Preplanned Studies

Assessment on the Diagnostic Capacity for Parasitic Diseases of Health Facilities — China, 2019

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Summary

What is already known about this topic?

Morbidity and prevalence of several major parasitic diseases have been declining in China. To reduce the disease burden of parasitic diseases and protect public health security, conducting accurate diagnoses following timely treatment is important.

What is added by this report?

In the national competition held in 2019, the overall accuracy rates of participants for theoretical knowledge and slides interpretation for parasitic diseases were 80.44% and 66.87%, respectively. Significant differences in the accuracy rates of detecting schistosomiasis or malaria existed between endemic areas and non-endemic areas, respectively.

What are the implications for public health practice?

The study results will help policymakers and health managers to identify the gaps in parasitic diseases, help to strengthen diagnostic capacity, and improve quality of control programs.

China used to be overloaded by the heavy burden caused by parasitic diseases. However, through several decades of effort, the number of cases and the prevalence of parasitic diseases had declined dramatically nationwide (*1–3*). However, misdiagnosis of parasitic diseases was reported from occasionally, especially for imported cases or asymptomatic cases with light infections. To understand the gap in diagnostic capacity that exists for parasitic diseases, a nationwide competition was conducted in August 2019 by the National Health Commission (NHC) through a paper test and interpretation of slides containing parasite worms or eggs. Generally, technicians grasped the knowledge of parasitic disease well but their practical skills for slides interpretation were not satisfactory with an overall accuracy rate of 66.87%. As parasitological methods relying on interpreting slides were still the gold standard for diagnosing parasitic diseases, further capacity building for diagnosis, especially parasitological methods, should be strengthened to avoid misdiagnosis of patients and provide accurate data for policymaking.

In August 2019, a national competition for parasitic diseases was held by the NHC in Changchun City of Jilin Province. A total of 32 teams with 128 technicians attended the competition. Each team was composed of four professional staff members, with at least one being from hospitals and two from agencies below the provincial level. All participants were aged less than or equal to 45 years old. The competition consisted of 2 parts: 1) theoretical knowledge on the life cycle of common parasites, their etiology and diagnosis, and control and prevention strategies of several parasitic diseases were evaluated through a paper test composed of 50 questions featured as single-choice, multiple-choice, and true or false categories; and 2) the technical skills for interpretation of blood smear slides and Kato-Katz thick smear slides were examined. All slides and the reference answers were prepared by the National Institute of Parasitic Disease (NIPD) of China CDC.

All assessment activities were conducted in parallel in single blind manner. The original results of each participant were entered into a computer by Microsoft Excel (version 2013, Microsoft Corp, Redmond, USA) and descriptive statistics was conducted by SPSS software (version 20, IBM Corp, Armonk, USA) to describe the general information of participants. The accuracy rate was calculated as the number of questions answered accurately divided by the total number of questions, or the accumulated number of parasite species in slides interpreted accurately divided by the total number of referenced parasite species provided by NIPD. Chi-squared statistics were used to compare the values between or among subgroups. The level of statistical significance was defined as $P<0.05$.

In total, 128 participants from 30 provincial-level administrative divisions (PLADs), Xinjiang Production and Construction Corps, and Chinese General Administration of Customs attended the competition.

Overall, 28.9% (37/128) of participants were male and 71.1% (91/128) were female. All participants were aged with a mean value of 32.43±4.95 years old. The majority of participants (96.1%, 123/128) were junior staff with primary or middle level professional titles, while the rest were senior staff. Among of them, 82 participants were working at agencies of public health while 46 participants were from hospitals.

In the theoretical knowledge assessment, the accuracy rate was 80.44% (5,148/6,400) for all participants but varied from 38.00% (19/50) to 98.00% (49/50). Chi-square analysis showed that the females had higher accuracy rates than the males (χ^2=14.139, *P*<0.01) while the accuracy rate in participants from public health agencies was higher than that from hospitals (χ^2=8.374, *P*<0.01). Significant differences were also detected when analyzing accuracy rates by strata of professional titles and agencies (χ^2=8.571, χ^2=24.023, *P*<0.05). But no difference in accuracy rate was found among different age groups (χ^2=2.442, *P*>0.05) (Table 1).

For the knowledge points, the accuracy rates regarding to diagnosis, detection technology, the life cycle of parasites, and control and prevention of parasitic diseases were 84.90% (1,304/1,536), 84.01% (1,398/1,664), 83.52% (1,176/1,408), and 70.87% (1,270/1,792), respectively, presenting significant differences (χ^2=145.682, *P*<0.05). In addition, the accuracy rates of answers to questions related to the diagnosis of schistosomiasis, malaria, echinococcosis, other parasitic disease, and comprehensive issues were 84.38% (1,080/1,280), 83.98% (1,075/1,280), 76.72% (982 /1,280), 81.75% (1,465/1,792), and 71.09% (546/768), respectively, showing significant difference (χ^2=78.673, *P*<0.05).

For the interpretation of slides, the accuracy rate for thick smear slides and blood smear slides was 67.19% (2,097/3,121) and 65.31% (418/640), respectively, with the overall accuracy rate being 66.87% (2,515/3,761) (Table 2). Individually, the accuracy rate for the interpretation of thick smear slides ranged from 10% (3/30) to 96.55% (28/29); 22 participants had a 100% accuracy rate, but 4 participants provided all wrong answers for blood smear slides interpretation. The average accuracy rates did not differ significantly among agencies (χ^2=5.494, χ^2=0.073, *P*>0.05), but females, younger professional staff, and senior staff had higher accuracy rates (*P*<0.05).

In analyzing the accuracy rates by helminth species, the highest accuracy was 87.50% (420/480) for the detection of *Clonorchis sinensi*, followed by 83.73% (669/799) for *Ascarias* spp. The lowest accuracy rate was 25.89% (124/479) for detection of *Schistosoma japonicum* (Table 3). Significant differences in accuracy rates were detected among helminth species identification (χ^2=593.544, *P*<0.05). For identification of plasmodium species, the accuracy rate for detecting *Plasmodium malariae*, *P. falciparum*, *P. vivax*, and negative slides were 57.50% (23/40), 60.47% (179/296), 69.64% (117/168), and 72.79% (99/136), respectively, presenting significant differences (χ^2=8.888, *P*<0.05). The accuracy rate of

TABLE 1. The accuracy rates of 128 participants for knowledge test related to parasitic diseases in China, 2019.

Categories	Features	No. participants	No. questions answered	No. questions answered accurately	Accuracy rate (%)	Chi-square test
Total		128	6,400	5,148	80.44	
Gender	Male	37	1,850	1,434	77.51	χ^2=14.139, *P*<0.001
	Female	91	4,550	3,714	81.63	
Age, years	≤30	43	2,150	1,706	79.35	χ^2=2.442, *P*=0.295
	31–40	72	3,600	2,915	80.97	
	≥41	13	650	527	81.08	
Professional title	Primary	74	3,700	2,933	79.27	χ^2=8.571, *P*=0.014
	Middle	49	2,450	2,004	81.80	
	High	5	250	211	84.40	
Agency level	Province	19	950	709	74.63	χ^2=24.023, *P*<0.001
	City	40	2,000	1,624	81.20	
	County	69	3,450	2,815	81.59	
Agency feature	Public health	82	4,100	3,342	81.51	χ^2=8.374, *P*=0.004
	Hospital	46	2,300	1,806	78.52	

TABLE 2. The accuracy rates of participants for slides interpretation in China, 2019.

Categories	Features	No. participants	Accumulated slides number	Accumulated slides number judged parasites correctly	Accuracy rate (%)	Chi-square test
Total		128	3,761	2,515	66.87	
Gender	Male	37	1,082	688	63.59	χ^2=7.397, P=0.007
	Female	91	2,679	1,827	68.20	
Age, years	≤30	43	1,268	896	70.66	χ^2=12.655, P=0.002
	31–40	72	2,114	1,377	65.14	
	≥41	13	379	242	63.85	
Professional title	Primary	74	2,173	1,477	67.97	χ^2=7.614, P=0.020
	Middle	49	1,441	930	64.54	
	High	5	147	108	73.47	
Agency level	Province	19	559	351	62.79	χ^2=5.494, P=0.064
	City	40	1,171	801	68.40	
	County	69	2,031	1,363	67.11	
Agency feature	CDC	82	2,423	1,624	67.02	χ^2=0.073, P=0.787
	Hospital	46	1,338	891	66.59	

Note: CDC: Center for Disease Control and Prevention.

TABLE 3. The accuracy rates of 128 participants for parasites identification based on slides interpretation in China, 2019.

Types of slides	Types of parasites in slides	Accumulated number of slides	Accumulated number of slides judged correctly	Accuracy rate (%)
Total		3,761	2,515	66.87
Thick smear slides	*Schistosoma japonicum*	479	124	25.89
	Trichuris trichiura	161	97	60.25
	Paragonimus	320	206	64.38
	Fasciolopsis	80	64	80.00
	Ascarias spp.	799	669	83.73
	Enterobius vermicularis	241	183	75.93
	Clonorchis sinensis	480	420	87.50
	Taeniidae	240	142	59.17
	Spirometra mansonia	321	192	59.81
	Subtotal	3,121	2,097	67.19
Blood smear slides	*Plasmodium falciparum*	296	179	60.47
	Plasmodium vivax	168	117	69.64
	Plasmodium malariae	40	23	57.50
	Negatives	136	99	72.79
	Subtotal	640	418	65.31

participants from schistosomiasis endemic areas for schistosomiasis slides interpretation was 35.87% (66/184), significantly higher than that of 19.66% (58/295) in participants from non-endemic areas (χ^2=15.517, P<0.01). Similarly, the accuracy rate of participants from malaria endemic areas for malaria slides interpretation was higher than that of participants from non-endemic areas [70.00% (322/460) *vs*, 53.33% (96/180), χ^2=15.863, P<0.01].

DISCUSSION

The results from the assessment through nationwide competition on the diagnosis of parasitic diseases showed that technicians grasped the knowledge of parasitic disease generally well, but the interpretation of slides of parasitological methods were not satisfactory. Females demonstrated higher diagnostic capacity than males, but differences of accuracy rates in participants also existed among subgroups when analyzing the data by professional title, specific knowledge points, or species of parasites. Significant difference in accuracy rates of detecting schistosomiasis and malaria was also detected between endemic areas and non-endemic areas, respectively.

With the decline of prevalence and infection intensity of local parasitic diseases and increase in the number of imported or emerging parasitic diseases (*4–6*), misdiagnosis occurred occasionally due to declining conscientiousness or weak skills related to parasitic diseases. The evaluation conducted nationwide by the NHC during 2012–2016 indicated gaps in the diagnosis of parasitic diseases nationwide to control or eliminate parasitic diseases (*7*). In past decade, capacity building was strengthened through construction of reference laboratories for parasitic diseases, conducting of training courses, or organizing inter-laboratories comparison (*8–9*). In this study, we found the diagnostic capacity for parasitic diseases improved but gaps still existed.

From the knowledge test results, the average accuracy rate was higher than 80%, demonstrating a general understanding of knowledge toward parasitic diseases. However, the accuracy rates differed significantly among individuals in the range of 38%–98%. Males, staff with first-level professional titles, and staff from hospitals presented lower accuracy rates for knowledge tests. In addition, the accuracy rates of questions among knowledge points and categories of diseases were relatively low in questions related to echinococcosis, comprehensive questions, and the control and prevention of parasitic diseases. The average accuracy rate for the interpretation of slides was 66.87% (2,515/3,761), suggesting big challenges existed in the diagnosis of parasitic diseases. For determination of parasitic species, the accuracy rates were highest for *Clonorchis sinensis* with an accuracy rate of 87.50%, which may be explained by increased attention on liver diseases in recent decades and the typical features of eggs that can be easily identified (*10*). The accuracy rates for 2 major parasitic diseases in China including malaria and schistosomiasis were 65.31% and 25.89%, respectively. Significant differences in accuracy rates existed between endemic and non-endemic area of schistosomiasis and malaria. As malaria has been eliminated in 2021 and schistosomiasis is close to elimination in China, the gap existing in diagnosis should be filled to build capacity building for the prompt finding of endemic cases and imported cases from foreign countries.

There are several limitations in this study. One limitation is that the participants involved in this study only accounted for a small part of medical workers in China. To understand the overall capacity level for diagnosis of parasitic diseases, further assessment should be conducted extensively. The other one is that the questionnaire test and slides used hadn't received scientific assessment. In addition, the results for both parts were analyzed separately and couldn't assess the overall capacity of participants comprehensively. It should be noted that all participants in this competition were recommended or selected by each PLAD and possibly received long periods of training. The actual diagnostic capacity in health facilities across China may be much lower than that reflected in our study and likely could not meet the needs of national control and prevention strategies for parasitic diseases. Further capacity building should be enhanced at all levels through more training courses, especially for parasitological tests as they remain the diagnostic gold standard of parasitic diseases. To ensure the efficiency of diagnosis, external quality assessment and rechecking samples should be considered and conducted during the implementation in the national control programs.

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