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Egypt, Factor 12: Human Diseases

When "parasitic infection" comes to mind, we often think of a child with a distended belly full of worms and watery, yellow eyes. However, this image is somewhat misleading to the truth: the most devastating parasitic disease of the world is no tapeworm or roundworm. It is a disease that comes completely unexpectedly and likes to stay. It is the most prevalent and damaging tropical disease after malaria. It was once so common, it was considered part of a right of male menstruation in Egypt (Kloos, David 20). It kills more than 200,000 people per year (WHO "Epidemiological"). This invisible scourge is of a different stock than many parasites. It is called schistosomiasis.

What is schistosomiasis?

Due to its status as a Neglected Tropical Disease, it is vital to disclose the general workings of this parasite and its debilitating disease. Schistosomiasis, also known as bilharzia or snail fever, is a chronic helminthiasis, often affecting the kidneys, bladder, liver, intestines, and genital organs (urogenital schistosomiasis). Five subspecies live around the world in sub-tropical and tropical zones, affecting close to 200 million people; this makes it the second most prevalent tropical disease on the entire planet, bested only by malaria (CDC). Schistosomiasis is primarily carried by the freshwater snail, which acts as an intermediary host, carrying eggs in its foot. When people come into contact with affected snail populations, larvae can be released from the snail. The newborn schistosomes swim through the water and penetrate the skin, migrating through blood vessels as they mature. When they reach adulthood, they mate in blood vessels, remaining in a constant state of copulation their whole adult lives and producing as many as five hundred eggs per day over three to six years (Parasite). Eggs are deposited in organs and soft tissues, where they cause inflammation, chronic pain, scarring pre-cancerous lesions, and in some cases, renal failure. A certain portion of other eggs are passed through the stool back into a water source, re-infecting snails and, by extension, unsuspecting citizens. Schistosomiasis causes fever, pain, hematuria, rash, anemia, developmental delays, inflammation, intestinal blockages, genital lesions, infertility, malnutrition, and general suffering. The infection can persist in the body for multiple years, longer if the patient is re-infected. It typically affects rural subsistence-farmer and fishing populations.

Egyptian Rural Life

Egypt is beset with poverty woes and, most recently, political upheaval. The global depression of 2008 exacerbated political unrest and poverty throughout the region, triggering a steep decline in employment and financial opportunity. According to the article "More Than 20 Million Egyptians Live in Poverty: Report" in *Egyptian Streets*, the total population of Egypt is about 82 million people; of these, twenty-two million, or 26%, live in poverty. There are an estimated fifteen million rural poor, creating a rural poverty rate of about 50% ("Rural Poverty in Egypt"). As a result, diet, education, and healthcare tend to be very poor. The average subsistence family consists of five people; it is not uncommon for multiple generations of the same family to live together (WHO "Egypt"). Although subsistence farming provides a livelihood, unpredictable food security and low crop prices generally make for a homogeneous diet consisting of rice, maize, and bread (UN "Plant Nematode…"). Rural Egyptian families simply do not have the buying power to maintain a consistent diet, offering an explanation for an extremely high rate of anemia (ENID "Poverty"). Education is inconsistent at best. While eighty-eight percent of children are reported to be enrolled in primary school, the truth is that attendance drops off in rural areas. In reality, only about 20% of the bottom 20% attend primary school—rural Egypt houses some of the poorest people in the world (ENID "Community Schools"). The number of rural children attending secondary and preparatory school decreases further due to work, marriage demands, and low-quality facilities. Additionally, rural schools have been reported as overcrowded and poorly taught. The literacy rate for all of Egypt is about 73.8% (CIA World Factbook); however, this percentage is probably lower in rural areas. Predictably, rural

Egyptians are often unskilled laborers and may exhibit only a rudimentary understanding of financial literacy, creating major barriers to making a living wage and gaining economic mobility.

Poverty also plays a negative role in access to healthcare. Rural families are burdened with low income and a failing health system. As a result, the prevalence of malnutrition and infant mortality is higher in the rural areas of Egypt than in the urban ones. It is estimated that about 29% of all Egyptian children suffer from some kind of chronic malnutrition wasting (UNICEF).
The typical Egyptian subsistence family lives on a farm of about 1.05 hectares (UN "Plant Nematode…"). Rice and maize are statistically the most common crops, but cotton, fruit, vegetables, and clover may be grown as well (UN "Plant Nematode…"). While agricultural practices using water buffalo (a schistosomiasis host) and simple tools can still be found, these methods are becoming less common with the advent of mechanized farm equipment (Kloos, David 22). Despite the increase of advanced farming practice, the rural family still relies on reclaimed farmland and local irrigation outside the Nile Delta in order to grow crops. This dependence on local irrigation—stagnant water—creates major spawning grounds for schistosomiasis.

Effects of Schistosomiasis
Currently, agriculture makes up more than fifty percent of the population's livelihood, thirteen percent of its GDP, and thirty percent of its labor force, making farming a centrally important and prevalent industry throughout all of Egypt ("Rural Poverty in Egypt"). Schistosomiasis targets rural and sometimes very isolated areas, where the most vulnerable populations in the Egyptian socio-economy live. The effects of schistosomiasis, while they can be deadly, are more nefarious in the sense they are more often chronic and disabling. Children—more likely to wade and play in infected waters—are impacted by long-term illness, often exhibiting malnutrition, anemia, slow growth, and poor academic performance. This hinders the growth and education of the next generation, thereby affecting agricultural productivity when debilitated children grow to be adults. In the older population, the fever, pain, and malnutrition caused by schistosomiasis is associated with severe disability and a lack of ability to work, exacerbating the effects of poverty. In fact, it is estimated that schistosomiasis permanently disables 5% of the people it affects, causing an accumulation of 49-56 million disability-adjusted life years worldwide (King 3-4). Subsistence farmers and fishermen rely on their good strength and their children for their livelihood. Schistosomiasis takes away this integral part of their lives. This worm, like malaria, causes millions of dollars and hundreds of work hours in losses each year—yet it remains, despite its horror, anonymous to the general public in America and in non-affected countries around the world.

Present Status of Schistosomiasis in Egypt
Schistosomiasis remains a criminal at large in Egypt, affecting men, women, and children who are part of the rural poor. Men suffer the effects of schistosomiasis, living for years with chronic pain and debilitation. Women have the added risk of losing their fertility or birthing a premature baby due to lesions in the uterus or fallopian tubes. In addition, these lesions contribute to an increased risk of contracting sexually transmitted infections. Children are at risk for developmental delay; without treatment, they will most likely grow to be unproductive and undereducated adults.

Disease Trends—Infection Rates and Treatment Rates
Concentrated efforts from international health organizations and the Egyptian government since the 1980s has contributed to a declining infection rate (Kloos, David 20). This decreasing rate in Egypt is at odds with the rate of other African and Middle Eastern countries, which have had increasing rates of infection in recent years. In 1985, researchers found that the prevalence of schistosomiasis subspecies infection in Middle Egypt had been reduced from 30% to 8.5% after observations began in 1977 (Barakat 430). The declining infection rates have been reflected in treatment methods. In 1997, Egyptian government's National Schistosomiasis Control Program began, promoting mass treatment for villages with schistosomiasis prevalence of over 20%. As the program cut schistosomiasis transmission, the mass

dosage guidelines were modified: infection thresholds for schistosomiasis was set to >10% in 1999, >5% in 2000, and >3% in 2003 (Barakat 431). They continue to make strides in treatment and diagnosis, further lowering the infection rates and treatment threshold of schistosomiasis.

Benefits of Removing Schistosomiasis

The prevalence of schistosomiasis suggests that its removal would free the population of a major burden, mitigating one of the major causes of disability in Egypt. The number of DALYs (Disability-adjusted life years) given to Egypt due to schistosomiasis would be greatly reduced, improving agricultural output and encouraging socioeconomic growth. Without the invisible scourge of schistosomiasis, a major cause and effect of poverty would be negated. Furthermore, the next generation would not be stunted by chronic infection. Eliminating schistosomiasis would ultimately eliminate a major cause of suffering in Egypt and a major cause of lost agricultural productivity and allowing rural populations to work and prosper.

Major Issues in Schistosomiasis Rates

Although 98% of all Egyptians supposedly have access to clean water, infection in reclaimed rural areas has remained largely as a result of the prevalence of open irrigation and water control ("Rural Poverty in Egypt"). While this can be attributed to daily activities, it can also be attributed to irrigation. Snails can live in irrigation system. Periodic drying of irrigation systems intended to kill off the snails has been unsuccessful, as the snails can simply hibernate in mud. As the rural poor, farmers, and fishermen are required to be in close contact with irrigation systems, canals, and other freshwater bodies, transmission rates can be intensely high. However, as irrigation systems improve and exposed canals and drainages are eliminated, the prevalence of host snails, and by extension, schistosomiasis, will fall (David, Kloos, 20-21).

Smaller, rural villages often do not have plumbing or have inadequate plumbing. Waste from pit latrines and open defecation by infected persons can cause schistosomes and their eggs to flow into the fields, irrigation systems, or canals. As plumbing and sanitation improve, the cycle of transmission can be broken or reduced.

One of the methods of schistosomiasis control revolves around the reduction of snail populations through molluscisides (Barakat 430). While snails as intermediary hosts cannot be completely eliminated, snail control has been shown to control the rates of infection. After all, less living space for schistosomiasis means less infection.

Recommendations for Schistosomiasis Control in Egypt

Mass Dosage

Although the campaign against schistosomiasis has been multifaceted, efforts to curb local snail populations and control water flow has been met in many rural areas with skepticism and hostility. This is due to the Egyptian government (both ancient and relatively recent) historically clashing with local farmers over water control rights, a precious privilege in a dry land. To avoid conflict with the intended patients, it may be prudent to focus on treating infections and preventing them with doses of Praziquantel, a popular heminthicide and the premier drug for treating schistosomiasis due to its low cost and low prevalence of clinical resistance. A single preventive course of Praziquantel, distributed once a year to the general population, has been a major strategy employed by the WHO in reducing overall infection rates. For the chronically infected, a dose two to four weeks after the first may be needed to force the worms from the system. At eight cents a pill, Praziquantel is an inexpensive remedy to a debilitating disease (WHO "Strategy"). A continuation and possible expansion of mass Praziquantel distribution is a major factor in eliminating schistosomiasis. It is recommended that communities with a schistosomiasis prevalence exceeding three percent of the population should receive dosages with reductions in the threshold when schistosomiasis cases begin to drop (Barakat 431).

Education—Explaining Causes and Offering Alternatives:
Despite common knowledge of the effects of schistosomiasis, educational attempts by the Egyptian government have not been terribly effective due to a lack of resources and, in some cases, ignorance as to the origin of the illness. These campaigns also sometimes did not offer alternative methods of water usage to rural audiences. Previous public awareness campaigns, while aggressive, did not offer any methods to manage schistosomiasis from the water sources rural Egyptians rely on (Kloos, David 21). Mass dosing efforts could be combined with educational efforts to offer a multifaceted approach to the disease. For washing and bathing, the local population could be advised to boil their water and store it in a separate place away from the infected freshwater. Children would have to be taught not to wade and to towel themselves dry if they come into contact with infected freshwater. The adjustment would not be perfect, but elimination of infected freshwater from everyday activities would reduce transmission. The population should also be taught to recognize a true cause of schistosomiasis—larvae in water—and informed of their local health options.

Sanitation Improvements:
One common method through which schistosomes transfer back into the water system is through open sewage and poor waste control. In tandem with preventing other waterborne diseases and parasites, there should be efforts put forth to institute effective waste control. This could be accomplished primarily through the introduction of piped water—with pipe sources, the population, barring fishermen, would not have to expose themselves to possible infected sewage. According to the NIH, piped water sources are responsible for a greatly reduced chance of transmission (Grimes et al 5). It is also advisable to offer more advanced methods of irrigation such as covered irrigation and canals to discourage snail habitation; this could be part of a much more sustained effort to improve the infrastructure of Egypt. Currently, this shift is already in progress, indicating a more natural progression of addressing other water-based diseases.

Periodic Snail Control:
Generally speaking, the more snails there are, the more infection there is. With periodic dosing and educational efforts, snail control could be implemented. By using molluscicides to lower the population of the intermediary host, schistosomiasis transmission could be reduced or eliminated. However, this method may be met with caution. Mollusciscides could potentially be very damaging to the environment and local water sources; not to mention, they are relatively expensive compared to Praziquantel. This can be the primary link through which schistosomiasis transmission is broken.

Other Options:
Other options for schistosomiasis treatment are currently being explored. The development of an antigen-based vaccine for schistosomiasis has been proposed, as schistosome eggs secrete specific antigens to prevent the immune system from destroying them. While large-scale dosing and education are extremely effective and could probably eliminate schistosomiasis, a vaccine would eliminate the tedium of specific targeted treatment. However, such development may not be economically feasible, as the development, production, and distribution costs would be quite expensive-- the average cost of vaccine development is half a billion dollars and ten years of research, and there is no reason to believe a schistosomiasis formula would be any cheaper (Serdobova, Kieny 1555).

Project Implementation on a Wider Scale
Mass praziquantel dosage could be implemented throughout other areas, such as in Asian countries, sub-Saharan Africa, and in South America. While the present subspecies of the worm would be different, the practice of mass dosage would be quite similar.

The Roles to Play to End Schistosomiasis

Charities and Global Organizations

Global organizations and charities have played and continue to play an integral role in the elimination of schistosomiasis. For example, WHO has used its extensive reach to administer its own schistosomiasis treatment program and treated 61.6 million people for schistosomiasis in 2014 alone, indicating a massive and effective effort (WHO "Schistosomiasis"). Other groups that specifically target schistosomiasis, such as Children Without Worms and the Global Schistosomiasis Alliance, have also aided in treatment and mass dosage. Though the treatment initiatives from large organizations have been instrumental in the decline of schistosomiasis, smaller organizations have also been helpful in delivering drugs and documentation. The Global NGO Deworming Inventory, for example, has collected and compiled deworming data from both very large and very small organizations for many years--it is, in itself, a huge collaborative effort (Deworming Inventory).

Generally speaking, NGOs and charities have access to an unprecedented amount of capital, global resources, and healthcare provisions. Ostensibly, they can work in tandem with both other NGOs to pool assets and staff. They can also work with the local government, which could provide employees that speak the local language and provide information about unfamiliar areas. Essentially, organizations are the global component of treatment, but the local people and government are the key to individualized treatment. Together, they can create distribution plans, draw up and collaborate on distributing educational material, and solve logistical issues associated with the treatment of schistosomiasis.

The Egyptian Government

In the 1920s, it was estimated that almost 70% of the population was infected with schistosomiasis. Early treatments brought that percentage down to 50%, but it wasn't until the late 1970s and the advent of Praziquantel that the reduction of schistosomiasis became a key issue in Egypt. Thus, in the early years of the decade, the Egyptian Ministry of Health launched its National Schistosomiasis Control Program, which was met with runaway success (Khaled 462).

The Egyptian government should continue its historic efforts to reduce the prevalence of schistosomiasis. As previously mentioned, collaboration with global organizations and charities has been both historical and necessary for the future. While organizations can provide resources, the government is necessary to provide the distribution network and the cultural knowledge to make an anti-parasite campaign a success. The government should keep accurate statistics of transmission and dosing rates in order to gauge its efficacy. Furthermore, while organizations can provide health professionals, the government needs to provide people who can communicate with, understand, and educate the varied ethnic and lingual groups across Egypt. It may also provide some funding for schistosomiasis control.

Governmental and organizational forces cannot stay forever at a village. It is impossible to observe all the schistosomiasis-related preventions and regimens. Therefore, it is the responsibility of the communities to make the anti-schistosomiasis campaign part of their daily lives. Normal citizens must reinforce prevention habits in each other and in their children; otherwise, the educational directive will fail. It is also the responsibility of the community, while governmental forces are away, to identify the signs and transmission methods of schistosomiasis and take steps to prevent its spread.

The Family in Ending Schistosomiasis:

While the government can focus on snail control and drug treatment, the subsistence family has their own role to play in preventing the spread of schistosomiasis. Families can break transmission through changes in their everyday life: collecting rainwater, storing water in closed containers, and boiling water used with skin contact should be a primary method of preventing schistosomiasis. All citizens, including children, should be taught to keep wading to a minimum and quickly towel off any infected water with which they

come into contact. It is ultimately the responsibility of the citizens to protect themselves and their neighbors.

Conclusion:

Schistosomiasis has been a scourge of Egypt for thousands of years—mummies in Egypt have been discovered with clear pathological signs of schistosomiasis (Barakat 426). However, it is only in the 20th and 21st centuries that there has arisen a prolonged and scientifically substantiated effort to eliminate it. With enough resources, patience, and knowledge, schistosomiasis could very well be eliminated. It is now a priority, in the world's most prosperous and scientifically advanced age, to eliminate the plagues that have so long crawled in the dirt and the water. Schistosomiasis, one day, may no longer cause human casualties; it itself will be—and must be—the casualty.

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