

How a Worm Gave the South a Bad Name

Rachel Nuwer :: 4/28/2016

For more than three centuries, a plague of unshakable lethargy blanketed the American South.

It began with “ground itch,” a prickly tingling in the tender webs between the toes, which was soon followed by a dry cough. Weeks later, victims succumbed to an insatiable exhaustion and an impenetrable haziness of the mind that some called stupidity. Adults neglected their fields and children grew pale and listless. Victims developed grossly distended bellies and “angel wings”—emaciated shoulder blades accentuated by hunching. All gazed out dully from sunken sockets with a telltale “fish-eye” stare.

The culprit behind “the germ of laziness,” as the South’s affliction was sometimes called, was *Necator americanus* —the American murderer. Better known today as the hookworm, millions of those bloodsucking parasites lived, fed, multiplied, and died within the guts of up to 40% of populations stretching from southeastern Texas to West Virginia. Hookworms stymied development throughout the region and bred stereotypes about lazy, moronic Southerners.

While the South eventually rid itself of hookworms, those parasites cost the region decades of development and bred widespread misconception about the people who lived there. Yet hookworm has not been defeated for good. Today, hundreds of millions of people in dozens of nations around the world suffer from hookworm infection. The South’s experience, measured in both its successes and pitfalls, can provide a rough blueprint of how to seek out and quash this “American murderer”—no matter where it is found around the world.

An Intimate Relationship

In the South, tiny enemies seem to be everywhere. Mosquitoes sneak bites, roaches creep into bedrooms, chiggers bore into tender skin around panty lines, and parasitic worms invade vulnerable guts. As a child growing up in Mississippi with a [Southern historian](#) mother who had a [fondness for hookworms](#), I became acquainted with those bloodsuckers at an early age. Hookworm was often an unappetizing topic of conversation around the dinner table, and knowledge of those parasites shaped Nuwer household conduct.

While all the neighborhood kids ran barefoot in the summer, for example, my mother did her best to intersect my sister and me as we bee-lined for the door, ready with pair of shoes and a warning: “You’ll get worms!” Our feet were not the only appendages she shielded from infection, however; fingernails underwent weekly clippings and cleanings to eliminate a potential conduit for eggs or larvae.

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The proof of the pudding is in the eating, however, so despite these precautions my mother also went directly to the source, inspecting our rears for tiny, slithery bodies and our stool for traces of movement. (For the record: my sister did contract pinworms on one occasion, but to the best of my knowledge, I enjoyed a worm-free childhood.)

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“Maybe I was a little more conscious of worms as a mother than a normal person,” my mom recently admitted. “But yes, I was real protective of the worm issues.”

My mother’s anti-worm antics might come across as a touch overzealous today, but as recently as the 1950s, hookworms were an intimate and ever-present threat for those living in the South. It was nearly impossible for the rural poor—the majority back then—to avoid hookworms.

Hookworms, like many other parasites, have a somewhat complex lifecycle, coming full circle in the human gut. There, a mated female lays up to 10,000 eggs per day, which are expelled into the environment via feces where they can come into contact with another hapless human victim.

Garland Brinkley, an associate professor of public health at Touro University in California, [argues](#) that hookworm disease worsened in the years following the Civil War, thanks to deteriorating conditions and economic setbacks, and that the rise of those parasites only served to slow recovery even further. Following the war, poverty and hookworms were even more closely linked. While wealthy and city-bred Southerners in the late 19th and early 20th century wore shoes and used bedpans, those of a more modest social standing often went barefoot and either used latrines or went in the woods. Many poor Southerners were also renters and did not have control over the land they lived on or the services provided there. “Your Mimi,” my mom often points out, “was raised without a toilet.”

“One quote from a landlord at the time was, ‘Just let them go in the bushes, like they’ve always done,’ ” says Margaret Humphreys, a professor of history of medicine at Duke University. “Just like today, landlords back then weren’t going to spend money on anything they didn’t have to.”

Free-ranging animals typically found on Southern farms spread the parasite-laden muck beyond the outhouse’s immediate vicinity, as did the South’s frequent torrential rains. The wriggling larvae that emerged from the eggs could remain in the soil or inch their way up blades of grass along morning dewdrops. When the larvae encountered the bare feet of a person attending to their business in the privy, or of a child playing near by, they quickly burrowed inside like a corkscrew, leaving behind an itchy sore called “ground itch” or “dew itch.”

Once inside the body, the larvae caught a ride in the victim’s bloodstream and entered into the lungs, which became irritated, triggering a dry cough. Up the windpipe the larvae went until they were swallowed back down the esophagus—finally on their way to their desired destination, the small intestine. There, they grew larger and could remain for up to five years, latched onto the gut’s soft lining with vampire-like fangs, leeching out blood.

An infection of about 100 worms meant the loss of a teaspoon of blood per day, though just 25 adult hookworms could cause iron deficiency in a child or pregnant woman. Chronic malnutrition and [pellagra](#) amplified the hookworms’ impact on many of their victims, whose diets could not support a daily depletion of iron. As the blues artist [Blind Blake sang](#) in 1929, “Hookworm in your body / And your food don’t do you no good.”

Only in the severest of cases, however, did hookworm-induced anemia actually kill victims. Instead, hookworms claimed lives indirectly by increasing the likelihood of mothers dying during childbirth or of a weakened host succumbing to diseases, from run-of-the-mill colds to more deadly maladies such as malaria or typhoid fever.

Hookworm disease’s most significant impact, however, was not in the death toll but in years of healthy life lost. Children were especially affected by hookworms, which would sometimes prevent girls from ever menstruating or boys from hitting their growth spurt. Because iron is critical for brain function, hookworm infection could also lead to irreversible cognitive and intellectual defects. A [1926 study](#) of Alabama school children found that the greater the number of worms that students harbored, the lower their IQ. As those authors wrote: “One has the impression that the [hookworm-infected] child is living in another, entirely separate world, and is only remotely in contact with the everyday world about him.”

“Neglected tropical diseases like hookworm not only occur in settings of poverty, but they also cause poverty,” says Peter Hotez, dean of the National School of Tropical Medicine at Baylor College of Medicine in Houston. “Hookworms were definitely a major factor in holding back progress in the American South.”

Exposing a Killer’s Identity

Hookworms aren’t endemic to the Americas, likely having arrived in the U.S. in the 17th century, unwittingly imported with the Atlantic slave trade. Until the early 20th century, however, most people in the U.S. did not know what a hookworm was, much less that millions of those parasites inhabited the guts of people throughout the South. Hookworm symptoms were written off as simply being indicative of Southerners’ backward character.

“You had an entire class of Southern society—including whites, blacks, and Native Americans—that was looked upon as shiftless, lazy good-for-nothings who can’t do a day’s work,” my mom explained to me. “Hookworms tainted the nation’s picture of what a Southerner looked and acted like.”

In 1902, Charles W. Stiles, a medical zoologist from New York, finally dragged the hookworm out of hiding. Stiles had been tasked by the Department of Agriculture to help farmers keep their animals healthy, but he became fascinated with solving the riddle of the South’s stunted, exhausted workers. He began collecting samples and soon identified the tiny culprit behind the workers’ debilities. “He was one of these people who becomes obsessed with something that few others acknowledge or recognize,” says John Ettlting, president of the State University of New York College at Plattsburgh and author of *The Germ of Laziness*. “He wouldn’t let it go.”

Stiles was convinced that ridding the South of hookworms would make the region more productive, but local doctors would not listen, dismissing him as arrogant or pointing out that his expertise was in animals, not people. “He was an interesting guy, but testy and hard to like,” Ettlting says. “He didn’t suffer fools.”

Word of Stiles and his discovery, however, soon reached John D. Rockefeller, who was actively looking for a certain type of philanthropy project. Hookworms fit the bill. “Rockefeller didn’t want to put money into things that would bring the American capital system into question, like income inequality,” Ettlting says. “Health, on the other hand, is not controversial: no one wants their kids growing up sick.”

Southerners, however, were not on board in the beginning. The idea of hookworms—parasites that live within the body and are contracted by direct contact with feces—was unseemly, and the South, unsurprisingly, wanted no association with such a disease. Indeed, some Southerners took the suggestion of hookworms as a personal affront, Ettlting says, demanding, “Where was the hookworm when it took three Yankees to take out one Rebel boy in the War?” Others proclaimed that Rockefeller was trying to further humiliate the South and that his money wasn’t wanted.

Nevertheless, the national press took up the story, calling hookworm the “germ of laziness” and writing that now the country finally had an explanation for why Southerners are so loath to work. “Of course, that did not play well in the South,” Ettlting says. “From the after effects of the Civil War, Southerners were already pretty touchy about this stuff.”

Road to Recovery

The South, however, was in dire need of support. Unlike in the North, Southern state public health agencies almost completely lacked funds or personnel. In 1909, Rockefeller donated \$1 million to create the [Rockefeller Sanitary Commission for the Eradication of Hookworm Disease](#), appointing Wickliffe Rose, a professor of philosophy in Nashville (and, crucially, a Southerner) to run the organization. Rose began an anti-hookworm propaganda campaign across the South and sent young doctors straight out of medical school to visit towns

throughout the region. “They were like itinerant evangelists riding across the South, carrying this medicine and message,” Ettlting says.

In the weeks prior to a doctor’s visit, Rose and his colleagues prepped the town with announcements and newspaper articles and also targeted children, who they realized could be an effective means of convincing parents to pay attention. They began an educational campaign in schools, where teachers collected stool samples from their pupils for testing. In his memoir, historian Thomas D. Clark [recalls such an experience](#), when the hookworm campaign reached his Mississippi town in 1912. “The *Winston County Journal* ran a bloodcurdling illustration of a greatly enlarged female hookworm that resembled a diamondback rattlesnake more than a worm,” he writes. “I became so frightened at the prospect [of being tested] that I was constipated for a week.” The entire student body of some rural, one-room schoolhouses turned up positive for hookworm infection—although Clark was relieved to learn that he was not one of them.

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Arriving on horseback with microscope in tow, the doctors set up makeshift clinics—sometimes in communities so isolated that the residents still spoke Elizabethan English. The townspeople often treated this as an event. People showed up with potato salad and fried chicken to make a day of it, and some asked if they could be married in the hookworm tent. All sat and listened to the doctor’s presentations about hookworms—usually carried out on a Saturday or Sunday so no one would have to miss work—and to his instructions about how to build a proper outhouse to avoid re-infection. “The doctors couldn’t give the townspeople indoor plumbing and running water, but they could teach them how to construct what they called sanitary privies,” Ettlting says. “And they couldn’t buy everyone shoes, but they could tell people to be careful about where they walk.”

Those who tested positive were sent home with Epsom salt and thymol—frequently their first encounter with pharmaceuticals—and strict instructions for how to take them. If combined with alcohol or taken all at once, the medications could be lethal. As Stiles wrote in a [1909 article](#) in the journal *Public Health Reports*: “The patient and the patient’s family should be carefully warned not to permit the patient under any circumstances to have on the Sunday during which the treatment is given any food or drink containing alcohol, fats or oil.” In one case, Stiles added, a patient suffered severe thymol poisoning after taking “a copious drink of milk” shortly after the medicine was administered. Later, that chemical was replaced by carbon tetrachloride—although that was hardly an improvement in terms of patient safety. “Carbon tetrachloride’s lethal stuff,” Ettlting says. “I used to use it to clean the keys of my typewriter.”

While the campaign was revolutionary in that it established the South’s first network of public health clinics, it lasted just five years and did not come close to eradicating hookworm. “The Rockefellers wanted to say, ‘We came, we saw, we conquered,’ but they didn’t,” Humphreys says. That doesn’t mean the campaign was a complete failure, however. It succeeded, Humphreys says, in that it “hit Southern communities over the head with the fact that, yes, they did have hookworm.”

Indeed, the battle against hookworms would rage on for decades. In 1942, for example, Humphrey’s grandfather arrived in east Tennessee to build a power plant and found the workers to be so weak from hookworm infection and malnutrition that they’d nearly fall over if they tried to push a wheelbarrow. He had to bring workers down from Pennsylvania to get the job done. Likewise, in 1947, “when a baseball commenter referred to Southern players as coming from the ‘Hookworm Belt,’ the phrase needed no explanation,” [Humphreys writes](#) in the journal *Neglected Diseases*.

By 1985, hookworm had all but disappeared in the South, thanks to a combination of factors: a rise in cheap but relatively healthy food, an increase in indoor plumbing, Franklin Roosevelt’s New Deal, a push toward

urbanization, the end of sharecropping following World War II, and the advent of agricultural mechanization. “The reason hookworm is not a scourge today is because people live in cities, wear shoes, eat better than they did 110 years ago, and have indoor plumbing,” Ettlign says. “Those factors, more than anything else, are responsible for the fact that hookworm is no longer a major problem in this country.”

Some, including Ettlign, Humphreys, and Hotez, still believe that holdout pockets of hookworm infection may still exist in the South today, most likely confined to the extreme poor, those based in the deep backwoods, or immigrant communities living in labor camps. By and large, however, hookworms have been driven out of this country.

But the South continues to lag behind the rest of the nation economically, with seven out of the 10 [poorest states in the U.S.](#) located there. And while stereotypes are fading, many outside of the region continue to look down on it. “When I told my family I was moving to Houston, it was like I was leaving for a leper community—they wanted to have a funeral for me,” Hotez says. “My in-laws certainly have perceptions about this being a backwards place, not realizing that some of the most sophisticated universities in the world are located in the South.”

How much credit, if any, hookworms can take for those lingering economic challenges and misconceptions, however, is nearly impossible to measure, although some have tried. Hoyt Bleakley, an associate professor of economics at the University of Michigan, used early to mid-20 th century census data and records from the Rockefeller Sanitary Commission to compare educational and economic gains in places where hookworm eradication did and did not take place. He found an increase in school attendance and literacy in relation to hookworm reduction and also discovered that those effects seemed to extend into adulthood, with better-educated children growing up to be higher-earning adults. This suggests, [Bleakley writes](#) , “that hookworm played a major role in the South’s lagging behind the rest of the country.”

“If you compare places in the South with the worst versus the least hookworm problem, you’re talking differences in income of maybe 25%,” he says. “There are lots of reasons why the South had a different developmental path than the rest of the country, and while disease is not the whole story, it was certainly part of it.”

Still on the Loose

In other parts of the world, hookworm disease is far from a fading memory. It occurs in any warm, humid place that has the right type of sandy, loamy soil and—most importantly—extreme poverty. An estimated 477 million people—including 44 million pregnant women—throughout South and Central America, Africa, and South and Southeast Asia carry hookworms today. Some of the highest rates of infection occur in Sierra Leone, Democratic Republic of Congo, Myanmar, Nigeria, Ethiopia, India, Venezuela, and Indonesia. But hookworm is also present in less obvious places, including China and Brazil, where the situation more closely resembles that found in the U.S. a century ago: part of the population lives in developed, modern cities, while the rest still struggles with rural poverty and suffers from the maladies that accompany it, including hookworm.

Hookworms, however, receive little attention, as countries, non-governmental organizations and researchers tend to home in on diseases such as malaria and HIV. As Hotez points out: “Everyone’s so focused on the 20,000 Ebola cases, but everyone in the Ebola-affected countries has hookworm and schistosomiasis.”

The prevalence of hookworm disease has declined globally by just 5% since 1990.

To raise awareness about hookworm disease’s true toll, Hotez and a colleague created a “worm index”—a measure of a country’s level of development compared to its parasitic worm burden (including hookworm and two other intestinal parasites, schistosomiasis and lymphatic filariasis). Focusing on the world’s 25 most populous nations, they compiled World Health Organization data of the number of school-aged children that

required deworming treatments compared to the country's human development index—a measure that takes into account factors such as life expectancy, per capita income and education. As [they recently reported](#) in the journal *PLoS Neglected Tropical Diseases*, the more infested a country is with parasitic worms, the lower its level of development. “It doesn't prove cause and effect, but it does go both ways: low development promotes worms, and worms promote low development,” Hotez says. “They reinforce each other.”

As the South's example shows, the solution is not as simple as handing out deworming pills to affected communities. Indeed, a treatment package Hotez helped to develop, which includes anti-hookworm medication, has already been deployed by USAID to more than 450 million people. Yet the prevalence of hookworm disease has declined globally by just 5% since 1990. The problem is that, although hookworms are easily purged from the body, reinfection quickly occurs if the sources of the problem—poverty and poor sanitation—are not addressed.

Lacking the ability to lift nations and communities out of poverty, however, Hotez and his colleagues are devising an alternative approach: [a hookworm vaccine](#). “The key question is what to do in countries without aggressive economic reforms in their near future,” Hotez says. “That's why we're developing this vaccine.”

The [recombinant protein-based vaccine](#) induces an antibody response to the blood-feeding apparatus of the worm. As the hookworm feeds, it takes up those lethal antibodies, which eventually kill it. Having proven the vaccine's efficacy in animal experiments, Hotez and his colleagues have moved on to tests with humans. In Washington, D.C., they are giving volunteers different doses of vaccine and then infecting them with hookworms to see how they fare. In addition to those tests, phase I clinical trials are also underway in Brazil and Gabon, where researchers are vaccinating volunteers and comparing rates of infection to others who received an unrelated vaccine, such as hepatitis B. If the vaccine is successful and the researchers can find a way to cheaply produce and distribute it, it could spare millions from the germ of laziness.

“The fact that hookworm is still such a major global health threat is something that people largely don't know,” Hotez says. “It's time to realize that anemia caused by hookworms and other intestinal worms is an important but unrecognized part of the story of global health.”

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