CHAPTER FOUR

Epidemiological Features and Control Progress of Schistosomiasis in Waterway-Network Region in The People's Republic of China

L. Shi[*,§], W. Li[*,§], F. Wu[*,§], J.-F. Zhang[*,§,], K. Yang[*,§,1], X.-N. Zhou[¶,||,#,1]**

[*]Jiangsu Institute of Parasitic Diseases, Key Laboratory of Parasitic Disease Control and Prevention (Ministry of Health), Jiangsu Provincial Key Laboratory of Parasite Molecular Biology, Wuxi, The People's Republic of China
[§]Public Health Research Center, Jiangnan University, Wuxi, The People's Republic of China
[¶]National Institute of Parasitic Diseases, Chinese Center for Disease Control and Prevention, Shanghai, The People's Republic of China
[||]Key Laboratory of Parasite and Vector Biology of the Chinese Ministry of Health, Shanghai, The People's Republic of China
[#]WHO Collaborating Center for Tropical Diseases, Shanghai, The People's Republic of China
[**]Zhejiang Academy of Medical Sciences, Hangzhou, Zhejiang, The People's Republic of China
[1]Corresponding authors: E-mail: jipdyk76@hotmail.com; zhouxn1@chinacdc.cn

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Abstract

Schistosomiasis was one of the most serious parasitic diseases in The People's Republic of China, and the endemic region was classified into three types according to the epidemiological characteristics and living conditions of the intermediate host. After more than 60 years of efforts, schistosomiasis control programme has made great strides in waterway-network regions. We analyse the epidemic changes of schistosomiasis and its control progress through the schistosomiasis regions' documents and investigation data to evaluate the efficacy of the schistosomiasis control strategies in the waterway-network–type endemic region, which provides the basis for refinement of efforts, as well as summary of the Chinese schistosomiasis control experience in the waterway-network areas.

1. INTRODUCTION

Schistosomiasis was one of the most serious parasitic diseases in The People's Republic of China with a documented history of over 2100 years. During the mid-1950s, at the beginning of the national control programme, schistosomiasis was endemic in 12 provinces, with estimated 11.6 million people (Zhou et al., 1994) and 1.2 million cattle infected, and an area of 14,300 km^2 infested by the intermediate host snail, *Oncomelania hupensis* (Xianyi et al., 2005). According to the epidemiological characteristics and living conditions of the intermediate host, the endemic regions were classified into three types, namely (1) waterway-network regions, (2) marshlands and lakes regions and (3) the mountainous and hilly regions (Chen and Zheng, 1999).

Compared with the marshland and lake regions, waterway-network regions constitute 7.9% of the total area and had 33% of the total accumulative number of patients in the whole country in 1950s (Table 1, Fig. 2). There are two main reasons for this: the high density of the district population and the high infection rate of residents. Shanghai, Jiangsu and Zhejiang provinces are few of the major growing regions along the Yangtze River delta in The People's Republic of China; therefore, schistosomiasis has affected the development and production of the country. For instance, in Qingpu County, located in Shanghai, during 1950s, nearly 92% (23/25) townships were infected with schistosomiasis. Residents' faecal positive test rate was 45.90% and accumulated snail area was 74,297,000 m^2, whereby snails infection rate was 8.88% (Cheng and Song, 1997). In a break out of acute infection in Gaoyou, a waterway-network–type city located in the middle of Jiangsu Province, 4019 residents were infected and 1335 residents died of schistosomiasis (Xu, 1994).

Waterway-network–type endemic areas in The People's Republic of China were mainly distributed in Shanghai, Jiangsu, Zhejiang, Anhui and

Table 1 Constituent ratio of different types of the distribution in The People's Republic of China in 1950s

Province	Waterway-network region Constituent ratio (%)	Marshlands and lakes region Constituent ratio (%)	Mountainous regions Constituent ratio (%)
Shanghai	14.84		
Jiangsu	59.06	5.91	3.51
Zhejiang	20.32	0.09	22.57
Anhui	5.44	7.9	16.66
Fujian		17.7	1.52
Jiangxi		36.46	20.5
Hubei		31.16	6.83
Hunan		0.77	0.73
Guangdong	0.35		0.32
Guangxi			1.46
Sichuan			14.03
Yunnan			11.88
Total	7.89	79.52	12.59

Guangdong provinces. All the schistosomiasis endemic areas in Shanghai were in the waterway-network region; 47.55%, 35.91% and 4.01% of the Jiangsu, Zhejiang and Guangdong provinces, respectively, were the waterway-network regions (Fig. 3). Shanghai, Jiangsu and Zhejiang had the most serious outbreaks of the epidemic in the waterway-network–type regions (Fig. 1). The results of a study by Shanghai Research Institute showed that in 1953, 9 of 10 country regions had the epidemic and 51.1% population was infected with schistosomiasis. The average prevalence was 24.7%, and about a third of the total villages and towns had high levels of prevalence with the infection rate over 30% (Jinli et al., 1982).

After the liberation of The People's Republic of China, the Communist Party of The People's Republic of China (CPC) Central Committee attached great importance to control schistosomiasis (Xu et al., 2016a,b). Professional management institutions were established in the epidemic area on the principle of 'integrated scientific control adjusting measures to local conditions, classification and guidance'. After more than 60 years of efforts, schistosomiasis control program has made great strides in the waterway-network regions. Shanghai, Jiangsu, Zhejiang and other waterway-network regions of the county (city) have achieved schistosomiasis transmission interruption standard and have entered the stage of surveillance and consolidation. In this chapter, we analyse the epidemic changes of schistosomiasis and its control progress through the schistosomiasis regions' documents and investigation data to evaluate the efficacy of the schistosomiasis control strategies in the

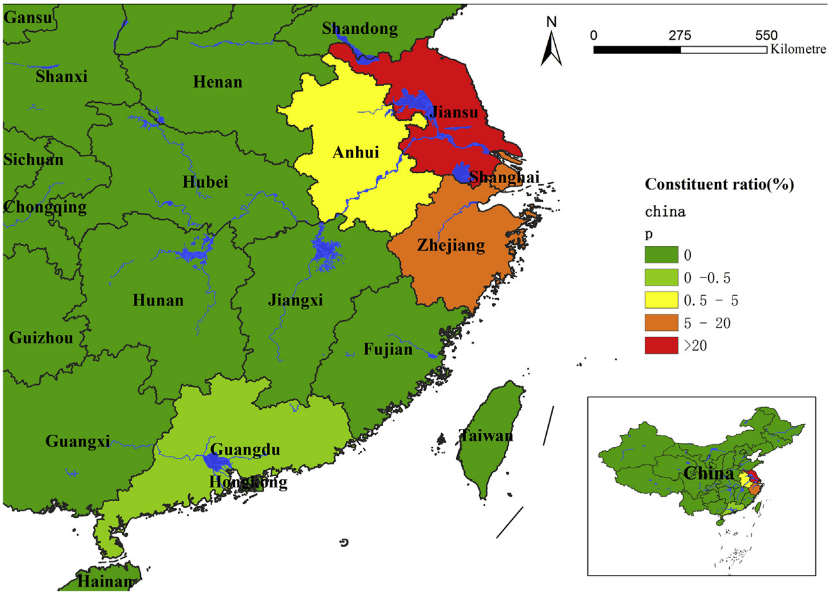

Figure 1 Constituent ratio of waterway-network regions of different provinces in The People's Republic of China during 1950s.

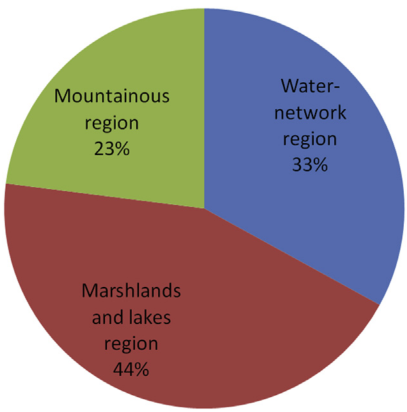

Figure 2 Constituent ratio of people infections in different types of regions in 1963.

waterway-network type endemic region, which provides the basis for refinement of efforts, as well as summary of the Chinese schistosomiasis control experience in the waterway-network areas.

2. WATERWAY-NETWORK AREAS: GEOGRAPHICAL FEATURE

Water-network areas, also called plain regions with waterway networks, mainly refer to the broad plains between the Yangtze River and

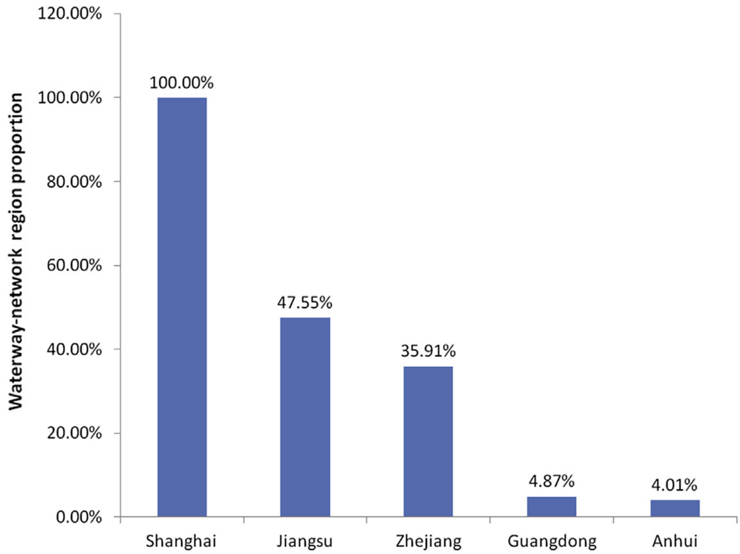

Figure 3 Proportion of waterway-network region areas in different provinces in 1950s.

the Qiantang River or belong to the Yangtze River delta region. This area belongs to subtropical climate zone, spring and winter rainy areas, where the annual rainfall is about 1200 mm. These areas are characterized by dense population, rivers and lakes, low altitude and many rice fields. Furthermore, the water levels have not changed significantly, there is slow or sluggish flow of water and the shore weeds along the river provide a conducive breeding environment for the snails responsible for schistosomiasis.

3. EPIDEMIOLOGICAL FEATURES OF SCHISTOSOMIASIS IN WATERWAY-NETWORK REGION

The waterway-network regions are different from the other two types of regions due to snail ecology, infected ways of population, reservoir type and geography.

3.1 Ecology and distribution of characteristics of snail

Structurally, the snail in waterway-network epidemic area is medium sized, 5.5—7.5 mm height and with shallow ribs. Each spiral has 15 ribs, but this is not always the case, as snails in north Jiangsu coastal plain have no ribs (Li et al., 2016; MOH, 2000) (Fig. 4).

Snail distribution is linear along the irrigation water system, but the snail density in the linear region sometimes is uniform. Usually the snails are

Figure 4 Waterway-network region snail.

found within the irrigation ditch where water flows slowly and it is full of grass. Sometimes the snails are also found in the ponds that interlink the river and the ditch, but the population density is scanty. In the fields, the snails are mainly distributed at the inlets and outlets of the ridge waterways.

3.2 Ways of infected and characteristic of patient distribution

Residents of waterway-network region live alongside the river, for the convenience to get water for domestic use and transportation to another area. They, also defaecate into cylinders from where faeces containing eggs of *Schistosoma* escape and contaminate the water. Daily life of the villagers brings them into frequent contact with the contamination: children swim in the contaminated water and local cattle drink at these water bodies.

In 1963 (Fig. 2), 34.3% of the total patients came from the water-network area. The prevalence was typically higher in men than in women and the prevalence also increased with age peaking at 15–19 or 20–24 years (Chen, 2014). Fishermen, boatmen and farmers had the highest infection rate, followed by rural children who bathed in the river.

3.3 The Reservoir Host

Sources of infection in the water-network regions were mainly infected persons and infected animals (cattle, dogs and rats) with schistosomiasis. Schistosomes infect animals mainly through skin and oral mucosa. Epidemiological investigations proved that infection of the human is related to animal's infection such as murine or bovine. There were examples found in two neighbouring villages in the suburbs of Shanghai; infection of cattle and rats in North-Ma village were higher than South-Ma village (Xu, 1985) (Table 2). In the waterway-network area, the number of infected animals is an indicator that affects the significance of the animals as a source of

Table 2 Comparison of people and animal infection in Shanghai in 1959

	North-Ma village			South-Ma village		
Statistical indicators	**People**	**Cattle**	**Ditch mouse**	**People**	**Cattle**	**Ditch mouse**
The number of survey	617	28	68	951	23	61
Number of infections	428	14	63	369	5	6
Infection rate (%)	69.4	50	92.6	41.6	21.7	9.8

infection due to the amount of the feces of the animals frequenting and polluting the water bodies. In general, the number of schistosomiasis eggs in cow dung (per unit weight) is far lower than that in the faeces of the patients, but the quantity of cow dung is nearly a 100 times that of the human feces. Livestock is often housed in the homes of local residents, so the impact of livestock infection on the residents is relatively straightforward. Wild animals being far away from the residential area had a less direct impact. Considering the nearness to the residential area the, ditch rat, although not a livestock, was also an important source of infection (Cao et al., 2016).

3.4 Snail control strategies and measures in the waterway-network region

In accordance with the human living conditions and occurrences of infection (contacting water frequently, high repeated infection rate), the integrated schistosomiasis control strategy with emphasis on snail control was taken up in the waterway-network region.

Rivers, ditches, paddy fields and beach were the main breeding grounds for snails in waterway-network regions. According to the snail ecology, the spring and autumn were the right seasons to survey and control the snails, especially in late March and early April. The experience gained proved that most snail habitats can be eliminated by snail control through environmental management as the main measure and drug as the auxiliary measure. Normally, the snail control method through environmental management in these areas was combined with farmland capital construction, water conservancy and aquatic production. There are various kinds of environmental management methods suitable to the different terrains. The Creek terrain used soil burial method by shovelling soil, ditching or trenching along the river bank or near the waterline, combined with spraying of drug to control the snails. The methods of opening a new channel, filling the old ditch, changing sunlight conditions on culverts and hardening channels were used in the ditch terrain. Soil burial or low-toxicity drugs spraying methods were used in the farmland terrain. All in all, environmental transformation and agricultural farm construction, such as flattening land, irrigation of ditches, river building by laying bricks or stones, were the effective measures of snail control in the waterway-network areas (MOH, 2000; Yang et al., 2016).

4. CONTROL PROGRESS AND ITS EFFECT ON THE WATERWAY-NETWORK REGIONS

For schistosomiasis, the epidemic is complex, and the control work was very difficult, especially in the early days after foundation of the programme, due to seriousness of the schistosomiasis epidemic, large population distribution and low development level of national economy. It was a big problem to adopt the appropriate kind of control strategy and measures, in the waterway-network—type endemic areas. According to the epidemic characteristics of schistosomiasis and the prevailing circumstances of the country, on the basis of the research and practice of prevention and cure, the government proposed an action of relying on the masses — the combination of prevention and cure, integrated prevention and control policy and giving priority to chemotherapy to control infection. Sixty years of the prevention and treatment practices showed that this policy is in conformity with the specific conditions of the country. According to the endemic feature, control strategy and control experiences of schistosomiasis in different areas of the waterway-network region (Cheng and Song, 1997; Jinli et al., 1982; Xu, 1994; Zheng et al., 1997), the progress of the control processes were generally divided into four stages (Fig. 10) as discussed in the following subsections.

4.1 Investigation and preparation stage

Before liberation, schistosomiasis seriously affected the lives of the people, it caused substantial morbidity, including wasting, weakness, ascites and growth retardation. Mortality was considerably high. Few years after the founding of The People's Republic of China, during the mid-1950s, the Government of The People's Republic of China recognized the social and economic importance and implication of schistosomiasis. It became a major public health concern. Hence, professional institutions and a national control and research programmes were established as early as the mid-1950s. This programme has been implemented until 2015, including periodic policy reviews to keep the control strategy in line with field realities and to adapt the approaches to the changing economic, epidemiological and socio-political conditions.

During the early 1950s, when the Chinese population was about 600 million, an estimated 11.612 million people were infected with *Schitosoma japonicum* (United Nations, 2002). Among the waterway-network endemic region, the highest proportion of people infected was recorded in the Jiangsu Province. Here, an estimated 371,700 people were infected, which comprised 21.3% of the total population. Large number of infected people and hence a high infection prevalence were also found in Shanghai (number of people infected: 33,016; infection prevalence: 26.3%) and Zhejiang Province (number of people infected: 2.037 million; infection prevalence: 17.5%). The average density of the intediate host snails during mid-1950s was 45.6/0.1 m^2 in Shanghai (Jinli et al., 1982).

4.2 Transmission control stage

In order to effectively control waterway-network region of schistosomiasis, and in the light of the characteristics of the region, integrated control measures targeted on schistosomiasis were carried out with emphasis on environmental management from 1956 to 1980s. It consisted of snail elimination, primarily by environmental management (Fig. 5), followed by diagnostic screening, chemotherapy, provision of clean water and improved sanitation and hygiene. In combination with agricultural engineering and water conservancy projects, large areas were environmentally modified to make them unsuitable

Figure 5 Snail control method by shovelling soil and distributing drugs in Shanghai city.

as habitats for the amphibious snails. Many of the approaches included methods with distinctive Chinese features which were applied in the waterway-network endemic areas.

Shanghai is a typical waterway-network endemic area. In the 1950s, because of the lack of understanding of snail ecology, only single shovel soil method was used as the control measure. Snail density was reduced, but it was difficult to compress the snail-affected area. Snails remained, and hence the snail breeding started again in the same region. For this reason, snail control measures were readjusted in 1958. To this effect, a series of integrated measures including damming, pumping, furrowing and soil burial were implemented near the river systems (Fig. 4).

Apart from People's Liberation Army (PLA), more than 20,000 people including a large number of middle school students and urban residents worked together with the local populace. Professional snail control teams were organized, and drug was used as a supplement to improve and consolidate the control effect. At the same time, active water sanitation management was carried out in the region. Family toilets near rivers were discouraged, and wells were dug in the village areas. In 1958, improved centralized sanitary management was reached at 78.62% in the endemic area. As a result, integrated control measures played an important role in the control of schistosomiasis infection. Regrettably, due to the 3 years of natural disasters and the resulting inadequate work control, there was a rebound of the snail situation and the snails resurfaced once more. With this endemic background, the control scheme in Shanghai region was adjusted again in 1964. In order to focus aggressive efforts to eliminate key environmental snails, the control area was moved from all the districts to key environmental snail districts; control teams were reconstituted as professional teams rather than from the masses. An integrated rapid drug control method (drug soaking, spaying, land filling) was carried out combined with construction for irrigation and water conservancy, which greatly reduced the density of snails, and the snail distribution was compressed from flakes to points in the map. At the same time, snail investigation of paddy fields was intensified and a large area of land snail was discovered (Fig. 6). A similar method was used in this area which gave good results. Up to 1968, aquatic snails in the whole region decreased by 85.8% and the land snails decreased by 96% compared with 1965 (Fig. 5). As there was a steady decline in the number of snail-infected areas and the number of patients, screening and treatment measures were strengthened again in the Shanghai region. Similar control strategy was used in other waterway-network regions, such as

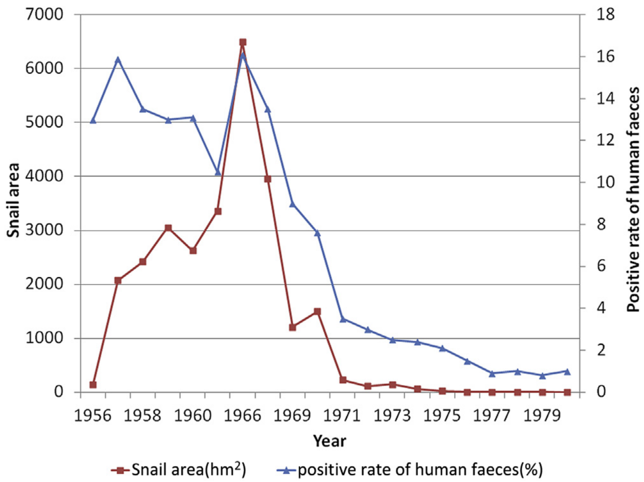

Figure 6 Percentage of snail area and pollution of infection rate in Shanghai (1956–80).

Kunshan County in Jiangsu Province and Jiashan County in Zhejiang Province (Zheng et al., 1997).

As a result, great success was achieved in these areas. In Shanghai, during this period, a total of 29.34 million people were examined and 1.86 million were treated in nine endemic areas. A total of 556,000 domestic cattle were investigated and 25,000 were treated. No acute cases of schistosomiasis and infected cattle were found in all the districts for more than 11 years by the end of 1975 (Table 3). No infected snail was found in the examined 126,176 snails by the end of 1980 (Jinli et al., 1982).

In Kunshan County of Jiangsu Province, according to the field surveillance carried out in 1980, among the 2206 cases of *S. japonicum*–infected persons and in comparison with the data at the early 1950, the number of infected people decreased by 80.4%. Among 19,245 examined cattle, 87 were found infected in 1980. The positive rate of stool examination was

Table 3 Cattle infection from year 1958 to 1978 in Shanghai

Cattle	1958	1963	1970	1971	1972	1973	1974	1975–78
Number of examination	2455	182	368	3729	553	1102	870	1835
Infection number	548	34	3	2	2	1	0	0
Infection rates (%)	22.3	18.68	0.82	0.05	0.36	0.09	0	0

0.45%; a decrease of 0.6% as compared to the early 1950s. Snail control also achieved great progress.

In 1980, intermediate host snails were found on a total surface area of 76.6 km^2. This translates to a decrease of 92.6% compared to the corresponding surface area of 1,000,321 km^2 during the early 1950s. More importantly, the control strategy not only decreased the patients and snail area, but also promoted agricultural production and economic development (Fig. 7). The experience gained proved that most snail habitats can be eliminated by snail control through environmental management as the main strategy (Fig. 8).

4.3 Transmission interruption stage

Great success was achieved in waterway-network endemic area in the early 30 years. Schistosomiasis control campaigns focused on transmission control had eliminated large areas of snail habitats and the number of schistosomiasis cases reduced remarkably. Schistosomiasis was then circumscribed to certain core regions that have been demonstrated to be more difficult to sustain control, such as the low endemic area and the area by the lake or marshland of the Yangtze River. Morbidity remained a serious problem with more than 10,000 cases of advanced schistosomiasis.

With the advent of praziquantel and the development of improved diagnostic techniques, the expert committee of the World Health Organization (WHO) replaced the strong emphasis on transmission control by morbidity control during the mid-1980s (WHO, 1985). The introduction of praziquantel, a highly effective, low-cost anti-schistosomiasis drug, led to the national schistosomiasis control strategy to shift from transmission control to

Figure 7 Snail fields changed into fish ponds by environmental transformation in Jiangsu Province.

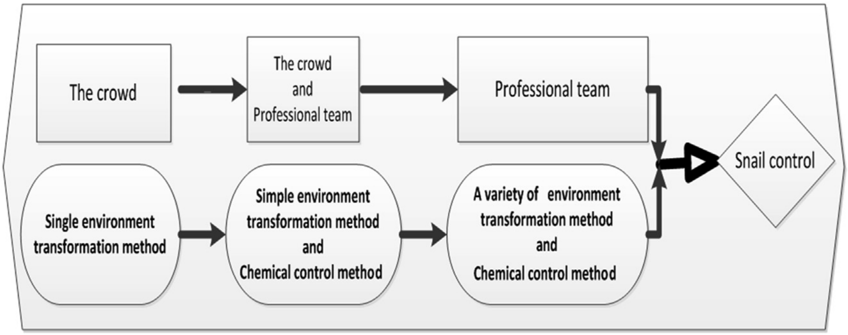

Figure 8 Evolution of snail control method in waterway-network region.

morbidity control in accordance with the new WHO global strategy of Tambo et al. (2015) with considerable success. For instance, in Kunshan County, no new infections were found in five consecutive years (1986–90), and only one reinfected case was found by the end of 1990 (Fig. 9).

Consequently, a stepwise control strategy was employed for controlling schistosomiasis in these core regions (Collins et al., 2012). The first step was to control morbidity through mass chemotherapy in the severely endemic areas and selective chemotherapy in less severely endemic areas. Further steps included snail control through mollusciciding and/or environmental modification, as well as health education and sanitation. For example, in

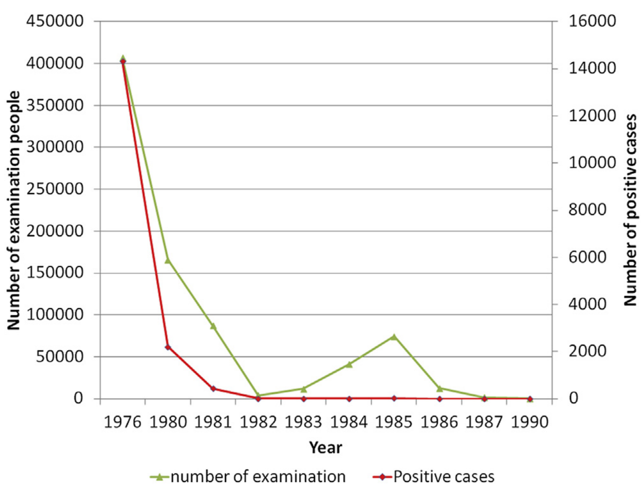

Figure 9 Number of examined and positive-tested people in Kunshan County of Jiangsu Province (1976–90).

1992 a joint project supported by the World Bank, which was also an important component of National Schistosomiasis Control Program, was initiated. The primary objectives were to control morbidity due to schistosomiasis and in some areas to interrupt the transmission. With the introduction of the anti-schistosomal drug praziquantel, the strong reliance on praziquantel-based morbidity control during the 10-year World Bank Loan Project (WBLP) for Schistosomiasis Control in The People's Republic of China, complemented with health education and continued to yield rich dividend in snail control (Xianyi et al., 2005; Zhou et al., 2005).

By the end of the year 1995, the endemic townships gradually reached transmission interruption criteria and schistosomiasis in the waterway-network regions had been eliminated in Shanghai, Jiangsu, Zhejiang and Guangdong provinces (Wu et al., 2005; Zheng, 1988).

4.4 Consolidation and surveillance (1990s to present)

Since 1990s, after the elimination of schistosomiasis, an overall surveillance and consolidation work has been unfolded in the water-network regions. When the program is focussed on the surveillance of the snail and the disease, it must be combined with the urbanization and economic development in rural areas, integrated with the improvement of ecological environment of rural areas and change of people's unhealthy living habits, through the establishment of modern, hygienic facilities in villages and towns so as to guarantee the real implementation of integrated control and management approaches. As a result, by the end of 1994 in Shanghai, among the 5.5 million rural residents the availability of running water supply had reached 98.7%, and Shanghai become the first city in the The People's Republic of China to realize running water supply in rural areas. This was endorsed by the National Patriotic Health Campaign Committee through an assessment. By the end of the year 2000, a total of 1234 million new sanitary toilets had been built up in peasants' households, 92.6% of the 1.33 million peasants' households had their own sanitary toilets and human night soil is now mostly sanitized (Handing et al., 2002). The total amount of original snail habitats along the rivers was found to be 46,261 million m^2 and among these habitat areas, 13,991 million m^2 have been thoroughly modified and the snails eliminated. There were 120,211 million m^2 original snail-ridden ditches, canals and mud flats of which 25,342 million m^2 have been thoroughly modified, with a modification rate of 21.1%. Many areas which have undergone environmental management have been kept free from snails for about 10–20 years. By the end of 2011, no new local infection case has been found in both human and livestock in the waterway-network regions in the whole country. Achievement of schistosomiasis eradication has been effectively consolidated. The time taken by the waterway-network region to reach the criteria was over 15 years and the programme has now entered a long-term surveillance phase. However, due to the fact that the prevalence and spread of schistosomiasis is influenced by many factors, the outbreaks appear repeatedly in some waterway-network regions. Some of these main factors include:

(1) *Biological factors*: Though the living snail density achieved the acceptance criteria, which was difficult to seize, by strengthening control measures such as molluscicide, detection and treatment of livestock, if surveillance and consolidation are weakened, the remaining snails easily breed into a large population and can cause an epidemic rebound. For instance, certain waterway-network regions found high density of snails' areas which accounted for more than 20% of the total snail area in Zhejiang Province in 2000 which had reached transmission interruption criteria in 1995. After 10 years of transmission interruption, 57.38 km^2 snail area have been found in 6 counties and 134 villages in Shanghai (Gao et al., 1998).

(2) *Natural factors*: Due to the changes in ecological impacts of floods (Zhou et al., 2002), returning farmland for lake and large water conservancy construction, an exogenous source of infection of input snails appeared in waterway-network area which caused an epidemic. Research has shown that input snails can reproduce in waterway-network region and can cause a high prevalence of schistosomiasis. Surveillance result showed that in Songjiang and Jinshan districts in Shanghai, 23 river-ways were found to have snails which occurred on the flotage between 1997 and 2002 (Jiang et al., 2003). Gaochun County of Jiangsu Province reached transition interruption in 1985, but in 1999 large infected snails area were discovered again in this county after the floods in 1998 (Fig. 11) (Shi et al., 2004). Moreover, climate change has been proven to be a factor of the transmission of vector-borne diseases (Githeko et al., 2000; Kilpatrick and Randolph, 2012; Medlock and Leach, 2015), and it has also been demonstrated that schistosomiasis, being snail-borne, is affected by the climate change (Mas-Coma et al., 2009; McCreesh and Booth, 2013). The rise in temperature may cause snail survival and reproduction in currently nonbreeding sites, resulting in the potential transmission of schistosomiasis (McCreesh et al., 2015). It is therefore considered that climate change may affect, in a long term, the progress of schistosomiasis elimination in The People's Republic of China (Butler, 2012; Mayala et al., 2015).

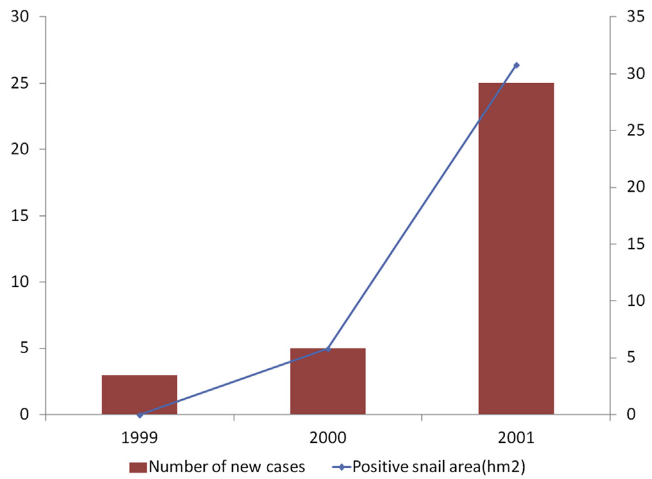

Figure 10 Schistosoma epidemics monitoring results in Gaochun County from 1999 to 2001.

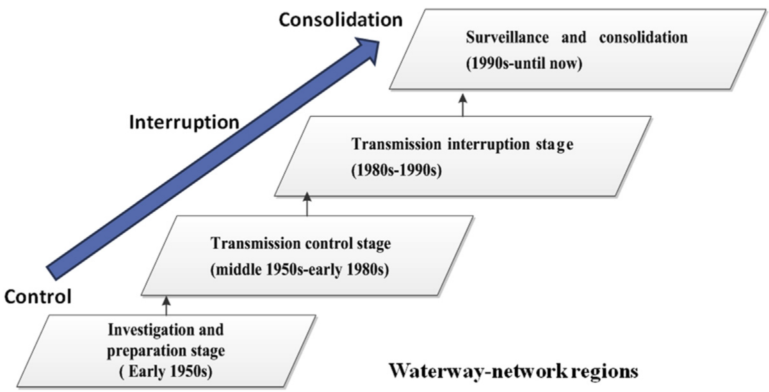

Figure 11 Control status of schistosomiasis in waterway-network regions in The People's Republic of China at different stages.

(3) *Social factors*: The diminished funding after the WBLP in The People's Republic of China in the early 2000s, in conjunction with wider demographic, environmental and socioeconomic transformations and changes in the health sector and professional control teams, including cost escalation and declining quality and availability of primary health care and preventive care, contributed to the reemergence of schistosomiasis in certain parts of the country. From the history of schistosomiasis control in The People's Republic of China, it is considered that reduced political will and financial support may pose a great threat to the progress of schistosomiasis elimination

(Fan, 2012). Moreover, with the progress of urbanization and the increasing mobility of the population imported schistosomiasis cases in some areas also showed an increase of trend (Wen et al., 2004). Between 1996 and 2005 in Shanghai, 31 input cases were found and among them 14 cases were acute (Jiang et al., 2007). Between 1996 and 2009 in Zhejiang Province, 174 imported cases were found which included 36 acute cases (Liyong et al., 2010). These emergent new circumstances have become potential risk factors to influence the achievements of prevention and consolidation and have become the main issues and priorities in transmission interrupted areas (Zheng et al., 2013).

5. FUTURE CHALLENGE

In future work, based on the Schistosomiasis Prevention Act, the surveillance and consolidation in waterway-network regions should be strengthened to eliminate the potential risk factors and prevent the spread of schistosomiasis (Lin et al., 1996; Liu et al., 2014):

1. In waterway-network areas which still have potential risk factors, risk evaluation should be carefully carried out in the areas which still have the possibility of snail habitats proliferation and infection input. At the same time, passive and active surveillance of snails and patients should be carried out steadily.
2. The strategy 'wipe out the remnants of snails with prevention of the input snails as supplement' should be adopted in the snail surveillance and control work. The history of snail habitats and snail-suitable environment should be taken into account, especially focussing on production and living areas of the population. Timely investigation should be carried out when infection of snails is found; the drug and environment change can be used to control the snails in agriculture and fishing industry.
3. During the disease surveillance and control work, 'control on the exogenous source of infection with clean endogenous source of infection as supplement' strategy should be adopted. The movement of people and livestock from uncontrolled or epidemic county is vital to the population. Suspected cases of schistosomiasis should be reported by medical institutions promptly, diagnosed cases should be reported through the disease surveillance information report management system timely through the internet and then epidemiological investigation process should be implemented timely as well (Feng et al., 2016; Wang et al., 2016).

4. From the history of schistosomiasis control in The People's Republic of China, the long-term and complex work on schistosomiasis should be fully understood (Cao et al., 2016; Zhang et al., 2016). The waterway-network area should remain stable and controlled by a professional team that should ensure funds for surveillance and consolidation. In addition, to ensure that prevention and treatment course to be effective, The People's Republic of China should also establish sensitive and efficient surveillance and early warning mechanisms to effectively cope with the possible outbreak of schistosomiasis thus preventing the resurgence of an epidemic (Zhou, 2009; Zhu et al., 2011).

Although remarkable progress has been made in the control of waterway-network regions of schistosomiasis during the past 60 years, the disease remains endemic in 124 counties in the other types of regions. To consolidate the achievements made to date and to ultimately eliminate the disease, The People's Republic of China still has a long way to go. However, the prospects are bright and the tasks ahead can be achieved alongside the social and economic development of the country. The experiences gained in The People's Republic of China are likely to stimulate schistosomiasis control and guide integrated and sustainable control elsewhere in the world (Tambo et al., 2014; Xu et al., 2016a,b).

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