

Testing the tests



by Luis Wilfrido Atienza

How do scientists come up with accurate results? They apply multiple tests. A case in point is the diagnosis of flatworm disease.

Schistosomiasis is a parasitic disease caused by an infection by a species of flatworm, *Schistosoma japonicum*, also known as the Oriental blood fluke, which takes up residence in portal and mesenteric blood vessels of infected people. It causes chronic liver disease due to parasite egg deposition, inflammation, and fibrosis, with occasionally deleterious effects on the lungs and the brain. The flatworm is transmitted through contact with snail-infested fresh water and can infect humans and domestic animals that come into contact with such contaminated water.

Signs and symptoms of the disease include abdominal pain, diarrhea, passage of bloody stools, and other gastrointestinal tract manifestations. Chronic schistosomiasis can result in malnutrition manifesting as anemia, stunted growth, wasting, as well as longer-term effects such as liver, lung, and brain involvement. People with late-stage disease may develop complications such as abdominal enlargement due to ascites or abnormal accumulation of peritoneal fluid, and bleeding esophageal veins or varices, rupture of which could result in death.

The disease is common in tropical regions where *S. japonicum* thrives, especially in developing countries where access to clean water and environmental sanitation remain as challenges. The disease is relatively common in certain 12 out of 17 Philippine regions where poverty incidence remains relatively high. The Philippine Department of

Health sets the national policy for disease control and monitors program implementation of local government units as well as disease prevalence in the endemic regions and provinces.

Being able accurately to diagnose the disease in large numbers of people is essential in identifying infected individuals for the provision of appropriate treatment (which may be life-saving), determining its prevalence in different regions, and figuring out the effectiveness of different measures taken to fight the disease. The recommended method of diagnosing schistosomiasis is the Kato-Katz Technique (KKT), which involves examining a patient's stool for blood fluke eggs. It is currently considered the gold standard for diagnosing schistosomiasis; however, some scientists think that this method may not be sensitive enough—many times being unable to find eggs in the stool of infected individuals.

Because of this major challenge in laboratory diagnosis for treatment and monitoring the prevalence of the disease in the Philippines, scientists from the University of the Philippines Manila and the National Institutes of Health are looking into alternative tests for the diagnosis of schistosomiasis that would be most suitable for the laboratory diagnosis of the disease.

Side by side with KKT, the scientists used another stool examination technique, the Formalin Ether Concentration Test (FECT), as well as serological methods that look for signs of schistosomiasis by using blood rather than stool. The Circumoval Precipitin Test (COPT) was one of these, where processed blood fluke eggs from laboratory animal

Ages in years by study site	Gender		Total
	Female	Male	
Age groups in near-elimination areas			
<10	11	4	15
10-12	155	110	265
>12	222	246	468
Subtotal	388	360	748 (67.2%)
Age groups in endemic areas			
Age not recorded	0	1	1
<10	13	7	20
10-12	76	62	138
>12	108	97	205
Subtotal	197	167	364 (32.8%)
Total	585	527	1,112

To evaluate the different tests, the scientists examined over 1,000 patients—mostly children—in areas with differing prevalence of schistosomiasis.

infection are combined with patient's blood, and a reaction is observed indicating that a patient has produced antibodies against the blood fluke—a sign of exposure to the parasite.

The scientists also utilized the Enzyme-Linked Immunosorbent Assay (ELISA), which also tests for the presence of antibodies in patient's blood. Another ELISA type used by the scientists looks for parasite antigen instead of antibodies.

To determine how sensitive these tests were in detecting blood fluke infection, the scientists took samples from over a thousand patients in three known schistosomiasis-endemic provinces and used statistical analysis to figure out which test had the highest success rate in diagnosing the infection.

The provinces where the study was undertaken were Bohol and Zamboanga del Norte, where the disease is allegedly nearly eliminated, and Agusan del Sur, where it is still highly prevalent. Thus they would be able to see if a certain test had a higher sensitivity in areas where the infection was prevalent than where it was less so.

Examining 1,112 children in the three provinces, the scientists took blood and stool samples from each and attempted to diagnose schistosomiasis. Because they were performing several tests on each child, they were able to figure out which children were really infected with schistosomiasis. The ideal test would be able to diagnose all infected children without missing any or raising any false positives.

After conducting all the tests, the scientists found out that KKT performed very well in diagnosing more cases in Agusan del Sur, where schistosomiasis was more common. However, in the other two provinces, where it is much less common, they found that KKT was very prone to missing infected cases. In those provinces ELISA antigen detection had the best success rate for identifying those with current infection. ELISA antibody detection had better success rate in identifying those with exposure to the parasite compared with COPT.

The results showed that while KKT is still an important test in monitoring schistosomiasis, it needs to be deployed in the right kind of situation. Other tests, such as ELISA antigen detection, might need to play a more prominent role in identifying those with current infection, thus needing appropriate treatment. ELISA antibody detection also may play a major role in monitoring the status of schistosomiasis in light of control strategies being implemented.

This study will serve as an important basis for assessing outcomes and impact of control efforts targeting schistosomiasis, whether the goal is to reduce the number of infected cases, monitor the spread of the disease, or prevent outbreaks. The results of the study serve as a constant reminder that even the most established and seemingly reliable tests and methods used by scientists need to be periodically evaluated and improved upon to ensure that conclusions are as accurate as possible.

REFERENCES

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