinder full-scale programmatic implementation	Develop more sensitive and specific diagnostic methods adapted to low-transmission settings	WHO, Ministry of Health, Ministry of Education, NGOs, partners, academic and research institutions
	Update the currently underestimated burden of schistosomiasis	
	Assess the role played by preschool-age children in sustaining transmission of schistosomiasis and the need to extend treatment to this group; develop appropriate guidance on how to treat them	
	Explore the seasonality of transmission in relation to the efficacy of treatment	
	Clarify the relationship between HIV transmission and urogenital schistosomiasis and its public-health implications	
	Assess the significance of haematuria in areas where urogenital schistosomiasis is not transmitted, and its role as a confounding factor in assessment of endemicity	
	Develop improved tools for snail control and water management	
	Develop protocols for monitoring reduced drug efficacy	

in order to compare results in different settings and to set up specific surveys in sentinel-identified countries, possibly through WHO Collaborating Centres, in working with national and international research institutions.

4.8.6 Operational guidance

Diagnostic tools for schistosomiasis are dated. While reagent strips provide a cost-effective and rapid means for diagnosing urogenital schistosomiasis, there is no equivalent test for intestinal schistosomiasis. There is a need to improve and validate the circulating cathodic antigen assay and other point-of-care tests for *S. mansoni* (*88, 89*).

As programmes succeed in controlling morbidity and lowering transmission, there is a need for more sensitive diagnostic techniques for people exposed to infection and transmission foci. It is possible to use serology to determine if schistosomiasis transmission has been interrupted or whether vectors snails are infected (*79, 90, 91*). Recombinant antigens are required to ensure that the serological tests can be standardized.

Recent evidence shows that the prevalence of schistosomiasis in preschool-age children (aged <5 years) is significant in some high-endemic situations, and that the effect of infection on children so young could lead to serious morbidity (*92, 93*).

The magnitude of the problem in terms of numbers involved may be in the range of 5–10 million children meriting treatment in Africa; however, that is still a significant number, and the resulting morbidity may be out of proportion and heightened upon comparison with older children.

The treatment of preschool-age children in public-health campaigns presents a common problem in paediatric medicines for there is no appropriate formulation of praziquantel for this age group and the drug is rather unpalatable. Current WHO recommendations on the treatment of schistosomiasis in children aged under 4 years are that they should be treated on an individual basis by medical personnel (*32*). Children in this age group could also be treated in child health services where children are given vitamin A capsules, anthelminthics for soil-transmitted helminthiases, and are vaccinated.

Research on the best ways to safely treat young children with available formulations should be encouraged.

It is also not clear how such young children contribute to local transmission for they may act as more cryptic reservoirs of infection especially as they are not routinely screened for infection or treated.

It has been known for a long time that treatment when transmission is high results in lower apparent effectiveness of praziquantel treatment (*94*). A recent study has shown that treatment outcomes are better when treatment occurs during the low-transmission season (*95*). It is thus important in each country to determine if there is seasonal transmission and if treatment campaigns for schistosomiasis can be arranged accordingly.

A study in Zimbabwe showed that women with genital schistosomiasis were three times more likely to have HIV infection than women without schistosomiasis (*96*). A causal association between schistosomiasis and HIV transmission is plausible because of genital lesions, inflammatory processes and immune responses to urogenital schistosomiasis (*97*). There is a need for further research on this association, which is beyond the capacity of most control programmes. However, because treatment for schistosomiasis in childhood prevents genital schistosomiasis in later life (*29*), it is important to adequately document who is treated, and how often, to be able to follow them up over the long term. The scale-up of schistosomiasis treatment may have other cost-effective public-health impacts.

There is also a need to evaluate how other operational control components can be used in low-transmission settings. Snail control will have to be introduced in areas where transmission is highly focal, and there is a need to determine how the appropriate sanitation technologies can be introduced in different endemic settings. In many endemic areas, the expertise in snail control has been lost. Along with building capacity, there will be a need for new approaches for snail control and possibilities for their integration into ongoing vector control activities for other diseases.

There is no consensus on the best mapping approaches for schistosomiasis, and different groups use their own methods. There is a need for further research to guide control programmes on the best mapping strategies.

4.8.7 Complementary public-health interventions

Strategic approach	Strategic action	Responsible parties
Increasing guidance on implementation of complementary public health interventions such as snail control, provision of water and sanitation, and environmental management	Create multisectoral collaboration in countries	WHO, Ministry of Health, Ministry of Education, NGOs, partners, academic and research institutions
	Address multisectoral approaches in national plans of action, including water and sanitation, education and agriculture sectors	
	Revise and disseminate guidelines for snail control	
Improving technical capacity for vector control and funding to implement reliable snail surveys	Exploit regional initiatives and training on vector control	
	Look for synergy with other vector control programmes (integrated vector management)	

Access to potable water and adequate sanitation has an important role to play in schistosomiasis control, and have a much broader health and social impact. Potable water can reduce at-risk water contact, while adequate sanitation can reduce the amount of parasite eggs reaching the environment. These components can then reduce schistosomiasis transmission. Because responsibility for water and sanitation does not usually reside with the Ministry of Health, it is important that stakeholders from additional pertinent ministries are included in the national steering committee on neglected tropical diseases. Areas endemic for schistosomiasis should be priorities for the provision of water and sanitation, and this should be advocated for in the planning of these services.

Snail control reduces transmission by removing the intermediate hosts. This can be achieved through environmental management of water courses and through the use of molluscicides. Chemical snail control should be used in discrete water bodies and transmission foci and requires adequate preparation at the community level before its use.

There has been resurgence in vector control with pesticides, especially for malaria control through indoor residual spraying. This offers the possibility for integrated vector management in the control of tropical diseases. Thus, in countries applying indoor residual spraying, there will be technical capacity and equipment for the control of disease vectors. There are initiatives to train personnel for indoor residual spraying, and these could also be considered as channels to train personnel in the use of molluscicides for schistosomiasis control.

While provision of water, adequate sanitation and snail control are essential for schistosomiasis elimination following morbidity control, they can also have an impact in selected high-transmission areas. Previous studies have shown that chemotherapy is the most cost-effective approach to controlling schistosomiasis in the short term. It should be determined how the other control components, especially water and sanitation, can be used, given their broader impact on health.

4.9 Milestones

Milestones have been set to monitor global progress in scaling up schistosomiasis control. They also show the timeline towards schistosomiasis control at global level.

Milestones for global progress in scaling up schistosomiasis control

Year	Milestone
2012	• Global Strategic Plan for schistosomiasis is adopted • Global coordination mechanism is in place for: – adequate supply of praziquantel – resources for implementation at country level – harmonization of partners' activities • National policies for NTD control including schistosomiasis are in place in 50% of the countries requiring preventive chemotherapy • A school-deworming manual including monitoring and evaluation is made available • A resolution on schistosomiasis elimination is adopted
2013	• National Plans of Action for NTD control are developed by 75% of the countries requiring preventive chemotherapy for schistosomiasis • Procedure and guidelines for verification of interruption of transmission are established • Interruption of transmission is verified in countries which request it • Geographical mapping of at least 75% of countries requiring preventive chemotherapy is completed and PCT Databank updated • Guidelines for snail control are revised and disseminated • Training for NTD programme managers is conducted • Standard operating procedure to monitor efficacy of praziquantel is developed
2015	• Multisectoral approach to NTDs is addressed in all national plans of action, including water and sanitation, education and agriculture sectors • National Plans of Action for NTDs including schistosomiasis are adopted in all endemic countries • 100% geographical coverage and at least 75% national coverage is reached in at least 50% of the countries requiring preventive chemotherapy • A standard system to monitor efficacy of large-scale use of praziquantel is designed and put in place
2016	• Mid-term evaluation of the Strategic Plan is completed
2019	• Preparation of the Strategic Plan for 2020 and beyond is finalized
2020	• At least 75% national coverage is reached in all the countries requiring preventive chemotherapy for schistosomiasis

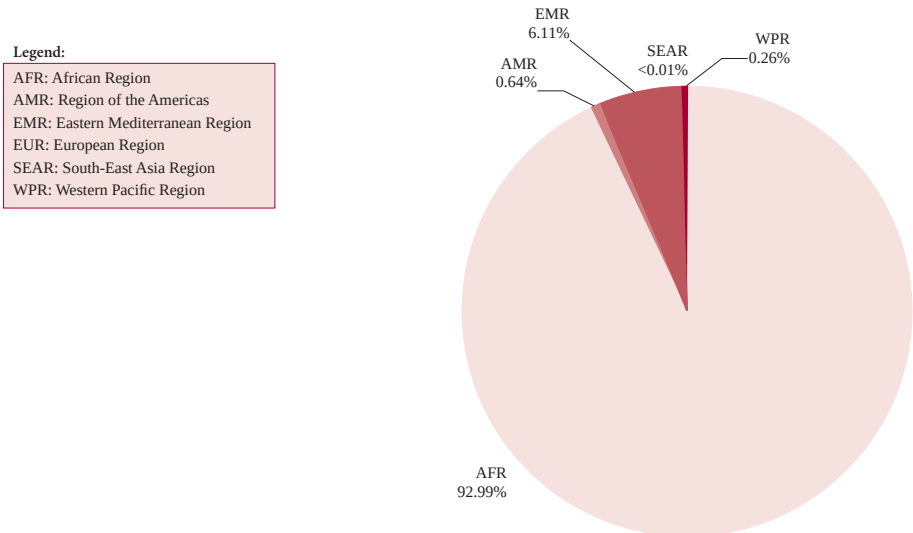
NTD, neglected tropical disease; PCT preventive chemotherapy and transmission control

Section 5

Regional highlights

Schistosomiasis is endemic in five of WHO's six regions (In the European region, a few cases were reported from Turkey in 1959), but almost 93% of the people requiring preventive chemotherapy are in the African Region, and 6.1 are in the Eastern Mediterranean Region (*Figure 5.1*).

Figure 5.1 Proportion of people requiring treatment for schistosomiasis, by WHO region, 2010



Of the 34.8 million people who received treatment for schistosomiasis in 2010, 28.5 million (81.9%) were in the African Region. While some countries do not give a breakdown between treatment of adults and school-age children, it is estimated that the majority of those treated were, in fact, children of school age.

This section highlights for each WHO region the status of countries where schistosomiasis is endemic (*Tables 5.1–5.6*) and for all regions except the European and the South-East Asia regions, the proportion of people requiring treatment for schistosomiasis by country in 2010 (*Figures 5.2, 5.4, 5.6, 5.8*); and the reported number and corresponding coverage of people treated for schistosomiasis during 2006–2010 (*Figures 5.3, 5.5, 5.7, 5.9*). Regional priorities for 2012–2020 are itemized.

African Region

5.1. African Region

In WHO's African Region, 10 countries account for 67.4% of the total number of people requiring preventive chemotherapy globally, and 72.4% in the region itself. However, only seven of the 10 countries have schistosomiasis control programmes, and the number of individuals treated in 2010 in these countries represented only 6.1% of the total number of people requiring treatment for schistosomiasis in that year. In the region, only 17 countries have treatment programmes, and only Burkina Faso, Mali and Sierra Leone have achieved more than 75% coverage of school-age children.

The WHO Regional Office for Africa has developed a strategic plan for schistosomiasis for the period 2011–2020, with the goal of eliminating schistosomiasis as a public-health problem, and to interrupt transmission, where possible. Of the 42 endemic countries, 40 have populations requiring preventive chemotherapy. In the remaining two countries (i.e. Algeria and Mauritius), it has to be determined as to whether transmission has been interrupted. The countries with populations requiring chemotherapy have been put into three groups according to their mapping and implementation status (*Table 5.1*).

Table 5.1 Status of schistosomiasis-endemic countries in the WHO African Region

Group	Countries and territories
Countries requiring preventive chemotherapy	Angola, Benin, Botswana, Burkina Faso, Burundi, Cameroon, Central African Republic, Chad, Congo, Côte d'Ivoire, Democratic Republic of the Congo, Equatorial Guinea, Eritrea, Ethiopia, Gabon, Gambia, Ghana, Guinea, Guinea-Bissau, Kenya, Liberia, Madagascar, Malawi, Mali, Mauritania, Mozambique, Namibia, Niger, Nigeria, Rwanda, Sao Tome and Principe, Senegal, Sierra Leone, South Africa, Swaziland, Togo, Uganda, United Republic of Tanzania, Zambia, Zimbabwe
Countries requiring updating for planning and implementation purposes	–
Countries requiring evaluation in order to verify if interruption of transmission has been achieved	Algeria, Mauritius

Regional priorities for 2012–2020

Among the 40 countries requiring preventive chemotherapy:

- 8 countries have been fully mapped and have reached 100% geographical coverage in implementation. Treatments should be maintained in these countries to achieve 75% national coverage for a number of years to control morbidity, and complementary control measures used to enhance control and strengthen monitoring and evaluation.
- 18 countries have started or completed mapping and have initiated preventive chemotherapy but have not yet attained 100% geographical coverage; mapping should be completed and treatment scaled up to 100% geographical coverage and 75% population coverage; prevention measures should be incorporated and monitoring and evaluation strengthened.
- 14 countries have not yet been mapped; there, mapping should be completed and preventive chemotherapy initiated and scaled up; complementary control interventions should also be implemented.

It is expected that by 2020 the countries in the three groups will have, respectively, interrupted transmission, eliminated schistosomiasis as a public-health programme and controlled morbidity. In addition:

- Algeria and Mauritius should have their elimination status verified.

Figure 5.2 Proportion of people requiring treatment for schistosomiasis in the WHO African Region, by country, 2010

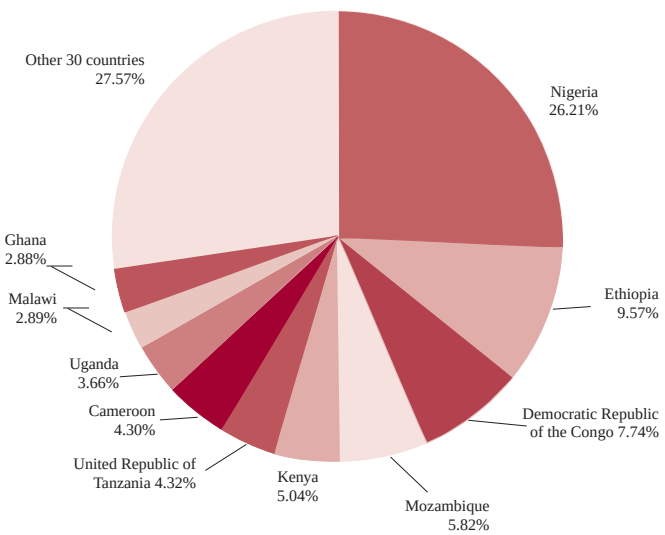
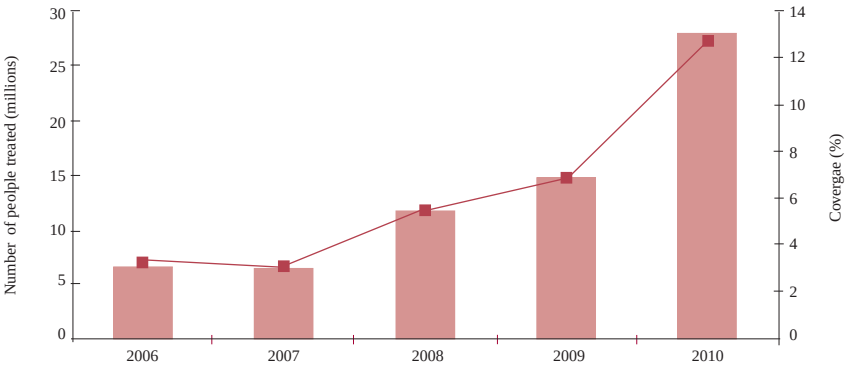


Figure 5.3 Reported number and corresponding coverage of people treated for schistosomiasis in the WHO African Region, 2006–2010



	2006	2007	2008	2009	2010
AFR	6696140	6481371	11805750	14735638	28535607
Coverage (%)	3.3	3.1	5.5	6.8	12.9

Region of the Americas

5.2 Region of the Americas

The Region of the Americas includes:

- 2 countries that require preventive chemotherapy: Brazil and the Bolivarian Republic of Venezuela. In Brazil, treatment of schistosomiasis is mainly administered on the basis of a positive parasitological diagnosis (selective chemotherapy) through municipal health services, while small-scale treatment interventions are carried out in the Bolivarian Republic of Venezuela.
- 2 countries in which the status of schistosomiasis has to be determined for planning and implementation purposes (Saint Lucia and Suriname).
- 6 countries and territories where the status of schistosomiasis has to be determined in order to verify if interruption of transmission has been achieved: Antigua, the Dominican Republic, Guadeloupe, Martinique, Montserrat and Puerto Rico.

Brazil accounts for 95.80% of the people requiring treatment for schistosomiasis in the region and 39 868 of the 41 346 people who were treated in the region in 2010.

The PAHO/WHO Directing Council Resolution CD49.R19, signed by Member States in October 2009, documents a commitment to dramatically reduce the prevalence of schistosomiasis by 2015 (*98*). An analysis of the progress, priorities and lines of action was published in 2010 (*99*).

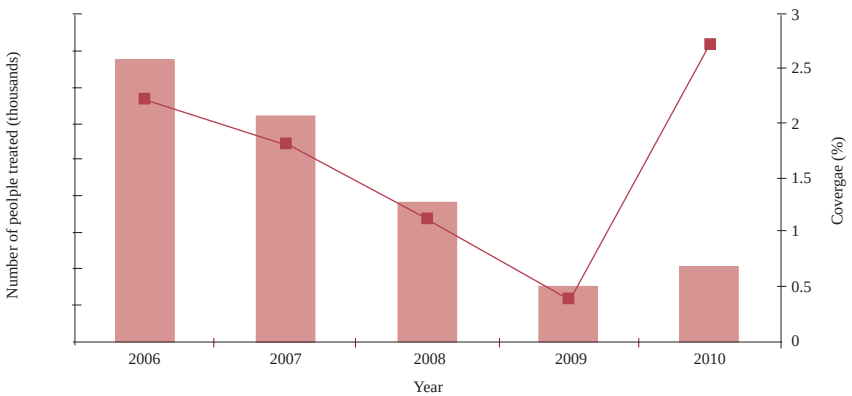
Table 5.2 Status of schistosomiasis-endemic countries in the WHO Region of the Americas

Group	Countries and territories
Countries requiring preventive chemotherapy	Brazil, Venezuela (Bolivarian Republic of)
Countries requiring updating for planning and implementation purposes	Saint Lucia, Suriname
Countries requiring evaluation in order to verify if interruption of transmission has been achieved	Antigua, Dominican Republic, Guadeloupe, Martinique, Montserrat, Puerto Rico

Regional priorities for 2012–2020

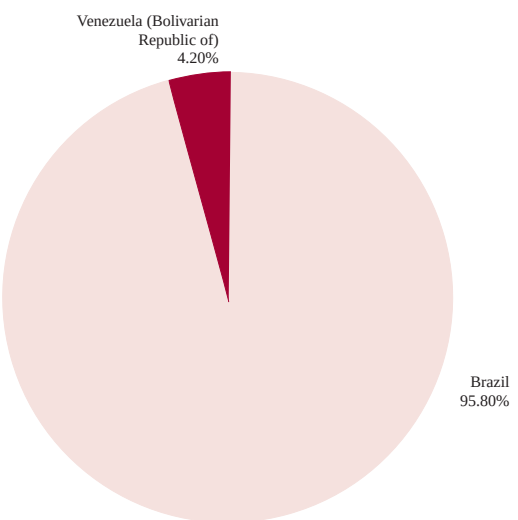
- Brazil and Venezuela (Bolivarian Republic of): intensify preventive chemotherapy and implement complementary public-health measures with the aim of interrupting transmission.
- Saint Lucia and Suriname: determine the current epidemiological status; if still endemic, intensify preventive chemotherapy and implement complementary public-health measures with the aim of interrupting transmission.
- Antigua, Dominican Republic, Guadeloupe, Martinique, Montserrat, Puerto Rico: verify status of elimination.

Figure 5.3 Reported number and corresponding coverage of people treated for schistosomiasis in the WHO African Region, 2006–2010



	2006	2007	2008	2009	2010
AMR	154394	123905	76306	30418	41336
Coverage (%)	2.2	1.8	1.1	0.4	2.7

Figure 5.4 Proportion of people requiring treatment for schistosomiasis in the WHO Region of the Americas, by country, 2010



Eastern Mediterranean Region

5.2 Eastern Mediterranean Region

The Eastern Mediterranean Region includes:

- 5 countries that require preventive chemotherapy: Egypt, Somalia, South Sudan, Sudan, and Yemen;
- 5 countries in which the status of schistosomiasis has to be determined for planning and implementation purposes: Iraq, Libya, Oman, Saudi Arabia and the Syrian Arab Republic;
- 6 countries where the status of schistosomiasis has to be determined in order to verify if interruption of transmission has been achieved: Djibouti, Iran (Islamic Republic of), Jordan, Lebanon, Morocco and Tunisia.

The countries with the highest schistosomiasis burden are Sudan (estimates for South Sudan are not yet available) and Yemen. Yemen accounted for more than 95% of the people treated in the region in 2010. Egypt has one of the oldest control programmes, while only limited control interventions are implemented in Somalia.

In 2006, the EMRO Regional Committee passed Resolution RC54/R.3 (Neglected Tropical Diseases: an emerging public health problem in the Eastern Mediterranean Region), which calls upon Member States to intensify control of schistosomiasis in all endemic countries in the region and to eliminate it in low transmission areas (*100*).

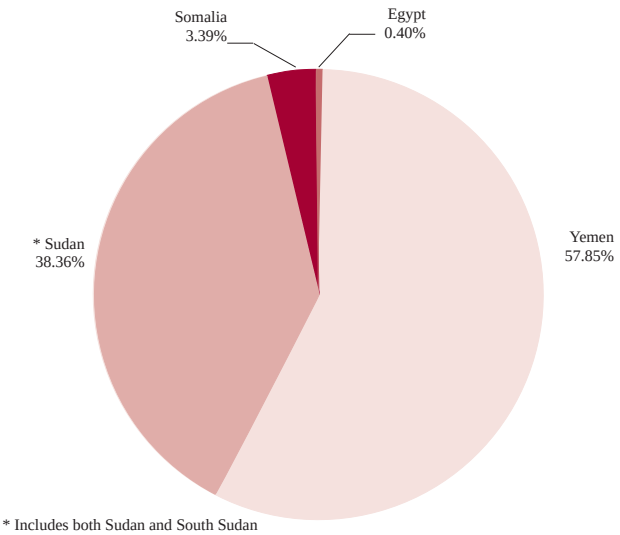
Table 5.3 Status of schistosomiasis-endemic countries in the WHO Eastern Mediterranean Region

Group	Countries and territories
Countries requiring preventive chemotherapy	Egypt, Somalia, South Sudan, Sudan, Yemen
Countries requiring updating for planning and implementation purposes	Iraq, Libya, Oman, Saudi Arabia, Syrian Arab Republic
Countries requiring evaluation in order to verify if interruption of transmission has been achieved	Djibouti, Iran (Islamic Republic of), Jordan, Lebanon, Morocco, Tunisia

Regional priorities for 2012–2020

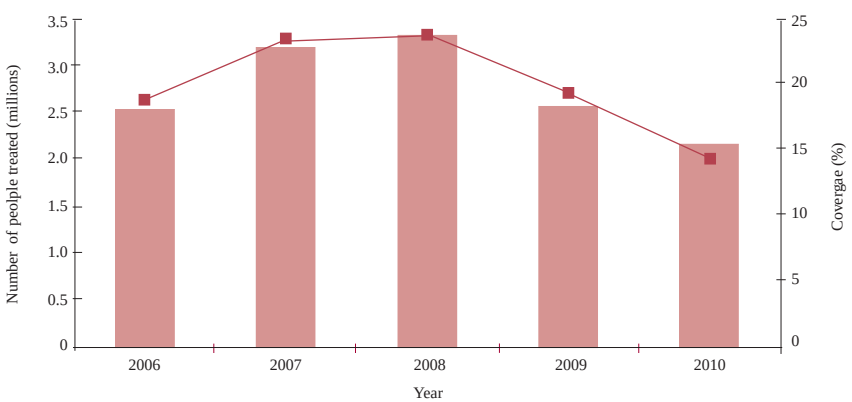
- Somalia, South Sudan, Sudan and Yemen: scale up preventive chemotherapy to full geographical coverage and at least 75% national coverage.
- Egypt: intensify preventive chemotherapy and implement complementary public-health measures and strengthened surveillance with the aim of interrupting transmission.
- Iraq, Libya, Oman, Saudi Arabia, and Syrian Arab Republic: determine the current epidemiological status; if still endemic, intensify preventive chemotherapy and implement complementary public-health measures with the aim of interrupting transmission.
- Djibouti, Iran (Islamic Republic of), Jordan, Lebanon, Morocco, Tunisia: verify status of elimination.

Figure 5.6 Proportion of people requiring treatment for schistosomiasis in the WHO Eastern Mediterranean Region, by country, 2010



* Includes both Sudan and South Sudan

Figure 5.7 Reported number and corresponding coverage of people treated for schistosomiasis in the WHO Eastern Mediterranean Region, 2006–2010



	2006	2007	2008	2009	2010
EMR	2510000	3173329	3309815	2551316	2852874
Coverage (%)	18 5	23.2	23.6	19.1	20.8

European Region

5.4 European Region

The WHO European Region includes one country (Turkey) where the status of schistosomiasis has to be determined in order to verify if transmission is occurring at the present time. No schistosomiasis cases have been reported from Turkey since 1959 (Farooq M.: Report on a visit to bilharziasis endemic areas in the Province of Syria, UAR, and Turkey. WHO unpublished document, EM/BIL/12 (1959)).

Table 5.4 Status of schistosomiasis-endemic countries in the WHO European Region

Group	Countries and territories
Countries requiring preventive chemotherapy	–
Countries requiring updating for planning and implementation purposes	–
Countries requiring evaluation in order to verify if interruption of transmission has been achieved	Turkey

Regional priorities for 2012–2020

- Turkey: verify status of elimination.

South-East Asia Region

5.5 South-East Asia Region

The South-East Asia Region includes:

- 1 country requiring preventive chemotherapy: Indonesia
- 2 countries where the status of schistosomiasis has to be determined in order to verify if interruption of transmission has been achieved: I Thailand.

The only geographical area in the region where schistosomiasis is of public-health significance is the Central Sulawesi Province of Indonesia. Resources should be identified to try and eliminate the disease from these foci. The transmission of schistosomiasis in India and Thailand needs to be verified.

Table 5.5 Status of schistosomiasis-endemic countries in the WHO South-East Asia Region

Group	Countries and territories
Countries requiring preventive chemotherapy	Indonesia
Countries requiring updating for planning and implementation purposes	–
Countries requiring evaluation in order to verify if interruption of transmission has been achieved	India, Thailand

Regional priorities for 2012–2020

- Indonesia: intensify preventive chemotherapy and implement complementary public-health measures with the aim of interrupting transmission.
- India, Thailand: verify status of elimination.

Western Pacific Region

5.6 Western Pacific Region

The Western Pacific Region includes:

- 4 countries that require preventive chemotherapy: Cambodia, China, the Lao People's Democratic Republic and the Philippines
- 2 countries where the status of schistosomiasis has to be determined in order to verify if interruption of transmission has been achieved: Japan and Malaysia

Only 4 countries in the region require preventive chemotherapy for schistosomiasis, as Japan interrupted transmission more than three decades ago and zero cases are reported from Malaysia. The Philippines has almost 80% of the burden, but China accounted for 2.7 million of the 3.3 million people treated in the region in 2010. All the people requiring preventive chemotherapy in the Western Pacific Region were treated in 2010.

Table 5.6 Status of schistosomiasis-endemic countries in the WHO Western Pacific Region

Group	Countries and territories
Countries requiring preventive chemotherapy	Cambodia, China, Lao People's Democratic Republic, Philippines
Countries requiring updating for planning and implementation purposes	–
Countries requiring evaluation in order to verify if interruption of transmission has been achieved	Japan, Malaysia

China has adopted a plan to interrupt transmission of schistosomiasis in all endemic areas except the lake regions and "control transmission" by keeping prevalence below 1% in the lake regions by 2015 (*101, 102*). Along with preventive chemotherapy where required, new strategies have been implemented to reduce environmental contamination and transmission through health education, sanitation improvements, and infection source control where agriculture is mechanized and animal reservoirs of schistosomiasis are removed from potential transmission areas.

While preventive chemotherapy can eliminate schistosomiasis mekongi from both Cambodia and the Lao People's Democratic Republic, there is a need for guidance as to how transmission of this parasite can be eliminated (44). In Cambodia, levels of prevalence of schistosomiasis have been drastically reduced even though low-level transmission still occurs (*45*). In the Lao People's Democratic Republic, schistosomiasis morbidity had been controlled in humans, but contamination of the Mekong River by animals has contributed to the resurgence of transmission and disease, leading the country to restart large-scale treatment in 2007 after an 8-year lapse.

There is a need to maintain high treatment coverage and implement regularly in the Philippines. There is also a need to determine how to deal with the many animals that are reservoir hosts of S. japonicum in the country. Draft treatment and control guidelines were produced in 2010, and a consultative planning process is under way.

Regional priorities for 2012–2020

- Lao People's Democratic Republic and the Philippines: maintain high coverage; the Philippines should implement regularly.
- Cambodia and China: intensify preventive chemotherapy and implement complementary public-health measures with the aim of interrupting transmission.
- Japan and Malaysia: verify status of elimination.

Figure 5.8 Proportion of people requiring treatment for schistosomiasis in the WHO Western Pacific Region, by country, 2010

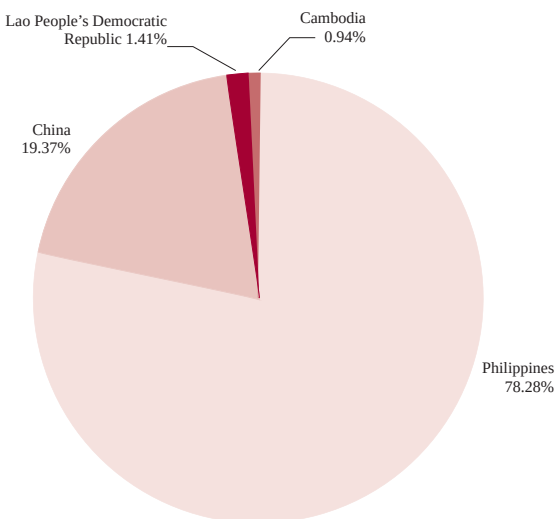
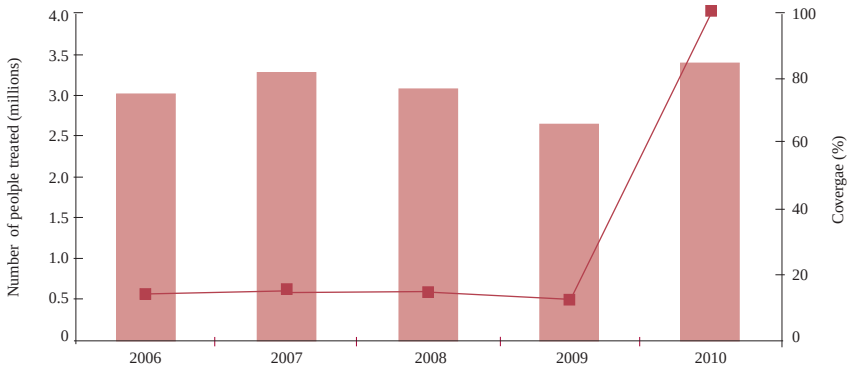


Figure 5.9 Reported number and corresponding coverage of people treated for schistosomiasis in the WHO Western Pacific Region, 2006–2010



	2006	2007	2008	2009	2010
WPR	3011071	3296960	3069475	2642207	3373880
Coverage (%)	14.5	15.8	14.7	12.7	100

Section 6

Projected needs of praziquantel

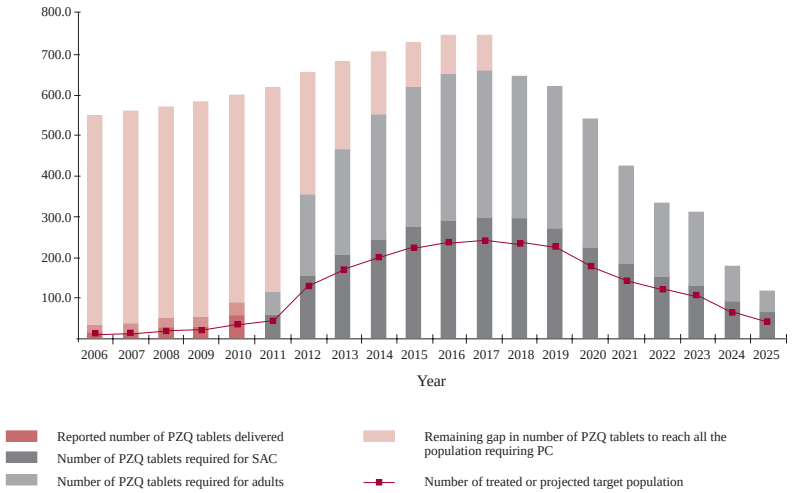
6.1 Population requiring preventive chemotherapy for schistosomiasis

Estimates of the number of people requiring treatment for schistosomiasis have been revised, based on the number of school-age children (SAC) living in areas of low risk for schistosomiasis, and SAC and adults living in areas of moderate and high risk (*103*) (*Table 6.1*).

Calculations have been made based on the recommendations on target groups and frequency of treatment in Table 1.1. These recommendations indicate that a third of SAC living in low-risk areas would require treatment each year. In areas of moderate risk, half of SAC and 20% of adults would be eligible for treatment every year. All SAC and adults in high-risk areas require treatment every year. United Nations population data for 2010 were used in the estimates for each country.

Survey data – published and non-published – were used to determine the schistosomiasis status of each district in endemic countries. In districts where there were no data, data from contiguous districts were used. Based on the population of each district, province or region and the endemic status for each area, the population eligible for schistosomiasis treatment for each country was estimated (*Annex 4*). The amount of praziquantel required for treatment of the eligible populations was based on the use of 2.5 tablets for each SAC and 3 tablets for each adult, on average.

Figure 6.1 Projected number of target population requiring preventive chemotherapy (PC) and required need of praziquantel (PZQ) tablets globally, 2011–2025[a]



[a] The number of PZQ tablets required decreases significantly after 2017 because a number of countries are projected to complete 5–6 rounds of PC with full national coverage and adjust or intensify PC intervention strategy, resulting in focalization of areas targeted by PC and associated reduction of target population.

Projected number of praziquantel tablets required (million)

Age group	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
SAC	59.2	154.4	203.9	243.9	274.5	289.8	298.0	295.1	272.4	226.4	182.0	151.5	128.6	90.1	63.0
Adults	56.1	200.9	263.0	306.6	343.9	362.6	363.2	349.5	360.2	254.0	202.4	178.3	167.9	83.9	42.0
Total	115.3	355.3	466.9	550.4	618.4	652.4	661.2	644.6	632.6	480.3	384.5	329.8	296.5	174.0	105.0

Projected number of target population (million)

Age group	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
SAC	23.7	61.8	81.5	97.6	109.8	115.9	119.2	118.0	109.0	90.5	72.8	60.6	51.5	36.0	25.2
Adults	18.7	67.0	87.7	102.2	114.6	120.9	121.1	116.5	120.1	84.7	67.5	59.4	56.0	28.0	14.0
Total	42.4	128.7	169.2	199.7	224.4	236.8	240.3	234.5	229.0	175.2	140.3	120.0	107.4	64.0	39.2

6.2 Projected need of praziquantel, 2012–2020 and beyond

Specifying the projected number of people who would require preventive chemotherapy for schistosomiasis (and the number of praziquantel tablets that would be required for their treatment) is expected to guide national programme managers and partners in their planning processes to ensure attainment of national and global targets.

Because of the importance of SAC in the transmission of schistosomiasis and the cost-effectiveness of using the school infrastructure in reaching this at-risk group with preventive chemotherapy, the following section elucidates, separately for SAC and adults, the methods undertaken to project (i) the number of people who would require preventive chemotherapy for schistosomiasis and (ii) associated drug needs between 2011 and 2020.

This projection does not take into account the availability of potential or future funding for implementing or scaling up schistosomiasis control interventions. Rather,

it indicates the minimum number of individuals that should be targeted for preventive chemotherapy in order for all the countries to reach 100% national coverage as soon as possible and at the latest by 2020, starting from the existing institutional capacity (which was assumed based on the past progress of deworming activities). This should be used as (i) a reference to evaluate if the schistosomiasis control or elimination programme is progressing towards achievement of the national, regional and global targets and to adjust the pace as necessary, and also (ii) as a guide for resource mobilization and for regional or national planning.

This preliminary projection will serve as a base from which additional activities can be built if more funding and technical support for strengthening institutional capacity becomes available in the future. The projection will be updated annually in accordance with the latest country situation, national plans, funding available and annual progress of the deworming activities in each year.

Regional priorities for 2012–2020

Scale-up and down

Country status	Start point of projection	Scale-up phase	Maintenance phase	Scale-down (intensification) phase
A country with past implementation data	Adopted the highest number of individuals (in each age group) treated per year between 2003 and 2010. Starting from 2011.	IF the projected no. SAC targeted for STH is larger than 50% increase of the 1st year projection, STH projection for SAC was adopted. Otherwise, 50% increase of the 1st year projection was adopted.	100% national coverage was maintained for 5–6 years.	The target population was reduced by 30% for SAC and 50% for adults annually, assuming that the level of prevalence goes down and the target population is focalized progressively. Projections take into account the expected increase in praziquantel needs that will be registered in areas of residual transmission as elimination of schistosomiasis as a public-health problem and the interruption of its transmission are progressively targeted and more aggressive PC interventions are implemented (adjusted/intensified PC).
A country without past implementation data	Adopted the projected number of SAC targeted for STH			

Population growth

Population growth was applied to each country for the estimated population requiring preventive chemotherapy.

Procurement data for 2011 and 2012

The number of praziquantel tablets supplied to the implementers in 2011 and planned supply for 2012 was cross-checked, assuming that all of the tablets supplied or to be supplied are delivered to the population requiring preventive chemotherapy.

Data source

Population growth (for each country): PCT Databank. (*103*)

Population requiring preventive chemotherapy for schistosomiasis: PCT Databank for 2010 figure, which was multiplied by population growth for 2011 onwards.

Limitation

Assumption after reaching 100% national coverage is based on experience of a number of selected countries and expert opinion, subject to revision as more evidence is gathered.

References

1. Gryseels B et al. Human schistosomiasis. *Lancet*, 2006, 23,368(9541):1106–1118.
2. Kane RA et al. A phylogeny based on three mitochondrial genes supports the division of Schistosoma intercalatum into two separate species. *Parasitology*, 2003, 127(Pt 2):131–137.
3. Farooq M. Recent developments and trends in epidemiology and control of schistosomiasis. *Journal of Tropical Medicine and Hygiene*, 1969, 72(9):210–211.
4. Tanaka H, Tsuji M. From discovery to eradication of schistosomiasis in Japan: 1847-1996. *International Journal for Parasitology*, 1997, 27(12):1465–1480.
5. Christopherson JB. The curative dose of antimony tartrate in schistosomiasis (bilharzia disease). BMJ, 1923, 2(3287):1254–1255.
6. Jordan P. From katayama to the Dakhla Oasis: the beginning of epidemiology and control of bilharzia. *Acta Tropica*, 2000, 77(1):9–40.
7. *Epidemiology and control of schistosomiasis. Report of a WHO Expert Committee*. Geneva, World Health Organization, 1980 (WHO Technical Report Series, No. 643):5–62.
8. Jordan P. Schistosomiasis--research to control. *American Journal of Tropical Medicine and Hygiene*, 1977, 26(5 Pt 1):877–886.
9. Mahmoud AA et al. Effect of targeted mass treatment on intensity of infection and morbidity in schistosomiasis mansoni. 3-year follow-up of a community in Machakos, Kenya. *Lancet*, 1983, 1(8329):849–851.
10. Arap Siongok TK et al. Morbidity in Schistosomiasis mansoni in relation to intensity of infection: study of a community in Machakos, Kenya. *American Journal of Tropical Medicine and Hygiene*, 1976, 25(2):273–284.

11. Warren KS, Mahmoud AA. Targeted mass treatment: a new approach to the control of schistosomiasis. *Transactions of the Association of American Physicians*, 1976, 89:195–204.
12. Mott KE, Cline BL. Advances in epidemiology survey methodology and techniques in schistosomiasis. *Bulletin of the World Health Organization*, 1980, 58(4):639–647.
13. *The control of schistosomiasis. Report of a WHO Expert Committee*. Geneva, World Health Organization, 1985 (WHO Technical Report Series, No. 728):1–113.
14. Bartram J, Cairncross S. Hygiene, sanitation, and water: forgotten foundations of health. *PLoS Medicine*, 2010, 7(11):e1000367.
15. Korte R, Rehle T, Merkle A. Strategies to maintain health in the Third World.*Tropical Medicine and Parasitology*, 1991, 42(4):428–432.
16. Brinkmann UK et al. The National Schistosomiasis Control Programme in Mali, objectives, organization, results. *Tropical Medicine and Parasitology*, 1988, 39(2):157–161.
17. Chen MG. Use of praziquantel for clinical treatment and morbidity control of schistosomiasis japonica in China: a review of 30 years' experience. *Acta Tropica*, 2005, 96(2–3):168–176.
18. Zhou XN et al. The public health significance and control of schistosomiasis in China--then and now. *Acta Tropica*, 2005, 96(2–3):97–105.
19. Curtale F et al. The School Health Programme in Behera: an integrated helminth control programme at Governorate level in Egypt. *Acta Tropica*, 2003, 86(2–3):295–307.
20. Spencer HC et al. Evaluation of UNICEF/Arab Republic of Egypt/WHO schistosomiasis Control Project in Beheira Governorate. *American Journal of Tropical Medicine and Hygiene*, 1990, 42(5):441–448.
21. Fenwick A et al. The Schistosomiasis Control Initiative (SCI): rationale, development and implementation from 2002-2008. *Parasitology*, 2009, November, 136(13):1719–1730.
22. Garba A et al. Present and future schistosomiasis control activities with support from the Schistosomiasis Control Initiative in West Africa. *Parasitology*, 2009, 136(13):1731–1737.
23. Kabatereine NB et al. Impact of a national helminth control programme on infection and morbidity in Ugandan schoolchildren. *Bulletin of the World Health Organization*, 2007, 85(2):91–99.
24. Linehan M et al. Integrated implementation of programs targeting neglected tropical diseases through preventive chemotherapy: proving the feasibility at national scale. *American Journal of Tropical Medicine and Hygiene*, 2011, 84(1):5–14.
25. *Schistosomiasis control. Report of a WHO Expert Committee*. Geneva, World Health Organization, 1973 (WHO Technical Report Series, No. 515):1–47.
26. *Epidemiology and control of schistosomiasis. Report of a WHO Expert Committee*. Geneva, World Health Organization, 1967 (WHO Technical Report Series, No. 372):5–33.

27. *Prevention and control of schistosomiasis and soil-transmitted helminthiasis*. Geneva, World Health Organization, 2002 (WHO Technical Report Series, No. 912):1–57.
28. *Schistosomiasis and soil-transmitted helminth infections*. Fifty-fourth World Health Assembly. Geneva, World Health Organization, 2001 (Resolution WHA54.19; also available at: http://apps.who.int/gb/archive/pdf_files/WHA54/ea54r19.pdf; accessed May 2012).
29. Kjetland EF et al. Prevention of gynecologic contact bleeding and genital sandy patches by childhood anti-schistosomal treatment. *American Journal of Tropical Medicine and Hygiene*, 2008, 79(1):79–83.
30. Olds GR et al. Double-blind placebo-controlled study of concurrent administration of albendazole and praziquantel in schoolchildren with schistosomiasis and geohelminths. *Journal of Infectious Diseases*, 1999, 179(4):996–1003.
31. Namwanje H, Kabatereine NB, Olsen A. The acceptability and safety of praziquantel alone and in combination with mebendazole in the treatment of Schistosoma mansoni and soil-transmitted helminthiasis in children aged 1–4 years in Uganda. *Parasitology*, 2011, 138(12):1586–1592.
32. *Preventive chemotherapy in human helminthiasis. Coordinated use of anthelminthic drugs in control interventions: a manual for health professionals and programme managers*. Geneva, World Health Organization, 2006.
33. King CH, Dangerfield-Cha M. The unacknowledged impact of chronic schistosomiasis. *Chronic Illness*, 2008, 4(1):65–79.
34. Allen HE et al. New policies for using anthelmintics in high risk groups. *Trends in Parasitology*, 2002, 18(9):381–382.
35. Stothard JR et al. Closing the praziquantel treatment gap: new steps in epidemiological monitoring and control of schistosomiasis in African infants and preschool-aged children. *Parasitology*, 2011, 138(12):1593–1606.
36. Garba A et al. Risk factors for Schistosoma haematobium infection and morbidity in two villages with different transmission patterns in Niger. *Acta Tropica*, 2010, 115(1–2):84–89.
37. Namwanje H, Kabatereine N, Olsen A. A randomised controlled clinical trial on the safety of co-administration of albendazole, ivermectin and praziquantel in infected schoolchildren in Uganda. *Transactions of the Royal Society of Tropical Medicine and Hygiene*, 2011, 105(4):181–188.
38. Eigege A et al. Triple drug administration (TDA), with praziquantel, ivermectin and albendazole, for the prevention of three neglected tropical diseases in Nigeria. *Annals of Tropical Medicine and Parasitology*, 2008, 102(2):177–179.
39. Mohammed KA et al. Triple co-administration of ivermectin, albendazole and praziquantel in zanzibar: a safety study. *PLoS Neglected Tropical Diseases*, 2008, 2(1):e171.
40. Olsen A. Efficacy and safety of drug combinations in the treatment of schistosomiasis, soil-transmitted helminthiasis, lymphatic filariasis and onchocerciasis. *Transactions of the Royal Society of Tropical Medicine and Hygiene*, 2007, 101(8):747–758.

41. Na-Bangchang K et al. Assessments of pharmacokinetic drug interactions and tolerability of albendazole, praziquantel and ivermectin combinations. *Transactions of the Royal Society of Tropical Medicine and Hygiene*, 2006, 100(4):335–345.
42. Kjetland EF et al. Prevention of gynecologic contact bleeding and genital sandy patches by childhood anti-schistosomal treatment. *American Journal of Tropical Medicine and Hygiene*, 2008, 79(1):79–83.
43. Barkia H et al. [Schistosomiasis in Morocco: from discovery to after elimination]. *Eastern Mediterranean Health Journal*, 2011, 17(3):250–256.
44. Muth S et al. Schistosoma mekongi in Cambodia and Lao People's Democratic Republic. *Advances in Parasitology*, 2010, 72:179–203.
45. Sinuon M et al. Control of Schistosoma mekongi in Cambodia: results of eight years of control activities in the two endemic provinces. *Transactions of the Royal Society of Tropical Medicine and Hygiene*, 2007, 101(1):34–39.
46. Sellin B et al. [Course of urinary schistosomiasis over 3 consecutive years after treatment with metrifonate in a dry savanna village in Upper Volta]. *Médecine Tropicale*, 1984, 44(4):357–359.
47. Toure S et al. Two-year impact of single praziquantel treatment on infection in the national control programme on schistosomiasis in Burkina Faso. *Bulletin of the World Health Organization*, 2008, 86(10):780–787.
48. French MD et al. Observed reductions in Schistosoma mansoni transmission from large-scale administration of praziquantel in Uganda: a mathematical modelling study. *PLoS Neglected Tropical Diseases*, 2010, 4(11):e897.
49. Amaral RS et al. An analysis of the impact of the Schistosomiasis Control Programme in Brazil. *Memórias do Instituto Oswaldo Cruz*, 2006, 101 Suppl 1:79–85.
50. *Estimates for the use of improved drinking-water sources: Egypt* [updated March 2010]. World Health Organization/United Nations Children's Fund.
51. Chitsulo L et al. The global status of schistosomiasis and its control. *Acta Tropica*, 2000, 77(1):41–51.
52. Hatz CF. The use of ultrasound in schistosomiasis. *Advances in Parasitology*, 2001, 48:225–284.
53. Richter J. The impact of chemotherapy on morbidity due to schistosomiasis. *Acta Tropica*, 2003, 86(2–3):161–183.
54. Gryseels B et al. Human schistosomiasis. *Lancet*, 2006, 368(9541): 1106–1118.
55. *Informal consultation on expanding schistosomiasis control in Africa*. Geneva, Switzerland, 26 January 2010. Geneva, World Health Organization, 2010 (available at: http://www.who.int/schistosomiasis/epidemiology/PZQ_WHO_report_meeting.pdf; accessed May 2012).
56. King CH, Dickman K, Tisch DJ. Reassessment of the cost of chronic helmintic infection: a meta-analysis of disability-related outcomes in endemic schistosomiasis. *Lancet*, 2005, 365(9470):1561–1569.
57. *The control of schistosomiasis. Second report of the WHO Expert Committee.* Geneva, World Health Organization, 1993 (WHO Technical Report Series, No. 830):1–86.

58. Koeck JL et al. [Discovery of a focus of intestinal bilharziasis in the Republic of Djibouti]. *Médicine Tropicale*, 1999, 59(1):35–38.
59. Eigege A et al. Triple drug administration (TDA), with praziquantel, ivermectin and albendazole, for the prevention of three neglected tropical diseases in Nigeria. *Annals of Tropical Medicine and Parasitology*, 2008, 102(2):177–179.
60. Clements AC et al. Mapping the probability of schistosomiasis and associated uncertainty, West Africa. *Emerging Infectious Diseases*, 2008, 14(10):1629–1632.
61. Koukounari A et al. Schistosoma haematobium infection and morbidity before and after large-scale administration of praziquantel in Burkina Faso. *Journal of Infectious Diseases*, 2007, 196(5):659–669.
62. French MD et al. Observed reductions in *Schistosoma mansoni* transmission from large-scale administration of praziquantel in Uganda: a mathematical modelling study. *PLoS Neglected Tropical Diseases*, 2010, 4(11):e897.
63. Zhang Y et al. Parasitological impact of 2-year preventive chemotherapy on schistosomiasis and soil-transmitted helminthiasis in Uganda. *BMC Medicine*, 2007, 5:27.
64. Koukounari A et al. Morbidity indicators of Schistosoma mansoni: relationship between infection and anemia in Ugandan schoolchildren before and after praziquantel and albendazole chemotherapy. *American Journal of Tropical Medicine and Hygiene*, 2006, 75(2):278–286.
65. King CH. Long-term outcomes of school-based treatment for control of urinary schistosomiasis: a review of experience in Coast Province, Kenya. *Memórias do Instituto Oswaldo Cruz*, 2006, 101 (Suppl 1):299–306.
66. Frenzel K et al. Evidence for a long-term effect of a single dose of praziquantel on *Schistosoma mansoni*-induced hepatosplenic lesions in northern Uganda. *American Journal of Tropical Medicine and Hygiene*, 1999, 60(6):927–931.
67. Parraga IM et al. Gender differences in growth of school-aged children with schistosomiasis and geohelminth infection. *American Journal of Tropical Medicine and Hygiene*, 1996, 55(2):150–156.
68. Salem S et al. Successful control of schistosomiasis and the changing epidemiology of bladder cancer in Egypt. *British Journal of Urology International*, 2011, 107(2):206–211.
69. Toure S et al. Two-year impact of single praziquantel treatment on infection in the national control programme on schistosomiasis in Burkina Faso. *Bulletin of the World Health Organization*, 2008, 86(10):780–787.
70. Chen MG. Use of praziquantel for clinical treatment and morbidity control of schistosomiasis japonica in China: a review of 30 years' experience. *Acta Tropica*, 2005, 96(2–3):168–176.
71. Chen MG. Schistosomiasis control program in the People's Republic of China: a review. *Southeast Asian Journal of Tropical Medicine and Public Health*, 1989, 20(4):511–517.
72. Wang LD et al. A strategy to control transmission of Schistosoma japonicum in China. *New England Journal of Medicine*, 2009, 360(2):121–128.

73. Guo JG et al. A baseline study on the importance of bovines for human *Schistosoma japonicum* infection around Poyang Lake, China. *American Journal of Tropical Medicine and Hygiene*, 2001, 65(4):272–278.
74. Zhu YC. Immunodiagnosis and its role in schistosomiasis control in China: a review. *Acta Tropica*, 2005, 96(2–3):130–136.
75. *Elimination of schistosomiasis from low-transmission areas. Report of a WHO Informal Consultation*. Geneva, World Health Organization, 2009 (also available at: http://extranet.who.int/iris/bitstream/123456789/297/1/WHO_HTM_NTD_PCT_2009.2_eng.pdf; accessed May 2012).
76. D'Aoust L et al. [Status report on public health in Mauritius in 2009]. *Médecine Tropicale*, 2010, 70(3):229–238.
77. Dhunputh J. Progress in the control of schistosomiasis in Mauritius. Transactions of the Royal Society of Tropical Medicine and Hygiene, 88(5):507–509.
78. Rokni MB. The present status of human helminthic diseases in Iran. *Annals of Tropical Medicine and Parasitology*, 2008, 102(4):283–295.
79. Amarir F et al. National serologic survey of Haematobium schistosomiasis in Morocco: evidence for elimination. *American Journal of Tropical Medicine and Hygiene*, 2011, 84(1):15–19.
80. Rey L et al. [Schistosomiasis in Tunisia. Results after 10 years of the endemics control]. *Bulletin de la Societe de pathologie exotique et de ses filiales*, 1982, 75(5):505–522.
81. Utzinger J et al. Conquering schistosomiasis in China: the long march. *Acta Tropica*, 2005, 96(2–3):69–96.
82. El KT, Galal N, Fenwick A. The USAID/Government of Egypt's Schistosomiasis Research Project (SRP). Parasitology Today, 1998, 14(3): 92–96.
83. Anto F et al. Simultaneous administration of praziquantel, ivermectin and albendazole, in a community in rural northern Ghana endemic for schistosomiasis, onchocerciasis and lymphatic filariasis. *Tropical Medicine and International Health*, 2011, 16(9):1112–1119.
84. Olliaro PL et al. A multicentre randomized controlled trial of the efficacy and safety of single-dose praziquantel at 40 mg/kg vs. 60 mg/kg for treating intestinal schistosomiasis in the Philippines, Mauritania, Tanzania and Brazil. *PLoS Neglected Tropical Diseases*, 2011, 5(6):e1165.
85. Danso-Appiah A et al. Treatment of urinary schistosomiasis: methodological issues and research needs identified through a Cochrane systematic review. *Parasitology*, 2009, 136(13):1837–1849.
86. King CH et al. Utility of repeated praziquantel dosing in the treatment of schistosomiasis in high-risk communities in Africa: a systematic review. *PLoS Neglected Tropical Diseases*, 2011, 5(9):e1321.
87. Botros S et al. Current status of sensitivity to praziquantel in a focus of potential drug resistance in Egypt. International Journal for Parasitology, 2005, 35(7):787–791.

88. Ashton RA et al. Accuracy of circulating cathodic antigen tests for rapid mapping of Schistosoma mansoni and S. haematobium infections in Southern Sudan. *Tropical Medicine and International Health*, 2011, 16(9):1099–1103.
89. Shane HL et al. Evaluation of urine CCA assays for detection of *Schistosoma mansoni* infection in Western Kenya. *PLoS Neglected Tropical Diseases*, 2011, 5(1):e951.
90. Abbasi I et al. Detection of *Schistosoma mansoni* and *Schistosoma haematobium* DNA by loop-mediated isothermal amplification: identification of infected snails from early prepatency. *American Journal of Tropical Medicine and Hygiene*, 2010, 83(2):427–432.
91. Abbasi I et al. Differentiation of Schistosoma haematobium from related schistosomes by PCR amplifying an inter-repeat sequence. *American Journal of Tropical Medicine and Hygiene*, 2007, 76(5):950–955.
92. Garba A et al. Schistosomiasis in infants and preschool-aged children: Infection in a single Schistosoma haematobium and a mixed *S. haematobium-S. mansoni* foci of Niger. *Acta Tropica*, 2010, 115(3):212–219.
93. Betson M et al. Intestinal schistosomiasis in mothers and young children in Uganda: investigation of field-applicable markers of bowel morbidity. *American Journal of Tropical Medicine and Hygiene*, 2010, 83(5):1048–1055.
94. Gryseels B et al. Are poor responses to praziquantel for the treatment of *Schistosoma mansoni* infections in Senegal due to resistance? An overview of the evidence. *Tropical Medicine and International Health*, 2001, 6(11):864–873.
95. Augusto G et al. The influence of transmission season on parasitological cure rates and intensity of infection after praziquantel treatment of *Schistosoma haematobium*-infected schoolchildren in Mozambique. *Parasitology*, 2009, 136(13):1771–1779.
96. Kjetland EF et al. Association between genital schistosomiasis and HIV in rural Zimbabwean women. *AIDS*, 2006, 20(4):593–600.
97. *Report of an informal working group meeting on urogenital schistosomiasis and HIV transmission*. Geneva, World Health Organization, 2010 (also available at: http://whqlibdoc.who.int/hq/2010/WHO_HTM_NTD_PCT_2010.5_eng.pdf; accessed May 2012).
98. *Elimination of neglected diseases and other poverty-related infections*. Sixty first session of the Regional Committee for the Pan American Health Organization, Washington DC, USA, 28 September – 2 October 2009. Washington, DC, USA, Pan American Health Organization, 2009 (Resolution CD49.R19).
99. *Control and elimination of five neglected diseases in Latin America and the Caribbean 2010–2015: analysis of progress, priorities and lines of action for lymphatic filariasis, schistosomiasis, onchocerciasis, trachoma and soil-transmitted helminthiases*. Pan American Health Organization Regional Office of the World Health Organization, Washington DC, USA, 2010.

100. *Neglected Tropical Diseases: an emerging public health problem in the Eastern Mediterranean Region*. Cairo, World Health Organization Eastern Mediterranean Regional Office, 2006 (Resolution EM/RC54/R.3).

101. Wang LD et al. China's new strategy to block *Schistosoma japonicum* transmission: experiences and impact beyond schistosomiasis. *Tropical Medicine and International Health*, 2009, 14(12):1475–1483.

102. Wang LD et al. A strategy to control transmission of Schistosoma japonicum in China. *New England Journal of Medicine*, 2009, 360(2):121–128.

103. Schistosomiasis: population requiring preventive chemotherapy and number of people treated in 2010. *Weekly Epidemiological Record*, 2012, 87:37–44 (also available at: http://www.who.int/wer/2012/wer8704.pdf; accessed May 2012).

Annexes

ANNEX I. Chronology of WHO official publications on schistosomiasis

Year	Title
1950	Joint OIHP/WHO Study-Group on bilharziasis in Africa. Report of the First Session. WHO Technical Report Series 17. Geneva, WHO, 1950
1953	Expert Committee on Bilharziasis: First Report. WHO Technical Report Series 65. Geneva, WHO, 1953
1957	Study Group on the ecology of intermediate snail hosts of bilharziasis. Report. WHO Technical Report Series 120. Geneva, WHO, 1957
1961	Molluscicides. Second Report of the Expert Committee on Bilharziasis. WHO Technical Report Series 214. Geneva, WHO, 1961
1965	WHO Expert Committee on Bilharziasis. Third Report. WHO Technical report Series 299. Geneva, WHO, 1965
1965	Snail control in the prevention of bilharziasis. WHO Monograph Series 50. Geneva, WHO, 1965
1966	Chemotherapy of bilharziasis. Report of a WHO Scientific Group. WHO Technical Report Series 317. Geneva, WHO, 1966
1967	Epidemiology and control of schistosomiasis. Report of a WHO Expert Committee. WHO Technical Report Series 372. Geneva, WHO, 1967
1967	Measurement of the public health importance of bilharziasis. WHO Technical Report Series 349. Geneva, WHO, 1967
1973	Schistosomiasis control. Report of a WHO Expert Committee. WHO Technical Report Series 515. Geneva, WHO, 1973
1980	Epidemiology and control of schistosomiasis. Report of a WHO Expert Committee. WHO Expert Committee on Epidemiology and Control of Schistosomiasis. WHO Technical Report Series 643. Geneva, WHO, 1980
1985	World Health Organization. The control of schistosomiasis. Report of a WHO Expert Committee. WHO Technical Report Series 728. Geneva, WHO, 1985
1988	Progress in assessment of morbidity due to Schistosoma mansoni infection: a review of recent literature. Geneva, WHO, 1988
1992	The role of molluscicide in schistosomiasis control. Geneva, WHO, 1992
1993	The control of schistosomiasis. Second report of the WHO Expert Committee. WHO Technical Report Series 830. Geneva, WHO, 1993

1993	Control of Tropical Diseases. Schistosomiasis. Geneva, WHO, 1993
1998	Guidelines for the evaluation of soil-transmitted helminthiasis and schistosomiasis at community level. A guide for managers of control programmes. Geneva, WHO, 1998
1999	Monitoring helminth control programmes. Guidelines for monitoring the impact of control programmes aimed at reducing morbidity caused by soil-transmitted helminths and schistosomes, with particular reference to school-age children. Geneva, WHO, 1999
1999	Report of the WHO Informal Consultation on schistosomiasis control. Geneva, WHO, 1999
1999	Report of the WHO Informal Consultation on monitoring of drug efficacy in the control of schistosomiasis and intestinal nematodes. Geneva, WHO, 1999
2001	Schistosomiasis and soil-transmitted helminth infections. Resolution WHA54.19. Geneva, WHO, 2001
2001	Report of the WHO Informal Consultation on schistosomiasis in low-transmission areas: control strategies and criteria for elimination. Geneva, WHO, 2001
2002	Prevention and control of schistosomiasis and soil-transmitted helminthiasis. Report of a WHO Expert Committee. Technical Report Series 912. Geneva, WHO, 2002
2002	Helminth control in school-age children. A guide for managers of control programmes. Geneva, WHO, 2002
2004	Prevention and control of schistosomiasis and soil-transmitted helminthiasis. WHO/UNICEF Joint Statement. Geneva, WHO, 2004
2006	Preventive chemotherapy in human helminthiasis. Coordinated use of anthelminthic drugs in control interventions: a manual for health professionals and programme managers. Geneva, WHO, 2006
2009	Elimination of schistosomiasis from low-transmission areas. Report of a WHO informal consultation. Geneva, WHO, 2009
2010	Monitoring drug coverage for preventive chemotherapy. Geneva, WHO, 2010
2010	Report on an informal working group on urogenital schistosomiasis and HIV transmission. Geneva, WHO, 2010
2011	Report of a meeting to review the result of studies on the treatment of schistosomiasis in preschool-age children. Geneva, WHO, 2011
2012	Report of the informal consultation on schistosomiasis control. Geneva, WHO, 2012

ANNEX II. Issues of the *Weekly Epidemiological Record* on schistosomiasis

Year	Title
2000	Schistosomiasis and soil-transmitted helminth infections. WER, 2000, 75:122–124
2001	Schistosomiasis and soil-transmitted helminth infections. WER, 2001, 76:74–76
2006	Schistosomiasis and soil-transmitted helminth infections – preliminary estimates of the number of children treated with albendazole or mebendazole. WER, 2006, 81:145–163
2010	Schistosomiasis. Number of people treated, 2008. WER, 2010, 85:158–164
2011	Schistosomiasis. Number of people treated, 2009. WER, 2011, 86:73–80
2012	Schistosomiasis. Population requiring preventtive chemotherapy and number of people treated in 2010. WER, 2012, 87: 37–44

ANNEX III. Resolutions of the World Health Assembly on schistosomiasis

Year	Number and title	
1950	WHA3.26	Bilharziasis
1975	WHA28.53	Schistosomiasis
1976	WHA29.58	Schistosomiasis
2001	WHA54.19	Schistosomiasis and soil-transmitted helminth infections
2012	WHA65.21	Elimination of schistosomiasis

ANNEX IV. Revised estimates of people requiring preventive hemotherapy for schistosomiasis

Region	Country	Population living in the country, 2010 Total	Yearly estimate of SAC requiring PC	Yearly estimate of adults requiring PC	Yearly estimate of the total number of people requiring PC
AFR					
AFR	Angola	18 992 707	2 620 044	2 102 113	4 722 157
AFR	Benin	9 211 741	1 211 805	1 051 981	2 263 785
AFR	Botswana	1 977 569	141 414	23 520	164 934
AFR	Burkina Faso	16 286 706	1 632 868	420 417	2 053 286
AFR	Burundi	8 518 862	383 428	487 766	871 194
AFR	Cameroon	19 958 351	3 402 169	6 082 725	9 484 894
AFR	Central African Republic	4 505 945	504 376	338 986	843 361
AFR	Chad	11 506 130	1 664 218	1 624 043	3 288 262
AFR	Congo	3 758 678	275 282	37 583	312 865
AFR	Côte d'Ivoire	21 570 746	2 298 149	1 412 686	3 710 835
AFR	Democratic Republic of the Congo	67 827 495	9 413 637	7 667 268	17 080 905
AFR	Equatorial Guinea	693 385	25 605	24 157	49 762
AFR	Eritrea	5 223 994	321 875	160 648	482 523
AFR	Ethiopia	84 975 606	11 225 868	9 880 654	21 106 522
AFR	Gabon	1 501 266	159 570	150 821	310 391
AFR	Gambia	1 750 732	159 524	15 171	174 695
AFR	Ghana	24 332 755	2 998 372	3 358 009	6 356 380
AFR	Guinea	10 323 755	1 159 314	798 513	1 957 826
AFR	Guinea-Bissau	1 647 380	121 771	50 054	171 825
AFR	Kenya	40 862 900	5 338 978	5 786 903	11 125 882
AFR	Liberia	4 101 767	381 406	598 325	979 731
AFR	Madagascar	20 146 442	2 626 382	3 482 833	6 109 215
AFR	Malawi	15 691 784	2 767 313	3 615 403	6 382 717
AFR	Mali	13 323 104	2 218 104	3 149 978	5 368 083
AFR	Mauritania	3 365 675	285 339	347 656	632 995
AFR	Mozambique	23 405 670	4 835 659	8 007 849	12 843 508
AFR	Namibia	2 212 037	185 426	252 453	437 879
AFR	Niger	15 891 482	2 653 981	2 663 083	5 317 065
AFR	Nigeria	158 258 917	21 493 224	36 320 859	57 814 083
AFR	Rwanda	10 277 212	403 157	295 098	698 255
AFR	Sao Tome and Principe	165 397	3 988	3 645	7 633
AFR	Senegal	12 860 717	1 777 012	2 188 265	3 965 277
AFR	Sierra Leone	5 835 664	553 430	819 549	1 372 979
AFR	South Africa	50 492 408	2 438 847	2 751 964	5 190 811
AFR	Swaziland	1 201 904	152 702	147 113	299 815
AFR	Togo	6 780 030	855 640	819 841	1 675 481
AFR	Uganda	33 796 461	3 721 189	4 358 517	8 079 707
AFR	United Republic of Tanzania	45 039 573	5 619 288	3 910 191	9 529 480
AFR	Zambia	13 257 269	2 122 028	2 252 452	4 374 480
AFR	Zimbabwe	12 644 041	1 468 662	1 498 347	2 967 009
		804 174 257	**101 621 045**	**118 957 439**	**220 578 484**

Region	Country	Population living in the country, 2010 Total	Yearly estimate of SAC requiring PC	Yearly estimate of adults requiring PC	Yearly estimate of the total number of people requiring PC
Other regions					
AMR	Brazil	195 423 252	1 460 250	0	1 460 250
AMR	Venezuela (Bolivarian Republic of)	29 043 555	64 020	0	64 020
EMR	Egypt	84 474 427	58 092	0	58 092
EMR	Somalia	9 358 602	270 700	220 440	491 140
EMR	Sudan[a]	43 192 438	2 139 532	3 419 877	5 559 409
EMR	Yemen	24 255 928	2 717 000	5 668 000	8 385 000
SEAR	Indonesia	232 516 771	2 937	0	2 937
WPR	Cambodia	15 053 112	5 734	0	5 734
WPR	China	1 361 763 412	119 563	0	119 563
WPR	Lao People's Democratic Republic	6 436 093	8 718	0	8 718
WPR	Philippines	93 616 853	483 104	0	483,104
		2 095 134 443	**7 329 650**	**9 308 317**	**16 637 966**
	WORLD		**108 950 695**	**128 265 756**	**237 216 451**

[a] Includes both Sudan and South Sudan.

AFR, WHO African Region; AMR, WHO Region of the Americas; EMR, WHO Eastern Mediterranean Region; PC, preventive chemotherapy; SAC, school-age children; SEA, WHO South-East Asia Region; WPR, WHO Western Pacific Region

ANNEX V. List of schistosomiasis-endemic countries according to WHO Technical Report Series No. 830

Country or territory	*S. haematobium*	*S. mansoni*	*S. intercalatum**	*S. japonicum*	*S. mekongi*	*S. malayensis*
African Region						
Algeria	+					
Angola	+	+				
Benin	+	+				
Botswana	+	+				
Burkina Faso	+	+				
Burundi		+				
Cameroon	+	+	+			
Central African Republic	+	+	+[a]			
Chad	+	+	+[a]			
Congo	+	+	+[a]			
Côte d'Ivoire	+	+				
Democratic Republic of the Congo	+	+	+			
Equatorial Guinea			+			
Eritrea[b]		+				
Ethiopia	+	+				
Gabon	+	+	+			
Gambia	+	+				
Ghana	+	+				
Guinea	+	+				
Guinea-Bissau	+	+				
Kenya	+	+				
Liberia	+	+				
Madagascar	+	+				
Malawi	+	+				
Mali	+	+	+[a]			
Mauritania	+					
Mauritius	+					
Mozambique	+	+				
Namibia	+	+				
Niger	+	+				
Nigeria	+	+	+[a]			
Rwanda		+				
Sao Tomé and Principe	+		+			
Senegal	+	+				
Sierra Leone	+	+				
South Africa	+	+				
Swaziland	+	+				
Togo	+	+				
Uganda	+	+				
United Republic of Tanzania	+	+				
Zambia	+	+				
Zimbabwe	+	+				

Country or territory	*S. haematobium*	*S. mansoni*	*S. intercalatum**	*S. japonicum*	*S. mekongi*	*S. malayensis*
Region of the Americas						
Antigua		+				
Brazil		+				
Dominican Republic		+				
Guadeloupe		+				
Martinique		+				
Montserrat[b]		+				
Puerto Rico		+				
Saint Lucia		+				
Suriname		+				
Venezuela (Bolivarian Republic Of)		+				
Eastern Mediterranean Region						
Djibouti[b]		+				
Egypt	+	+				
Iran (Islamic Republic of)	+					
Iraq	+					
Jordan	+					
Lebanon	+					
Libya	+	+				
Morocco	+					
Oman	+	+				
Saudi Arabia	+	+				
Somalia	+	+				
Southern Sudan[b]	+	+				
Sudan	+	+				
Syrian Arab Republic	+					
Tunisia	+					
Yemen	+	+				
European Region						
Turkey	+					
South-East Asia Region						
India	+					
Indonesia				+		
Thailand				+		
Western Pacific Region						
Cambodia					+	
China				+		
Japan				+		
Lao People's Democratic Republic					+	
Malaysia						+
Philippines				+		

[a] Confirmation required (as of 1993); [b] Countries not included in the 1993 list; * In some countries, this parasite should be reclassified as *S. guineensis*