

Spatio-temporal pattern of schistosomiasis in Anhui Province, East China: Potential effect of the Yangtze River - Huaihe River Water Transfer Project

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ABSTRACT

Anhui Province has been one of typical epidemic areas of schistosomiasis in East China as a wide range of large lake and marshland regions provide an ideal environment for growth and reproduction of the intermediate snail host. With the completion of the Yangtze River-Huaihe River Water Transfer Project (YHWTP), launched by the end of 2016, the epidemic areas are expected to expand and controlling schistosomiasis remains a challenge. Based on annual surveillance data at the county level in Anhui for the period 2006–2015, spatial and temporal cluster analyses were conducted to assess the pattern of risk through spatial (Local Moran's *I* and flexible scan statistic) and space-time scan statistic (Kulldorff). It was found that schistosomiasis sero-prevalence was dramatically reduced and maintained at a low level. Cluster results showed that spatial extent of schistosomiasis contracted, but snail distribution remained geographically stable across the study area. Clusters, both for schistosomiasis and snail presence, were common along the Yangtze River. Considering the effect of the ongoing YHWTP on the potential spread of schistosomiasis, Zongyang County and Anqing, which will be transected by the new water-transfer route, should be given a priority for strengthened surveillance and control. Attention should also be paid to Guichi since it is close to one of the planned inlets of the YHWTP.

1. Introduction

Schistosomiasis, caused by a trematode worm belonging to the genus *Schistosoma* [1], is a potentially debilitating disease and can result in both acute and chronic infections. It occurs in tropical and subtropical countries and remains a major burden for public health in these regions [2]. The World Health Organization (WHO) estimates that currently at least 218 million individuals require preventive treatment for schistosomiasis [3]. The global burden of schistosomiasis has been estimated at 3.31 (95% confidence interval (CI): 1.70–6.26) million disability-adjusted life years (DALYs) [4]. In China, schistosomiasis japonica is responsible for human and animal infections with a documented history of at least 2100 years along the Yangtze River Basin and connected lake areas [5]. Despite marked progress was made in controlling the disease, there were still clear signs of reemergence of schistosomiasis in the lake and marshland areas of the Yangtze River Basin [6].

Oncomelania hupensis is the only intermediate host snail of

Schistosoma japonicum therefore, its geographical distribution is strongly associated with schistosomiasis transmission. The massive epidemiological surveys conducted in mid-1950s showed that *O. hupensis* was mainly distributed along the Yangtze River Valley including the lakes and marshlands in southern China and that the snail habitat areas then was 14.3 billion km² [7]. After the past six decades of schistosomiasis control, China has made great strides towards reducing prevalence and the area of snail habitat has now declined to 3.6 billion km² (2015), mainly distributed in four provinces (Anhui, Hunan, Hubei, and Jiangxi) [8]. Nevertheless, schistosomiasis might re-emerge as a result of changes in ecological and socio-economic factors. Since *O. hupensis* is an amphibious snail, whose breeding and reproductive process require presence of water, water conversion projects could conceivably change local ecological environments and further lead to spreading of the snail into currently non-epidemic areas if no control activities are undertaken. For example, researchers have assessed the impact of the South-to-North Water Diversion Project on the transmission of *S. japonicum* in China and concluded that the risk of

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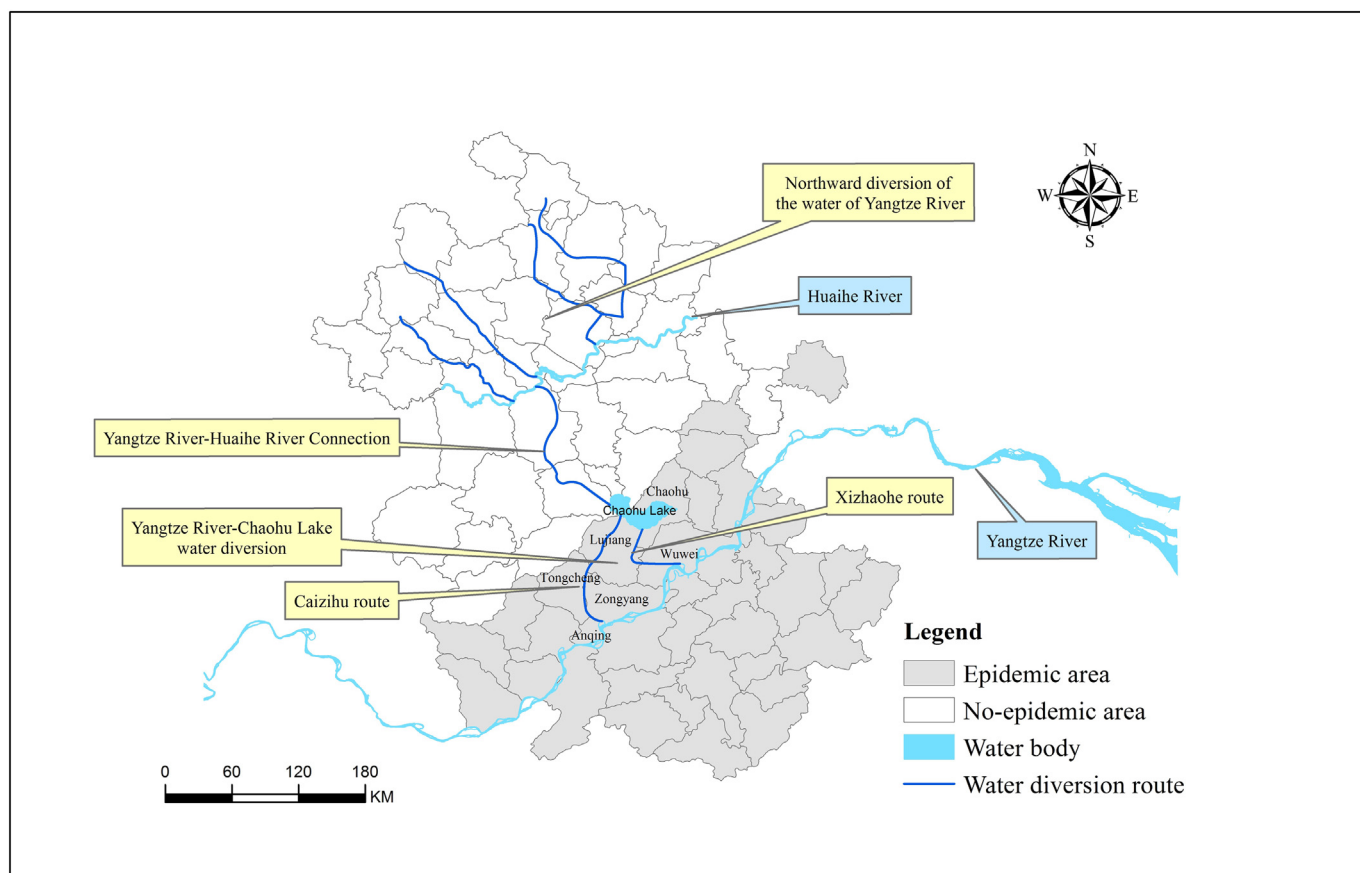


Fig. 1. General layout of the Yangtze River - Huaihe River Water Transfer Project of Anhui Province, China.

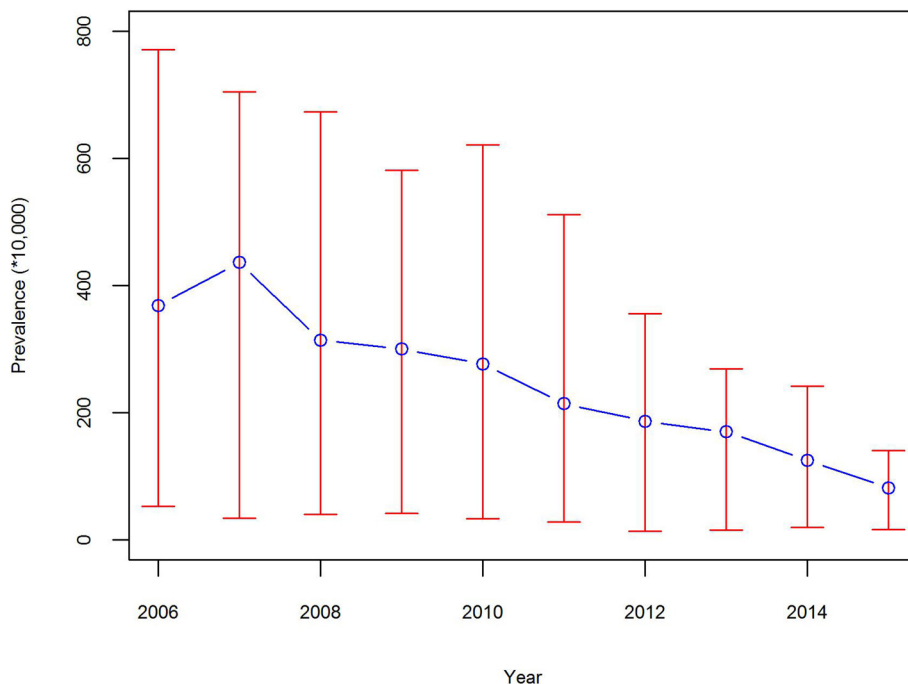


Fig. 2. Sero-prevalence of *S. japonicum* infection in Anhui's endemic counties in the period 2006–2015.

northward spread of schistosomiasis to non-endemic areas would increase unless long-term reliable interventions for snail control are implemented [9]. Invasion of the intermediate snail hosts and breakout of schistosomiasis have also been reported [10].

Anhui Province has been one of the typical endemic areas for schistosomiasis in China. Its endemic area is mainly located along the Yangtze River in the southern part of the province while the Chaohu Lake Basin, located in the middle part of the province, and the Huaihe

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