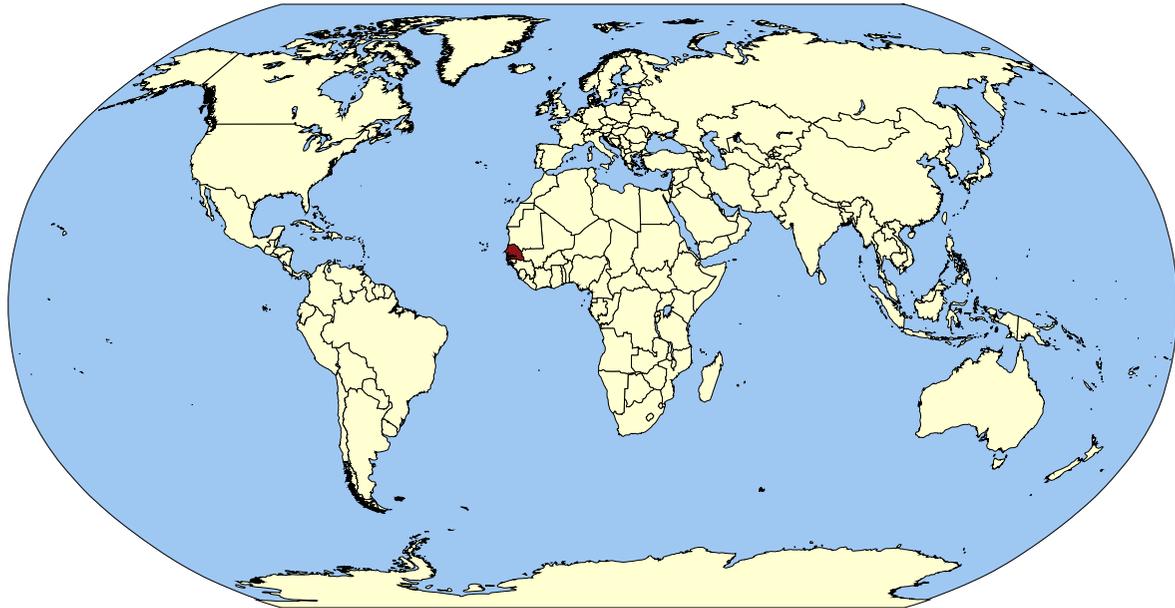


Senegal



The Long Record of Schistosomiasis in Senegal

In the town of Bakel, the French scientist Le Dantec encountered 20 patients showing symptoms of “vesical Schistosomiasis” in 1908. This represents the first record of schistosomiasis cases in Senegal [1]. In line with the country’s great diversity in aquatic habitat within Senegal, at least five species of snails are known to act as intermediate hosts for human infective schistosomes: *Bulinus senegalensis*, *B. globosus*, *B. umbilicatus*, *B. truncatus*, and seasonal populations of *Biomphalaria pfeifferi* [1,2].

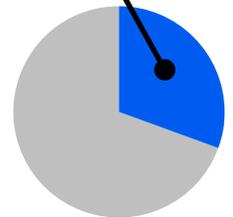
Senegal has one of the highest schistosomiasis disease burdens in the world. In 1965, schistosomiasis was reported to be found throughout the entire country, with the exception of the semi-arid zone of Ferlo [1]. Presently, intestinal and urinary schistosomiasis are endemic throughout the country [3]. As of 2000, the entire population of 8.5 million people in Senegal was considered at risk of infection, while 1.3 million people were estimated to be infected [3]. Recent estimations indicate that 25% of the population of Senegal is infected with schistosomiasis [4].

Schistosomiasis in Senegal [12]

Of the over 4 million people infected with schistosomiasis, almost **half are children**

31% of the population requires preventative chemotherapy for schistosomiasis

The national control programs of Senegal **reach 42% of the population** in need.



Overview of Senegal [13]

- » Population in 2015: 13,975,834
- » Official Language: French
- » Capital: Dakar
- » Republic
- » Percentage of Population with Access to Improved Drinking Water in 2015: 78.5%
- » Percentage of Population with Access to Improved Sanitation in 2015: 47.6%

Schistosoma in Senegal

Two schistosome species act as infectious agents in Senegal. *Schistosoma mansoni* is responsible for the intestinal cases found predominantly within the Senegal River Basin, whereas cases of *S. haematobium*, the urinary form of disease, are highly concentrated in the Lac de Guiers region and near the Eastern Senegalese border. Although urinary schistosomiasis has been a recognized problem in Senegal from the early 20th century, intestinal schistosomiasis was not reported until the 1980's.

The Problem with the Dam

In 1986, the first case of intestinal schistosomiasis in the Senegal River Valley was reported after the development of the Diama dam in Saint-Louis, built to prevent saltwater intrusion into the Senegal River. Before the expansion of freshwater habitat associated with dam building, the *Bulinus* species' high sensitivity to salinity prevented the snails from establishing themselves in the North Western region of Senegal. With the new dam in place, the mollusk population grew. The establishment of a large population of *Biomphalaria pfeifferi* in the late 1980's directly after the dam was constructed correlated with a sudden spike in cases of intestinal schistosomiasis [5]. Now, both urinary and intestinal schistosomiasis are prevalent in the lower Senegal River Basin, and co-infection is common - 21% of patients are infected with both *S. mansoni* and *S. haematobium* [6]. Resistance of *S. mansoni* infections towards treatment with praziquantel has been speculated in Northern Senegal as a potential reason for low cure rates with praziquantel. However, evidence is equivocal and rapid reinfection has been presented as a putative alternative hypothesis to acquired resistance [7].



The Diama Dam

Schistosomiasis rates have spiked since the erection of the Diama dam on the Senegal River, as shown above. The dam has drastically improved year-round water access, especially for Senegalese farmers. However, the dam has also led to increased vegetation in slow-moving water -- the perfect habitat for schistosome-hosting snails. Thus, after the Diama dam was built, schistosomiasis spiked.

Control Efforts

National control efforts began with a prevalence survey in 1996 followed by a national control program backed by the World Bank in 1997 [9]. According to the preventative chemotherapy databank provided by the WHO, there have been three large-scale attempts at curbing the schistosomiasis problem in Senegal. In 2009, 2010, 2012, and 2013, 3.33%, 14.24%, 29%, 42% of the population was treated, respectively, focused primarily on school-aged children [10]. It is well recognized that the schistosomiasis situation in Senegal will not improve unless permanent health care facilities are established, water supply is clean and reliable, and the population is educated about the schistosome transmission cycle and adopts appropriate hygienic behavior with relation to river bathing [2].

Looking Ahead to the Prawn

Other approaches to controlling schistosomiasis in Senegal revolve around biologically controlling snails through restoring *Macrobrachium vollenhovenii*, the African river prawn, to the Senegal River. *M. vollenhovenii* is a freshwater shrimp-like crustacean whose migration patterns were interrupted by the Diama dam. It preys voraciously on the snails that host schistosomiasis, and its absence from the Senegal River Basin in recent decades may have further magnified the boom in schistosomiasis prevalence rates. A case study conducted in 2012 demonstrated that when prawns were stocked in a frequently-used water access point, nearby inhabitants experienced a decrease in egg burden. Restoring prawns to the Senegal River -- by fish ladder or by aquaculture -- may reduce schistosomiasis and even lead to economic benefits [10].



Restoring Prawns to a Water Access Point

Initiatives like The Upstream Alliance [11] are looking to use prawns as snail control in order to ultimately reduce schistosomiasis prevalence.

References

1. Senghor, B. Prévalence Et Intensité D'infestation De La Bilharziose Urogénitale Chez Des Enfants D'âge Scolaire À Niakhar (milieu Rural Sénégalais). *Univ. Cheikh Anta Diop Dakar* **278**, 1-94 (2010).
2. Mone, H., Ibikounle, M., Massougboji, A. & Mouahid, G. Human schistosomiasis in the Economic Community of West African States: epidemiology and control. *Adv. Parasitol.* **71**, 33-91 (2010).
3. Chitsulo, L., Engels, D., Montresor, A. & Savioli, L. The global status of schistosomiasis and its control. *Acta Trop.* **77**, 41-51 (2000).
4. Senghor, B. *et al.* Prevalence and intensity of urinary schistosomiasis among school children in the district of Niakhar, region of Fatick, *Senegal. Parasit. Vectors* **7**, 5 (2014).
5. Talla, I. *et al.* Outbreak of intestinal schistosomiasis in the Senegal River Basin. *Ann. Soc. Belg. Med. Trop.* (1920). **70**, 173-180 (1990).
6. De Clercq, D., Rollinson, D., Diarra, A., Sacko, M., Coulibaly, G., Landoure, A., *et al.* Schistosomiasis in Dogon country, Mali: identification and prevalence of the species responsible for infection in the local community. *R. Soc. Trop. Med. Hyg.* **88**, 653-65 (1994).
7. Huyse, T. *et al.* Regular treatments of praziquantel do not impact on the genetic make-up of *Schistosoma mansoni* in Northern Senegal. *Infect. Genet. Evol.* **18**, 100-105 (2013).
8. Distribution of schistosomiasis survey data in Senegal | Global Atlas of Helminth Infections. at <<http://www.thiswormyworld.org/maps/2013/distribution-of-schistosomiasis-survey-data-in-senegal>>
9. *Schistosomiasis and intestinal parasites control. Planning and technical guidance. Communicable diseases prevention and control. Report of the WHO informal consultation on schistosomiasis control.* 1-45 (1999). at <http://whqlibdoc.who.int/hq/1999/WHO_CDS_CPC_SIP_99.1.pdf>
10. Sokolow, S.H. *et al.* Reduced transmission of human schistosomiasis after restoration of a native river prawn that preys on the snail intermediate host. *PNAS* **112**, 9650-9655 (2015). doi: 10.1073/pnas.1502651112
11. The Upstream Alliance (2015). at <www.theupstreamalliance.org>
12. WHO. PCT Databank for Schistosomiasis. at <http://www.who.int/neglected_diseases/preventive_chemotherapy/sch/en/>
13. Central Intelligence Agency. (2015). Senegal. In *The World Factbook*. at <<https://www.cia.gov/library/publications/the-world-factbook/geos/sg.html>>