Preplanned Studies

Soil-Transmitted Helminthiasis — China, 2018

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Summary

What is already known about this topic?

Soil-transmitted helminthiasis (STH) is distributed widely in China and a large number of the population is afflicted. However, trends of STH infections are decreasing.

What is added by this report?

The most recent data indicates that the overall prevalence of STH was 1.29% in 2018 in China, which was based on the national sentinel surveillance and demonstrates a continuous decline pattern.

What are the implications for public health practice?

Considering the current prevalence in China and various endemic statuses in different regions, precision control measures should be implemented for the control and elimination of STH in China.

Soil-transmitted helminthiasis (STH) is caused by infections with parasitic worms such as hookworms (*Necator americanus* and *Ancylostoma duodenale*), *Ascaris lumbricoides*, and *Trichuris trichiura*. STH is highly endemic in underdeveloped areas and causes a burden of 3.38 million disability-adjusted life years globally (*1*–*2*). Based on the three national surveys implemented in 1988–1992, 2001–2004, and 2014–2015 in China, the infection rate of STH was 53.58%, 19.56%, and 4.49%, respectively. Correspondingly, the estimated number of population infected was 646 million, 129 million, and 29.12 million, respectively (*3*–*5*).

China's National Sentinel Surveillance (NSS) on STH started in 2006 when 22 sites from 22 provincial-level administrative divisions (PLADs) were launched for ten successive years. The range of the system has been greatly expanded since 2016, covering 30 of the 31 PLADs in Mainland China with more than 250 sentinel surveillance spots each year (*6*). The results of NSS on STH in 2018 are reported here.

In 2018, 29 PLADs were included in the NSS, and 10%–15% of counties from each PLAD were included. Five townships were selected in each sentinel surveillance site, which was county-based, with one from the east, west, north, south, and central regions of the site. One village was then sampled from each township, and finally about 200 people were investigated from each village by cluster sampling. Thus, a total of 1,000 people were investigated at each site. Stool samples (>30 grams) were collected from each participant and examined by the Kato-Katz method (double smears for each sample). An infection was defined as one or more eggs detected in either of the two smears. The data were analyzed using SAS software (Version 9.3, SAS Institute Inc.). The infection rate of STH was categorized by PLAD, sex, and age group, and chi-square tests were used to compare the differences between categories. Statistical significance was set as 0.05.

A total of 325 sentinel surveillance spots from 29 PLADs were included in 2018. The overall infection rate of STH was 1.29% (4,200/326,207). The infection rate in 2018 was significantly lower than that found in 2017 ($\chi^2=253.14$, $p<0.0001$). The infection rate of hookworm was the highest (0.89%), followed by *A. lumbricoides* (0.27%), and *T. trichiura* (0.17%) (Table 1).

Yunnan showed the highest infection rate (14.08%), followed by Sichuan (7.44%) and Hainan (7.16%). No infection was detected in Beijing, Heilongjiang, and Shanghai. As revealed by the NSS in 2018, STH was mainly prevalent in southern and southeastern parts of China (Table 1, Figure 1). In PLADs with infection rates over 0.5%, Yunnan, Hainan, and Sichuan were mainly prevalent with hookworm infection; Guizhou, Hunan, Qinghai, and Ningxia with ascariasis; and Shandong with trichuriasis.

The infection rate in males and females was 1.16% (1,849/159,925) and 1.41% (2,351/166,282), respectively. It was higher in females than in males ($\chi^2=42.59$, $p<0.0001$). The overall infection rate was the highest in those aged 60 and above, followed by the age group of 45 to 59, 7 to 14, 15 to 44, and 0 to 6, which was also significant ($\chi^2=1,030.84$, $p<0.0001$). However, the infection rate by *A. lumbricoides* and

TABLE 1. Infection rate of soil-transmitted helminth in China according to the 2018 National Sentinel Surveillance.

PLADs	No. of examination	Soil-transmitted helminth		Hookworm		*Ascaris lumbricoides*		*Trichuris trichiura*	
		No. of infections	Prevalence % (95% CI)	No. of infections	Prevalence % (95% CI)	No. of infections	Prevalence % (95% CI)	No. of infections	Prevalence % (95% CI)
Beijing	3,087	0	0.00 (0.00−0.00)	0	0.00 (0.00−0.00)	0	0.00 (0.00−0.00)	0	0.00 (0.00−0.00)
Tianjin*	3,023	4	0.13 (0.00−0.26)	0	0.00 (0.00−0.00)	4	0.13 (0.00−0.26)	0	0.00 (0.00−0.00)
Hebei	15,048	1	0.01 (0.00−0.02)	0	0.00 (0.00−0.00)	1	0.01 (0.00−0.02)	0	0.00 (0.00−0.00)
Inner Mongolia*	10,034	1	0.01 (0.00−0.03)	0	0.00 (0.00−0.00)	0	0.00 (0.00−0.00)	1	0.01 (0.00−0.03)
Liaoning*	12,042	31	0.26 (0.17−0.35)	0	0.00 (0.00−0.00)	29	0.24 (0.15−0.33)	2	0.02 (0.00−0.04)
Jilin*	21,812	61	0.28 (0.21−0.35)	0	0.00 (0.00−0.00)	60	0.28 (0.21−0.34)	1	0.00 (0.00−0.01)
Heilongjiang	19,065	0	0.00 (0.00−0.00)	0	0.00 (0.00−0.00)	0	0.00 (0.00−0.00)	0	0.00 (0.00−0.00)
Shanghai	2,003	0	0.00 (0.00−0.00)	0	0.00 (0.00−0.00)	0	0.00 (0.00−0.00)	0	0.00 (0.00−0.00)
Jiangsu	4,003	7	0.17 (0.05−0.30)	1	0.02 (0.00−0.07)	4	0.10 (0.00−0.20)	2	0.05 (0.00−0.12)
Zhejiang*	9,120	124	1.36 (1.12−1.60)	122	1.34 (1.10−1.57)	0	0.00 (0.00−0.00)	2	0.02 (0.00−0.05)
Anhui	14,689	166	1.13 (0.96−1.30)	157	1.07 (0.90−1.24)	1	0.01 (0.00−0.02)	8	0.05 (0.02−0.09)
Fujian	12,475	215	1.72 (1.50−1.95)	201	1.61 (1.39−1.83)	0	0.00 (0.00−0.00)	14	0.11 (0.05−0.17)
Jiangxi	13,082	109	0.83 (0.68−0.99)	82	0.63 (0.49−0.76)	14	0.11 (0.05−0.16)	13	0.10 (0.05−0.15)
Shandong	14,399	96	0.67 (0.53−0.80)	0	0.00 (0.00−0.00)	21	0.15 (0.08−0.21)	76	0.53 (0.41−0.65)
Henan	19,856	16	0.08 (0.04−0.12)	7	0.04 (0.01−0.06)	8	0.04 (0.01−0.07)	1	0.01 (0.00−0.01)
Hubei	10,099	2	0.02 (0.00−0.05)	1	0.01 (0.00−0.03)	0	0.00 (0.00−0.00)	1	0.01 (0.00−0.03)
Hunan	37,398	251	0.67 (0.59−0.75)	57	0.15 (0.11−0.19)	184	0.49 (0.42−0.56)	14	0.04 (0.02−0.06)
Guangdong	19,463	44	0.23 (0.16−0.29)	19	0.10 (0.05−0.14)	11	0.06 (0.02−0.09)	16	0.08 (0.04−0.12)
Guangxi	13,727	334	2.43 (2.18−2.69)	305	2.22 (1.98−2.47)	4	0.03 (0.00−0.06)	26	0.19 (0.12−0.26)
Hainan	2,959	212	7.16 (6.24−8.09)	201	6.79 (5.89−7.70)	0	0.00 (0.00−0.00)	11	0.37 (0.15−0.59)
Chongqing	6,372	367	5.76 (5.19−6.33)	356	5.59 (5.02−6.15)	12	0.19 (0.08−0.29)	2	0.03 (0.00−0.07)
Sichuan	14,292	1,064	7.44 (7.01−7.88)	867	6.07 (5.67−6.46)	185	1.29 (1.11−1.48)	47	0.33 (0.23−0.42)
Guizhou	4,617	213	4.61 (4.01−5.22)	9	0.19 (0.07−0.32)	126	2.73 (2.26−3.20)	92	1.99 (1.59−2.40)
Yunnan	5,567	784	14.08 (13.17−15.00)	526	9.45 (8.68−10.22)	113	2.03 (1.66−2.40)	214	3.84 (3.34−4.35)
Shaanxi*	8,993	15	0.17 (0.08−0.25)	0	0.00 (0.00−0.00)	15	0.17 (0.08−0.25)	0	0.00 (0.00−0.00)
Gansu	8,750	12	0.14 (0.06−0.21)	0	0.00 (0.00−0.00)	12	0.14 (0.06−0.21)	0	0.00 (0.00−0.00)
Qinghai	3,906	23	0.59 (0.35−0.83)	0	0.00 (0.00−0.00)	23	0.59 (0.35−0.83)	0	0.00 (0.00−0.00)
Ningxia*	2,948	40	1.36 (0.94−1.77)	0	0.00 (0.00−0.00)	40	1.36 (0.94−1.77)	0	0.00 (0.00−0.00)
Xinjiang*	13,378	8	0.06 (0.02−0.10)	0	0.00 (0.00−0.00)	8	0.06 (0.02−0.10)	0	0.00 (0.00−0.00)
Total	326,207	4,200	1.29 (1.25−1.33)	2,911	0.89 (0.86−0.92)	875	0.27 (0.25−0.29)	543	0.17 (0.15−0.18)

Abbreviations: PLADs=provincial-level administrative divisions.

*These PLADs have no national surveillance spots before 2015 and started NSS since 2016.

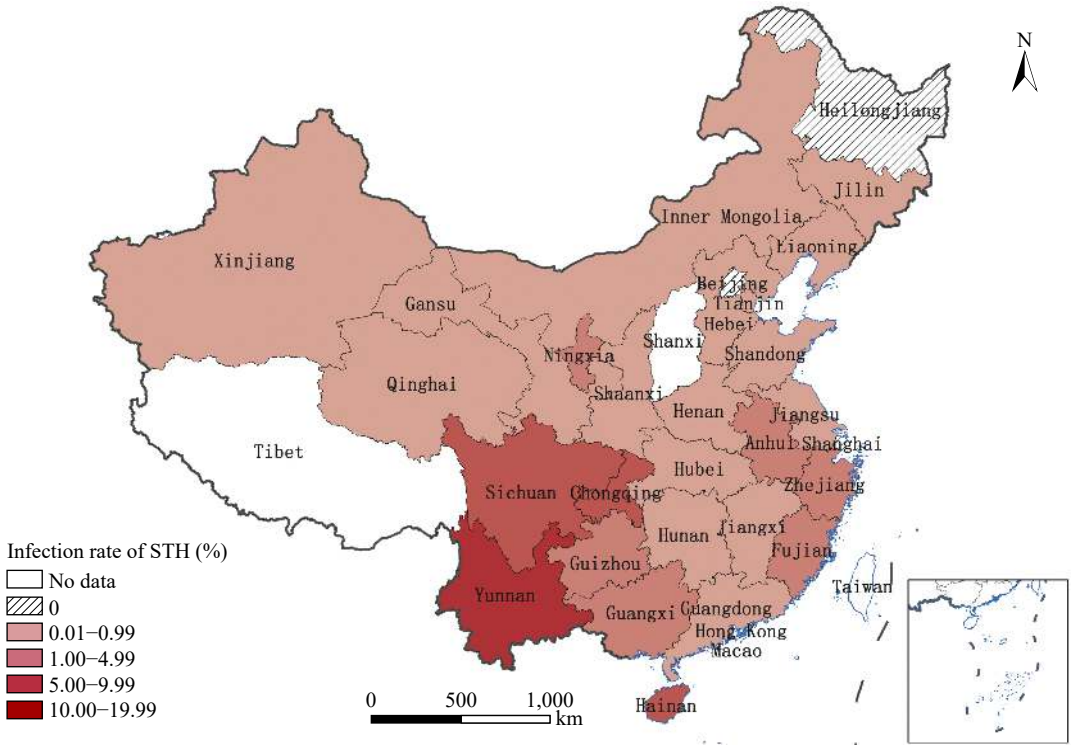

FIGURE 1. Infection rate of soil-transmitted helminth in each provincial-level administrative divisions of China according to the 2018 National Sentinel Surveillance.

T. trichiura was higher in children than that of other age groups, while the pattern of hookworm infection was similar to that of overall STH (Figure 2).

Discussion

STH declined in China based on the 22 NSS sites, and the rates in each year from 2006 to 2015 are as follows: 20.88%, 18.93%, 16.59%, 13.30%, 11.25%, 9.67%, 6.90%, 3.12%, 4.49%, and 4.95% (*7*–*8*). This is consistent with the results of the second and third national survey (*4*–*5*). Also, the expanded NSS from 2016 to 2018 revealed that STH infection rates were 2.46%, 1.78%, and 1.29%, respectively (*8*). These results indicated a continuous pattern of decline for prevalence for the 13 years following sentinel surveillance implementation. This can be attributed to improved economy and living standards of the

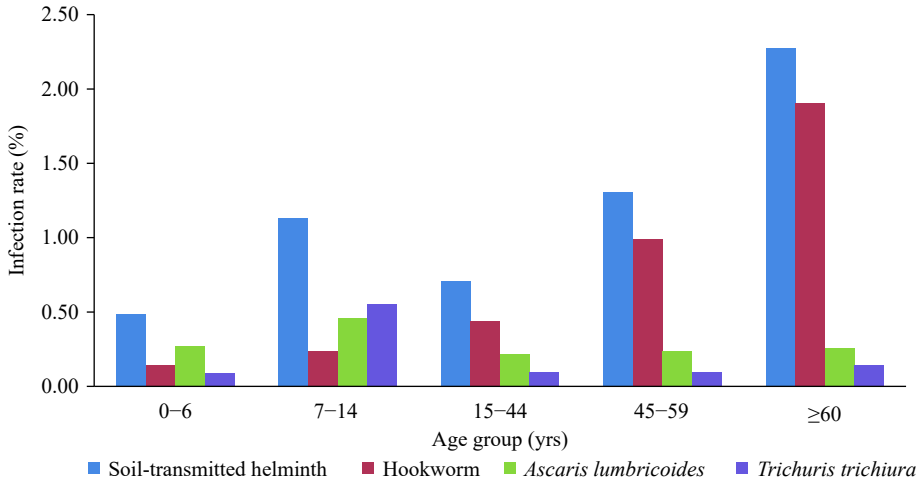

FIGURE 2. Infection rate of soil-transmitted helminth by different age groups in China according to the 2018 National Sentinel Surveillance.

population and effective implementation of control measures such as health education, chemotherapy, and improved sanitation and water safety in China (*9*).

The prevalence of ascariasis and hookworm infection was demonstrated to be similar between 2006 and 2010 and that trichuriasis was the lowest. However, the prevalence between types has changed since 2011 with hookworm infection becoming the highest one, followed by ascariasis and trichuriasis. Also, children rank highest with ascariasis and trichuriasis while the age group of 45-year-old and above ranks highest with hookworm infection as indicated by the NSS system (*8*). This is because elderly people usually have more exposure with hookworm, while *A. lumbricoides* and *T. trichiura* mostly infect children. Recognizing the predominant species of soil-transmitted helminth and different age group predisposed to risk of infection are crucially importance for implementing control strategies.

The NSS system provides basic information on STH's endemic status and trends, which are important for developing control strategies. Many PLADs have started or improved their own provincial sentinel surveillance following the efforts made by the NSS system regarding prevention and control of STH (*9*). In addition, this has greatly enhanced the capacity of staff members at the provincial, city, and county levels through training, communication, and other regular work during surveillance.

This study is subject to some limitations. Only 29 PLADs were included in the NSS in 2018 and Shanxi and Tibet were excluded, and the infection rates of STH in both PLADs were below average according to the third national survey (*5*). As a result, the infection rate of STH may therefore be slightly overestimated. Also, during the implementation of the surveillance system, participants may have become more aware and changed their behaviors, which would then contribute to further decreases of STH. Moreover, field investigations need to consider feasibility and scientific rigor because of increasing difficulties in field work, expanding surveillance ranges, and methods changing, such as the Kato-Katz method being changed from 3 slides to 2 slides since 2015 (*8*).

The National Control Program for Echinococcosis and Other Important Parasitic Diseases (2016–2020) was issued and included STH. Establishment of national surveillance is vitally important in the control of STH as it provides platforms to achieve the control targets set by the national control program and to evaluate control effectiveness. The control of STH should be combined with poverty alleviation in China, which might increase effectiveness. Additionally, precise control of STH was needed by implementing different strategies in different endemic level areas. High endemic-disease areas should be addressed with health education, with provision of water, sanitation, and hygiene (WASH), and with chemotherapy, while low endemic-disease areas should be addressed with health education and with improvement of compliance for examination and chemotherapy of STH. Children and the elderly should be given special attention when controlling STH.

Overall, the infection rate of STH approaches 1.00%, with some areas achieving infection control and other areas still having endemic disease (*10*). The "Criteria for Transmission Control and Interruption of Soil-Transmitted Nematodiasis" has been issued in China. Therefore, China should pursue higher targets in national control of STH to eventually achieve interruption.

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Conflict of interests

The authors declare no competing interests.

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