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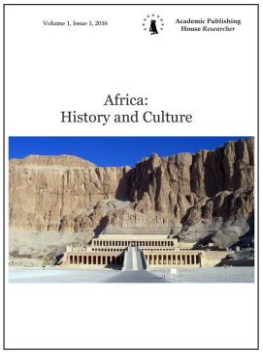


**Articles and Statements**

# Schistosomiasis in Ghana: A Mini-review

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**Abstract**

Schistosomiasis is one of the neglected tropical diseases with infections often asymptomatic and, in severe cases giving rise to largely chronic and incapacitating manifestations. Ghana, like many tropical regions is endemic to schistosomiasis. This paper seeks to give a brief global picture of this parasitic disease and some historical events that have so far occurred in Ghana. Though in recent years, prevalence of schistosomiasis recorded in some parts of the country has decreased, it still remains a disease of major public health concern. This mini-review has implications for disease control, policy and research.

**Keywords:** Schistosomiasis, Neglected Tropical diseases, Intestinal schistosomiasis, Urogenital schistosomiasis, Control of schistosomiasis.

## 1. Introduction

Schistosomiasis is a neglected tropical disease which causes severe morbidities in tropical and subtropical regions (Inobaya et al., 2014). In terms of socioeconomic and public health importance, it is the third most devastating tropical disease globally (Ross et al., 2017). The disease is common in South and Central America, Asia and Africa but disproportionately high in sub-Saharan Africa. In Africa, Schistosomiasis is endemic in 42 countries (Barsoum et al., 2013; Inobaya et al., 2014). Globally, over 240 million people are infected with approximately 800 million people at risk of infection (World Health Organization, WHO, 2017; Ross et al., 2017). There are two forms of human schistosomiasis. These forms are urogenital and intestinal schistosomiasis. These are caused by digenetic trematodes which belong to the genus Schistosoma. Among the five species from this genus, *Schistosoma japonicum, S. haematobium and S. mansoni* are pathogenic to man, thus, of great public health concern (WHO, 2017; Inobaya et al., 2014). *Schistosoma japonicum* is the aetiological agent of intestinal schistosomiasis in South-East Asia (Sun et al., 2017). In Africa, the Middle East, the Caribbean, Brazil, Venezuela and Corsica (France), *S. haematobium* and *S. mansoni* are responsible for urogenital and intestinal schistosomiasis respectively (WHO, 2017).

## 2. Discussion

Schistosoma species are dependent on fresh water intermediate snail hosts (see Figure 1). A fundamental part of their life cycle is completed in these snails belonging to the phylum Mollusca

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(class Gastropoda). Three Fresh water snails, *Biomphalaria, Bulinus* and *Oncomelenia* species act as vectors or intermediate hosts for the disease transmission globally (WHO, 2017). As such, the distribution of schistosomiasis is determined largely by the presence or absence of these intermediate hosts (Opisa et al., 2011; Stensgaard et al., 2013). These snails are found in fresh water bodies that are subjected to fluctuations in environmental factors that impacts on their relative abundance (Amoah et al., 2017). *Oncomelania* species are vectors for *S. japonicum* while *Biomphalaria* and *Bulinus* species are vectors for *S. mansoni* and *S. haematobium* respectively.

**Fig. 1.** The three Fresh water snail hosts of schistosomiasis
*Bulinus truncatus, Biomphalaria and Oncomelania* species.
*Image credit: Lewis et al.,* 2008

The schistosome species' life cycle begins with the release of eggs by sexually paired adult worms within the blood vessels (mesenteric venules of the gut for *S. mansoni* and venous plexus of the urinary bladder for *S. haematobium*) of the definitive host (man). In the case of human schistosomiasis when an infected person passes out the eggs either through the urine or faeces, they hatch into miracidia upon contact with fresh water. The miracidia then penetrate the appropriate intermediate snail host and develop into thousands of infective cercaria which are shed into the water. Transmission proceeds with the penetration of the skin of the definitive host by cercaria upon contact with a cercariae-infested water. Infections associated with schistosomiasis are often asymptomatic (Bruun et al., 2008; WHO, 2017). Even though most people in endemic regions generally have light infections with no symptoms, the effects of schistosomiasis on a country's health and economy cannot be overemphasized. Haematuria, that is blood in urine, is a classical sign of urogenital schistosomiasis. In some parts of Africa, this is considered as a normal phenomenon in adolescents (Aboagye et al., 2009). Ulcers, lower abdominal pain, bleeding disorders, and infertility are some of the common symptoms in women infected with urogenital schistosomiasis (Poggensee et al., 2000, Mazigo et al., 2012).

Globally, some studies indicate that women infected with urogenital schistosomiasis are at a higher risk of attracting HIV, experiencing ectopic pregnancy and painful intercourse (Hotez et al., 2009; WHO, 2013). Intestinal schistosomiasis on the other hand present symptoms such as vague abdominal pains, diarrhoea, blood in the stool, splenomegaly (spleen enlargement) and hepatomegaly (liver enlargement) in advanced cases which (WHO, 2013). Mortality although low, may be due to non-functioning kidney, obstructive uropathy cancer of the bladder hematemesis, liver fibrosis and portal hypertension (WHO, 2013, 2017). Due to insufficient data, mortality related to schistosomiasis is complicated. Nonetheless, mortality associated to non-functioning kidney (caused by *Schistosoma haematobium* infection) and haematesis (caused by *S. mansoni* infection) are about 150,000 and 130,000 persons respectively every year (van der Werf et al., 2003).

Risk factors associated with schistosomiasis are likely to be location-specific. They may comprise of age, sex, occupation, water contact practices, socioeconomic status, and distance to safe and unsafe water sources (Kosinski et al., 2012; WHO, 2017). In rural areas, schistosomiasis is

often an occupational disease. Chiefly, it affects persons who are unable to avoid contact with water because of their occupation (agriculture, fishing). In other cases, rural dwellers are affected due to lack of a reliable source of portable water for drinking, washing and bathing. Hence, washing of clothes, water collection, swimming or bathing, and fishing have been identified as risk factors for schistosomiasis (see Figure 2).

**Fig. 2.** School-aged children fetching water from an infested water body in a schistosomiasis endemic community
*Image credit*: *L. A. O. Amoah*

Again, schistosomiasis has been connected closely to variations in the environment due to anthropogenic activities such as water resource development (Grosse, 1993; Opisa et al., 2011). Over the years, water resource development and management have had impacts on the diversity and abundance of freshwater snails and in some cases altered schistosomiasis transmission (Mazigo et al., 2012; Opisa et al., 2011; Zakhary, 1997). The constructions of irrigation schemes, small dams and larger hydroelectric dams for power production and irrigation-fed agriculture have resulted in the spread of the disease to formerly non-endemic areas (Fenwick, 2006; Grosse, 1993; Steinmann et al., 2006). The suitable freshwater bodies created by the water resources development attract intermediate host snails which prepare for the parasite to be introduced (Fenwick, 2006; Steinmann et al., 2006). Researchers believe that this situation is likely to be exacerbated by climate change (Yang et al., 2005; Zhou et al., 2008).

**Brief History of Schistosomiasis in Ghana**

Schistosomiasis turned out to be a critical public health crisis after the Volta River was dammed in Akosombo in 1964 (Danso-Appiah, 2009; Grosse, 1993; Yirenya-Tawiah et al., 2011; Zakhary, 1997). The creation of the Volta Lake resulted in a sudden occurrence and infestation of *B. truncatus* (an intermediate host of *S. haematobium)*, consequently leading to occurrences of urogenital schistosomiasis in several communities along the lake (Zakhary, 1997). Subsequently, the creation of the Kpong head pond, about 25 km below the Akosombo dam, also became another active transmission site of both urogenital and intestinal schistosomiasis (Yirenya-Tawiah et al., 2011). The construction of these two dams (Akosombo dam and Kpong dam) resulted in the upsurge of the prevalence of schistosomiasis in riparian communities. A 90 % prevalence rate of schistosomiasis was recorded in the south western shore of Lake Volta, two years after it was filled in 1966 (Grosse, 1993). Prior to the creation of these dams, a 5-10 % prevalence rate was recorded in those areas (Danso-Appiah, 2009).

Similarly, infection rates of urogenital schistosomiasis also increased in Bator and Mepe, two communities located along the Volta Lake. The infection rates increased from 17 % in 1963, 74.6 % in 1981, 26.5 % in 1963, and 88.0 % in 1981 respectively (Grosse, 1993). Generally, a number of children living in communities along the Volta Lake continue to suffer from schistosomiasis mostly

associated with *S. hematobium* (Danso-Appiah, 2009). Of the two forms of the disease recorded in Ghana, urogenital schistosomiasis was described to be far more prevalent than intestinal schistosomiasis due to its predominant and extensive distribution throughout the country as far back as in the 1950s (Hamed, 2010; McCullough, 1959). It is documented that about 20 % of Ghanaians suffered from urogenital schistosomiasis at some time in their lives between 1965 and 1973 (Aryeetey et al., 2000).

Among riparian communities from Kpong to Ada in the Volta estuary, prevalence rates of 7-52 % for intestinal schistosomiasis and 88 % for urogenital schistosomiasis were recorded in the early 1990s (WHO, 1993). Also, additional creation of the Vea and Tono dams (Northern Ghana), Nwabi and Barekese dams (Ashanti Region), Okyereko and Mankessim dams (Central region) as well as the Weija dam (Greater Accra region) for irrigational and domestic purposes also marked the extensive distribution of schistosomiasis throughout Ghana, a situation that affirmed the importance of a control programme (Yirenya-Tawiah et al., 2011; Zakhary, 2018).

**Current Schistosomiasis Prevalence in Ghana**

Presently, Ghana is still endemic to schistosomiasis (see Figure 3). The disease, per the World Schistosomiasis Risk Chart (2012), is present throughout the whole country including the urban areas (International Association for medical Assistance to Travellers, 2012). According to Biritwum (2017), endemicity of schistosomiasis mapped out in Ghana between March and May, 2008 showed that 119 districts out of 138 districts were endemic to the disease. A further survey in 2010 indicated an increase in endemicity from 119 districts to 141 districts.

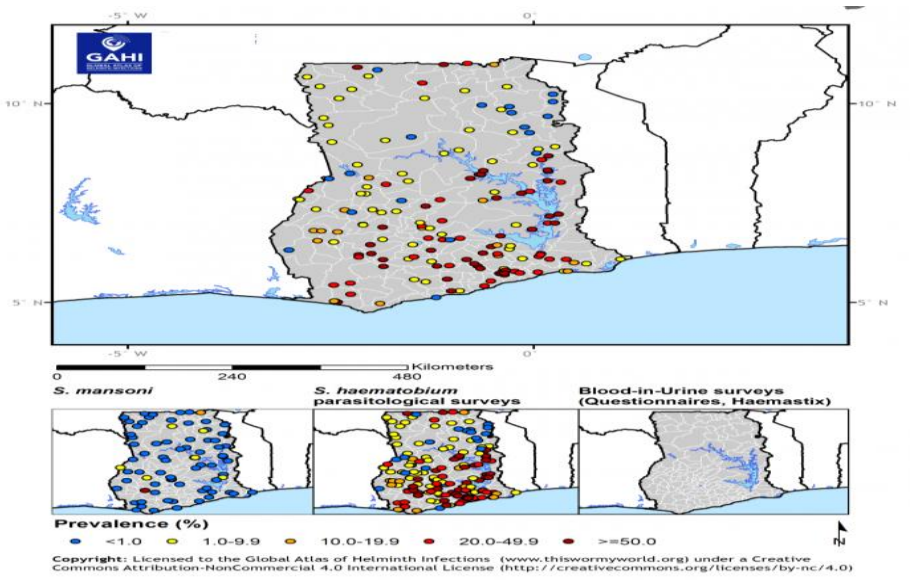


**Fig. 3.** Distribution of schistosomiasis survey data in Ghana
*Image credit: Global Atlas of Helminth Infections via*
*URL: http://www.thiswormyworld.org/maps/distribution-of-schistosomiasis-survey-data-in-ghana*

Additionally, the two forms of schistosomiasis reported to occur in the country affect all ages and sexes with varying prevalence rates. Among 2,516 children surveyed in 51 schools in 2007, documented cases of schistosomiasis were higher than other helminthic infections. An estimated 6.6 million school-aged children were also reported to be infected with the disease (Biritwum, 2017). Occupational health risk is very high for fishermen and farmers as well as persons in constant contact with infested water.

**Schistosomiasis Control Programmes in Ghana**

Over the past century, countries with endemic schistosomiasis have undertaken control programmes with the aim of interrupting the parasite's life cycle with outcomes varying from little

effect to total elimination (Sokolow et al., 2016). Over the years, a number of strategies employed in controlling schistosomiasis include chemotherapy, improving sanitation, public health education and controlling intermediate snail hosts or a combination of these approaches. However, current global strategies employed to control schistosomiasis aim at reducing morbidity by decreasing worm burden and intensity of infection (Mazigo et al., 2012). Chemotherapy continues to play an important role in reducing morbidity and mortality associated with the disease burden. Praziquantel, which is endorsed by WHO as the "drug of choice" for treating schistosomiasis marked the turning point for the control of schistosomiasis in many endemic countries (Danso-Appiah, 2009). Many endemic regions undertake mass drug administration using praziquantel which is repeated over a period of years (WHO, 2013; Sokolow et al., 2014). An integrated control approach of praziquantel treatment, environmental upgrading or modification, sanitation improvement, control of the intermediate snail hosts and public health education activities have been documented to be highly effective (Mazigo et al., 2012; Utzinger et al., 2000).

In the case of Ghana, a national schistosomiasis control programme was initiated in the 1980s which started population-based treatment campaign programmes using chemotherapy (praziquantel) (Danso-Appiah, 2009). The Volta River Authority (VRA) also introduced Schistosomiasis Control programmes in the 1990 in communities along the Volta Lake to alleviate the disease burden of schistosomiasis. Measures employed by VRA involved mass drug administration, supply of wells and pumps, public education on observing proper sanitary conditions along the shoreline among others (Zakhary, 1997).

In recent years, the principal objective of schistosomiasis control under the Neglected Tropical Diseases Programme (NTDP) in Ghana is to bring down the prevalence of the disease using integrated approach. Through NTDP, Ghana hopes to attain schistosomiasis control to levels which will not warrant public health concern. The control programmes include regular mass drug administration to school-aged children, health education and training of health workers and community volunteers. As of 2008, about 802,561 school aged children in 46 districts were treated in a school-based programme. This number increased from 681,114 among 87 districts in 2010 and further to 1,383,831 among 65 districts in 2011 (Biritwum, 2017). Unfortunately, several challenges such as improvement in access to potable and safe water, funding to support control activities and increase in insanitary conditions have stalled these control programmes.

## 3. Conclusion

Ghana, over several decades has been grappling with schistosomiasis and its associated morbidity. Although the journey towards schistosomiasis control and its ultimate elimination has been a rather long one, significant successes have been chalked in some parts of the country leading to substantial declines in prevalence rates. The use of an integrated approach (mass drug administration, education, community involvement, improved sanitation and sustainable funding from government and external donors as well as strong political will) targeting the various stages of the parasites' life cycle is definitely the surest way to ensure sustainable schistosomiasis control and elimination.

## 4. Conflicts of interest

The author declares no conflicts of interest.

## References

Aboagye et al., 2009 – *Aboagye, I. F., Edoh, D.* (2009). Investigation of the risk of infection of urinary schistosomiasis at Mahem and Galilea communities in the Greater Accra Region of Ghana. *West African Journal of Applied Ecology*, 15(1), doi.org/10.4314/wajae.v15i1.49426

Amoah et al., 2017 – *Amoah, L.A.O, Anyan, Aboagye-Antwi, F., Abonie, S., Tettey, M.D., Bosompem, K.M.* (2017). Environmental Factors and their Influence on Seasonal Variations of Schistosomiasis Intermediate Snail Hosts Abundance in Weija Lake, Ghana. *Journal of Advocacy, Research and Education,* 2017, 4(2), 68-80.

Aryeetey et al., 2000 – *Aryeetey, M.E., Wagatsuma, Y., Yeboah, G., Asante, M., Mensah, G., Nkrumah, F. K., Kojima, S.* (2000). Urinary schistosomiasis in southern Ghana: Prevalence and morbidity assessment in three (defined) rural areas drained by the Densu river. *Parasitology international*, 49(2), 155-163.

Barsoum et al., 2013 – *Barsoum, R.S., Esmat, G., El-Baz, T.* (2013). Human schistosomiasis: Clinical perspective: Review. *Journal of Advanced Research, 4*(5), 433-444.

Biritwum, 2017 – *Biritwum, N.K.* (2017). Overview of schistosomiasis control in Ghana. Date accessed: 7th June, 2018. [Electronic resource]. URL: http://citifmonline.com/2017/07/11/vra-donates-borehole-to-bilharzia-endemic-community/

Bruun et al., 2008 – *Bruun, B., Aagaard-Hansen, J.* (2008). The social context of schistosomiasis and its control: An introduction and annotated bibliography. Geneva: World Health Organization.

Danso-Appiah, 2009 – *Danso-Appiah, A.* (2009). Treatment effects and integrated morbidity control of schistosomiasis (Thesis). Erasmus MC, University Medical Centre, Rotterdam, Netherlands. [Electronic resource]. URL: http://www.repub.eur.nl/...091105

Fenwick, 2006 – *Fenwick, A.* (2006). Waterborne infectious diseases could they be consigned to history? *Science*, 313, 1077–1081.

Grosse, 1993 – *Grosse, S.* (1993). Schistosomiasis and water resources development: A re-evaluation of an important environment-health linkage. *Technical working paper no. 2*, P. 43. [Electronic resource]. URL: http://ageconsearch.umn.edu/.../1/twp

Hamed, 2010 – *Hamed, M.A.* (2010). Strategic control of schistosome intermediate host. *Asian Journal of Epidemiology, 3,* 123-140.

Hotez et al., 2009 – *Hotez, P.J., Kamath, A.* (2009). Neglected tropical diseases in sub-Saharan Africa: Review of their prevalence, distribution, and disease burden. *PLoS Neglected Tropical Diseases*, 3(8), e412.

Inobaya et al., 2014 – *Inobaya, M.T., Olveda, R.M., Chau, T.N., Olveda, D.U., Ross, A.G.* (2014). Prevention and control of schistosomiasis: A current perspective. *Research and Reports in Tropical Medicine*, 5, 65-75.

International Association for medical Assistance to Travellers, 2012 – International Association for medical Assistance to Travellers. (2012). Be aware of Schistosomiasis. Date accessed: 7th June, 2018. [Electronic resource]. URL: http://www.iamat.org

Kosinski et al., 2012 – *Kosinski, K.C., Adjei, M.N., Bosompem, K.M., Crocker, J.J., Durant, J.L., Osabutey, D., ... , Gute, D.M.* (2012). Effective control of Schistosoma haematobium infection in a Ghanaian community following installation of a water recreation area. *PLoS Neglected Tropical Diseases*, 6(7), e1709.

Lewis et al., 2008 – *Lewis, F.A., Liang, Y., Raghavan, N., Knight, M.* (2008). The NIH-NIAID schistosomiasis resource centre. *PLoS Neglected Tropical Diseases,* 2(7), e267.

Mazigo et al., 2012 – *Mazigo, H.D., Nuwaha, F., Kinung'hi, S.M., Morona, D., de Moira, A.P., Wilson, S., ... , Dunne, D.W.* (2012). Epidemiology and control of human schistosomiasis in Tanzania. *Parasites & Vectors*, *5*(274), doi.org/10.1186/1756-3305-5-274

McCullough, 1959 – *McCullough, F.S.* (1959). The susceptibility and resistance of Bulinus (physopsis) globosus and Bulinus (bulinus) truncatus rohlfsi to two strains of Schistosoma haematobium in Ghana. *Bulletin of the World Health Organization*, 20, 75-85.

Olveda et al., 2016 – *Olveda, R.M., Tallo, V., Olveda, D.U., Inobaya, M.T., Chau, T.N., Ross, A.G.* (2016). National survey data for zoonotic schistosomiasis in the Philippines grossly underestimates the true burden of disease within endemic zones: Implications for future control. *International Journal of Infectious Diseases*, 45, 13-17.

Opisa et al., 2011 – *Opisa, S., Odiere, M.R., Jura, W.G., Karanja, D.M., Mwinzi, P.N.* (2011). Malacological survey and geographical distribution of vector snails for schistosomiasis within informal settlements of Kisumu City, western Kenya. *Parasites & Vectors*, *4*(226), DOI: 10.1186/1756-3305-4-226

Poggensee et al., 2000 – *Poggensee, G., Kiwelu, I., Weger, V., Goppner, D., Diedrich, T., Krantz, I., Felmeier, H.* (2000). Female genital schistosomiasis of the lower genital tract: Prevalence and disease-associated morbidity in northern Tanzania. *The Journal of Infectious Disease*, 181, 1210–1213.

Ross et al., 2017 – *Ross, A.G., Chau, T.N., Inobaya, M.T., Olveda, R.M., Li, Y., Harn, D.A.* (2017). A new global strategy for the elimination of schistosomiasis. *International Journal of Infectious Diseases*, 54, 130-137.

Sokolow et al., 2016 – *Sokolow, S.H., Lafferty, K.D., Kuris, A.M.* (2014). Regulation of laboratory populations of snails (Biomphalaria and Bulinus spp.) by river prawns, Macrobrachium spp. (Decapoda, Palaemonidae): Implications for control of schistosomiasis. *Acta Tropica*, 132, 64-74.

Steinmann et al., 2006 – *Steinmann, P., Keiser, J., Bos, R., Tanner, M., Utzinger, J.* (2006). Schistosomiasis and water resources development: Systematic review, meta-analysis, and estimates of people at risk. *Lancet Infectious Diseases, 6*, 411–425.

Stensgaard et al., 2013 – *Stensgaard, A.S., Utzinger, J., Vounatsou, P., Hürlimann, E., Schur, N., Saarnak, C.F., … , Rahbek, C.* (2013). Large-scale determinants of intestinal schistosomiasis and intermediate host snail distribution across Africa: Does climate matter? *Acta Tropica*, *128*(2), 378-390.

Sun et al., 2017 – *Sun, L., Wei Wang, W., Qing-Biao Hong. Q., Li, S., Liang, Y., Yang, H., Zhou, X.* (2017). Approaches being used in the national schistosomiasis elimination programme in China: A review. *Infectious Diseases of Poverty, 6*(55), doi.org/10.1186/s40249-017-0271-9

Utzinger et al., 2000 – *Utzinger, J., Tanner, M.* (2000). Microhabitat preferences of Biomphalaria pfeifferi and Lymnaea natalensis in a natural and a man-made habitat in southeastern Tanzania. *Memórias do Instituto Oswaldo Cruz*, 95(3), 287-294.

Utzinger et al., 2000 – *Utzinger, J., Zhou, X.N., Chen, M.G., Bergquist, R.* (2005). Conquering schistosomiasis in China: the long march. *Acta Tropica,* 96, 69–196.

van der Werf et al., 2003 – *van der Werf, M.J., Bosompem, K.M., de Vlas, S.J.* (2003). Schistosomiasis control in Ghana: Case management and means for diagnosis and treatment within the health system. *Transactions of the Royal Society of Tropical Medicine and Hygiene*, 97, 146-152.

World Health Organization, 1993 – World Health Organization (1993). The control of schistosomiasis: Second report of the WHO Expert Committee. WHO Technical Report Series, 830. Geneva: World Health Organization.

World Health Organization, 2013 – World Health Organization (2013). Schistosomiasis progress report 2001-2011 and strategic plan 2012-2020. Geneva: World Health Organization.

World Health Organization, 2017 – World Health Organization (2017). *Schistosomiasis: Fact sheet*. Date accessed: 30th October, 2017. [Electronic resource]. URL: http://www.who.int/mediacentre/factsheets/fs115/en/

Yang et al., 2005 – *Yang, G.J., Vounatsou, P., Zhou, X.N., Tanner, M., Utzinger, J.* (2005). A potential impact of climate change and water resource development on the transmission of Schistosoma japonicum in China. *Parasitologia*, 47, 127–134.

Yirenya-Tawiah et al., 2011 – *Yirenya-Tawiah, D. R., Rashid, A. A., Futagbi, G., Aboagye, I., Dade, M.* (2011). Prevalence of snail vectors of schistosomiasis in the Kpong Head Pond, Ghana. *West African Journal of Applied Ecology*, 18(1), 39-45.

Zakhary, 1997 – *Zakhary, K.* (1997). Factors affecting the prevalence of schistosomiasis in the Volta Region of Ghana. *McGill Journal of Medicine, 3*(2), 93-101.

Zhou et al., 2008 – *Zhou, X. N., Yang, G. J., Yang, K., Wang, X. H., Hong, Q. B., Sun, L. P., … , Utzinger, J.* (2008). Potential impact of climate change on schistosomiasis transmission in China. *The American Journal of Tropical Medicine and Hygiene*, 78(2), 188-194.

Zhou et al., 2012 – *Zhou, Y.B., Liang, S., Jiang, Q.W.* (2012). Factors impacting on progress towards elimination of transmission of schistosomiasis japonica in China. *Parasites & Vectors*, 5(275), doi.org/10.1186/1756-3305-5-275