Preplanned Studies

Epidemic Characteristics of Schistosomiasis — China, 2016–2023

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Summary

What is already known about this topic?

Schistosomiasis is a water-borne parasitic disease that significantly threatens human health and socioeconomic development. In China, *Schistosoma japonicum* is the predominant pathogenic species, and transmission control criteria were successfully achieved nationwide in 2015.

What is added by this report?

This report comprehensively documents schistosomiasis epidemiology in China from 2016 to 2023, presenting provincial and county-level data on human infections, cattle reservoirs, and *Oncomelania hupensis* snail vector distribution. Serological findings at both provincial and county levels demonstrate persistently elevated seropositive rates in specific regions despite overall progress.

What are the implications for public health practice?

Development of highly sensitive diagnostic tools for low-intensity infections is essential, while intelligent early warning systems and multi-channel surveillance mechanisms must be strengthened to achieve the goal of schistosomiasis elimination in China.

ABSTRACT

Introduction: The Chinese government has established targets for elimination of schistosomiasis in all endemic counties by 2028. This study aimed to analyze the epidemiological characteristics of schistosomiasis in China after transmission control and provide a theoretical basis for achieving the county-level elimination goal by 2028.

Methods: Provincial and county-level data on human infection, cattle reservoirs and *Oncomelania hupensis* snail vector distribution were collected from 2016 to 2023, to analyze the trend of schistosomiasis epidemic situation and serological positive rate. Joinpoint regression analysis was employed to analyze seropositive rate trends.

Results: The number of schistosomiasis cases decreased by 49.00%, from 54,454 in 2016 to 27,772 in 2023. The 8-year average seropositive rate across provincial-level administrative divisions (PLADs) was 1.80%, with the highest rates observed in Yunnan (2.99%), Jiangxi (2.84%), and Hunan (2.67%) PLADs. Joinpoint analysis revealed a consistent decline in seropositive rates since 2016 and a significant inflection point was identified in 2021, indicating an acceleration in the rate of decline. No positive cattle have been detected since 2020. The total area of snail habitats exhibited a slight rebound from 356,835 square hectometers (hm^2) in 2016 to 367,702 hm^2 in 2023, with new habitats emerging annually, totaling 4,080 hm^2 of newly identified habitats.

Conclusions: Development of highly sensitive and specific diagnostic tools is essential, alongside intensified surveillance of wild animal reservoirs and high-risk snail habitats, to achieve the goal of eliminating schistosomiasis by 2030.

Schistosomiasis represents a significant and widespread neglected tropical disease (NTD) with substantial public health implications (*1*). In 2012, the World Health Assembly adopted a resolution targeting the global elimination of schistosomiasis as a public health problem by 2025 (*2*). China successfully met the criteria for transmission control of schistosomiasis across all provincial-level administrative divisions (PLADs) in 2015. The Healthy China 2030 Plan Outline and the Action Plan for Accelerating the Goal of Schistosomiasis Elimination (2023–2030) have established ambitious targets for transmission interruption and elimination in all endemic counties by 2025 and 2028, respectively (*3*). To evaluate the challenges associated with progress toward elimination, we analyzed schistosomiasis epidemic data and snail distribution patterns from 2016 to 2023 across 12 PLADs south of the Yangtze River Basin. While our findings demonstrate an overall decline in schistosomiasis prevalence, average seroprevalence remains elevated in certain counties, and snail habitat

areas have rebounded in specific regions. Enhanced surveillance systems and early-warning mechanisms should be developed to facilitate the successful elimination of schistosomiasis in China.

Populations in endemic regions underwent initial screening via serological tests, followed by confirmatory pathogenic examinations for positive cases. Cattle were primarily assessed through pathogenic testing. Snail surveys were systematically conducted across existing, historical, and potential snail habitats. Data from these surveillance activities were collected at both PLAD and county levels from 2016 to 2023 using the National Parasitic Diseases Control Information Management System (NPDCIMS). Seropositive rates were calculated exclusively for counties with a minimum of 100 serological screenings and were stratified into five categories: 0 (no positives), positive rate ≤1%, 1% < positive rate ≤3%, 3% < positive rate ≤5%, and positive rate >5%. Joinpoint regression analysis, a statistical method that identifies significant changes in temporal trends by determining optimal "joining points" that divide time series data into distinct segments, was employed to analyze seropositive rate trends. Snail habitat areas were classified into seven distinct levels to facilitate county-level distribution analysis.

Shanghai Municipality achieved schistosomiasis elimination status in 2015, followed by Guangdong, Guangxi, Fujian, and Zhejiang PLADs in 2016. Sichuan Province met the transmission interruption criteria in 2017, followed by Jiangsu in 2019, Yunnan and Hubei in 2020, and Hunan, Anhui, and Jiangxi in 2023. Consequently, by 2023, schistosomiasis control across China had successfully achieved the criteria for transmission interruption nationwide.

The number of schistosomiasis cases decreased by 49.00%, from 54,454 in 2016 to 27,772 in 2023, with the proportion of advanced schistosomiasis cases increasing from 56.14% to 99.99%. During this period, only 3 acute schistosomiasis cases were reported: one from Jiangxi in 2019 and 2 domestic imported cases from other PLADs. Table 1 presents the serological and parasitological test results for schistosomiasis in human and cattle hosts stratified by PLAD. In total, 3,134,928 person-times underwent parasitological testing, with 636 positive results. The 8-year average seropositive rate across PLADs was 1.80%, with the highest rates observed in Yunnan (2.99%), Jiangxi (2.84%), and Hunan (2.67%) PLADs. Based on transmission status by the end of 2023, with 354 counties at the elimination stage and 97 counties at the transmission interruption stage, the seropositive rates for elimination and transmission interruption groups were 0.70% and 1.43%, respectively.

Joinpoint analysis revealed a consistent decline in seropositive rates since 2016 (Figure 1A). A significant

TABLE 1. Serological screening and stool examination results for humans and cattle across 12 PLADs with schistosomiasis endemicity in China, 2016–2023.

PLADs	Serological and stool test in humans					Stool test in cattle	
	Number of serological tests	Number of seropositive cases	Seroprevalence (%)	Number of stool examinations	Number of egg-positives	Number of stool examinations	Number of egg-positives
Anhui	8,424,835	87,147	1.03	752,981	1	111,079	0
Fujian	30,346	3	0.01	1	0	3,280	0
Guangdong	29,474	32	0.11	34	0	0	0
Guangxi	48,920	47	0.10	17,068	0	31,747	0
Hubei	8,986,835	155,445	1.73	291,749	1	117,149	0
Hunan	7,725,475	206,097	2.67	267,708	582	288,684	3
Jiangsu	2,987,651	18,132	0.61	326,455	2	1,340	0
Jiangxi	4,570,976	129,910	2.84	333,270	21	115,244	15
Shanghai	180,006	203	0.11	161	2	0	0
Sichuan	11,165,107	187,858	1.68	870,261	0	26,806	0
Yunnan	1,880,313	56,243	2.99	271,450	0	465,474	0
Zhejiang	817,946	3,596	0.44	3,790	27	3,968	0
Total	46,847,884	844,713	1.80	3,134,928	636	1,164,771	18

Abbreviation: PLAD=provincial-level administrative division.

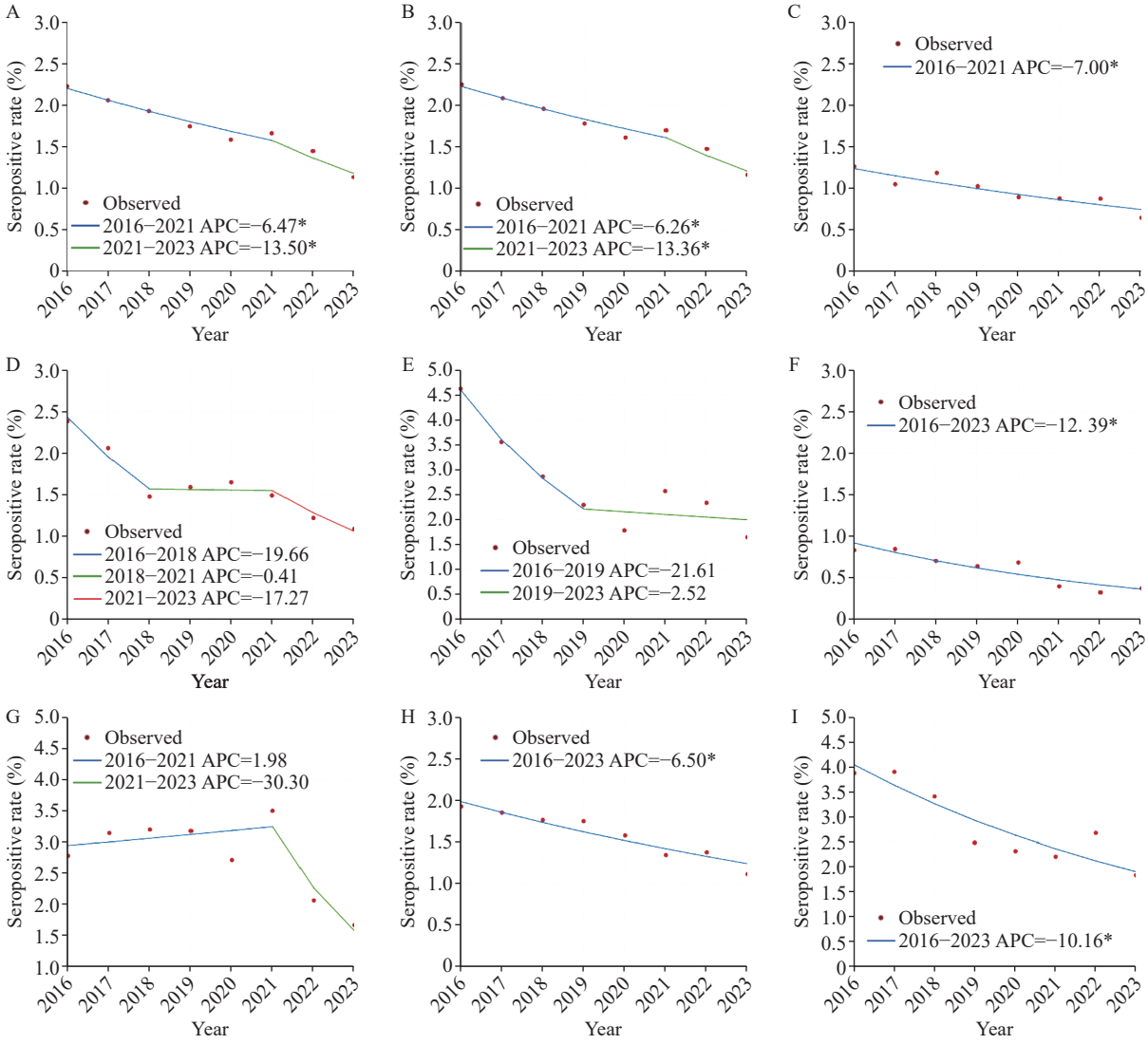

FIGURE 1. Joinpoint regression analysis of schistosomiasis seroprevalence trends from 2016 to 2023 across endemic regions in China. (A) One joinpoint for the 12 endemic PLADs. (B) One joinpoint for the 7 endemic PLADs. (C) Zero joinpoint for Anhui Province. (D) Two joinpoints for Hubei Province. (E) One joinpoint for Hunan Province. (F) Zero joinpoint for Jiangsu Province. (G) One joinpoint for Jiangxi Province. (H) Zero joinpoint for Sichuan Province. (I) Zero joinpoint for Yunnan Province.
Abbreviation: PLADs=provincial-level administrative divisions; APC=annual percent change.

inflection point was identified in 2021, indicating an acceleration in the rate of decline. Across the 12 endemic PLADs, the annual percent change (APC) shifted from –6.47% to –13.50%, while for the 7 PLADs where schistosomiasis has not been eliminated, the APC shifted from –6.26% to –13.36% (Figure 1A, B). At the provincial level, Anhui, Jiangsu, Sichuan, and Yunnan demonstrated continuous downward trends without significant turning points, with APCs ranging from –6.5% to –12.39%, indicating steady and consistent declines throughout the study period (Figure 1C, 1F, 1H, 1I). However, Hunan exhibited a distinct pattern with a turning point in 2019, after which the rate of decline plateaued substantially, with the APC shifting from –21.61% to –2.52% (Figure 1E). In contrast, Jiangxi demonstrated a brief upward trend prior to a turning point in 2021, followed by a precipitous decline thereafter (APC: 1.98%, –30.3%, Figure 1G). Hubei presented a more complex pattern with two turning points identified in 2018 and 2021, characterized by a relatively stable trend between 2018 and 2021 (APC: –19.66%, –0.41%, –17.27%, Figure 1D).

Figure 2A illustrates the distribution of counties

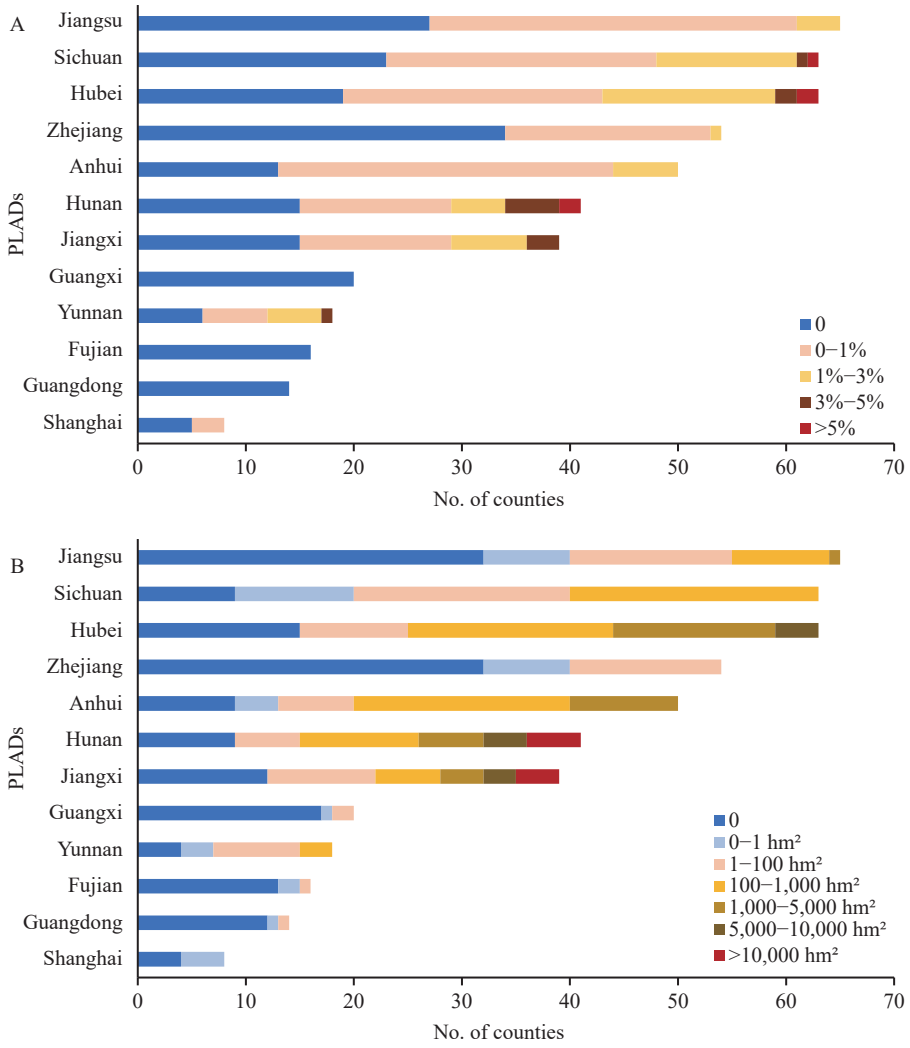

FIGURE 2. Number of counties with different levels of seropositive rates and snail habitat areas in 12 PLADs with schistosomiasis endemic regions in China, 2023. (A) Seropositive rates of schistosomiasis; (B) Snail habitat areas.
Abbreviation: PLADs=provincial-level administrative divisions.

with varying seroprevalence levels across PLADs in 2023. Among all 451 counties, 207 reported zero seropositive cases, while 170 had seropositive rates between 0–1%, 57 between 1%–3%, 12 between 3%–5%, and 5 counties exceeded 5%. The 12 counties with seropositive rates between 3%–5% were distributed across Hunan (n=5), Jiangxi (n=3), Hubei (n=2), Sichuan (n=1), and Yunnan (n=1). The 5 counties with seropositive rates exceeding 5% were located in Hunan (n=2), Hubei (n=2), and Sichuan (n=1).

The population of cattle hosts in endemic villages decreased by 38.76%, from 881,050 in 2016 to 539,548 in 2023. During this period, a comprehensive surveillance program examined 1,164,771 herd-time cattle through stool examinations, identifying only 18 positive cases, all reported from Jiangxi and Hunan Provinces (Table 1). Notably, no positive cattle have been detected since 2020.

The total area of snail habitats exhibited a slight rebound from 356,835 square hectometers (hm^2) in 2016 to 367,702 hm^2 in 2023, with new habitats emerging annually, totaling 4,080 hm^2 of newly identified habitats. From 2016 to 2019 and 2021 to 2023, no infected snail habitats were detected across any schistosomiasis-endemic region; however, in 2020, 1.96 hm^2 of habitats containing infected snails were identified in Anhui Province. Figure 2B illustrates the distribution of counties with varying levels of snail habitat areas across all 12 PLADs in 2023. Among the 451 counties surveyed, the number of counties with snail habitat areas of 0, 0–1, 1–100, 100–1000, 1,000–5,000, 5,000–10,000, and ≥10,000 hm^2 were 168, 42, 94, 91, 36, 11, and 9, respectively. The 11

counties with snail habitat areas of 5,000–10,000 hm^2 were distributed across Hunan (n=4), Hubei (n=4), and Jiangxi (n=3). The 9 counties with snail habitat areas ≥10,000 hm^2 were concentrated in Hunan (n=5) and Jiangxi (n=4).

DISCUSSION

Data from 2016 to 2023 indicate a substantial decline in schistosomiasis prevalence across China. Infection rates in both human and cattle populations decreased significantly, with no infected snails detected for several consecutive years, except for a single environment containing infectious snails identified in 2020. Joinpoint analysis revealed a consistent downward trend in serological positivity rates; however, certain counties still reported seroprevalence exceeding 5% in 2023. These five counties with elevated seroprevalence predominantly represent historical high-risk areas for schistosomiasis transmission. Positive serological results reflect cumulative infection exposure over time, with higher positivity rates among specific populations indicating increased exposure risk and suggesting potential ongoing transmission in counties with elevated rates (*4*). The true epidemic situation may be underestimated in low-prevalence settings due to limitations in detection technology or misdiagnosis (*5*).

Snail habitat areas exhibited a slight rebound during 2016–2023, with new habitats identified annually, particularly following the 2020 flood disaster along the Yangtze River Basin (*6*). Flood events, rice seedling transplantation, and wetland construction all presented significant challenges for snail control during this period. The livestock sector reported only 18 cattle testing positive since 2016, suggesting that comprehensive prevention and control strategies — particularly those targeting infectious sources such as buffaloes — have effectively controlled bovine infection. However, *Schistosoma japonicum* can infect over 40 mammalian species, including cattle, sheep, dogs, other domestic animals, as well as rodents and various wildlife species (*7*). The increasing population density of wild animals has amplified their role in schistosomiasis transmission dynamics (*8*).

It is important to note that serological tests cannot differentiate between current and historical infections. In regions with low endemic prevalence, research efforts should focus on developing advanced molecular diagnostic methods for schistosomiasis to minimize false negatives and enable precision-targeted prevention and control strategies (*9*). Additionally, comprehensive surveillance should be implemented for both domestic and wild animal reservoirs in high-risk transmission areas to facilitate robust monitoring and early warning systems.

A key limitation of this study was the absence of data regarding specific schistosomiasis control interventions, which would have been valuable for evaluating the effectiveness of particular strategies. Furthermore, detailed information on serologically positive cases, including antibody titers and historical infection status, was not collected for comprehensive analysis. Consequently, this investigation primarily focused on reporting epidemiological trends rather than intervention outcomes.

In conclusion, schistosomiasis in China has reached a low endemic level, with the majority of cases now classified as advanced disease. Cattle infections in endemic regions have been successfully reduced to zero over the past four years. However, positive cattle fecal samples detected during rapid risk assessments in 2019 and 2021 (*10*) reveal persistent transmission risks in certain areas. The recently issued Action Plan for Accelerating the Goal of Schistosomiasis Elimination (2023–2030) outlines six strategic initiatives to advance elimination efforts. To achieve the goal of eliminating schistosomiasis across all endemic counties by 2030, development of highly sensitive and specific diagnostic tools is essential, alongside intensified surveillance of wild animal reservoirs and high-risk snail habitats.

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