MEDICAL DISPATCH

THE MOP-UP

Eradicating polio from the planet, one child at a time.

BY ATUL GAWANDE

The index case was an eleven-month-old boy with thick black hair his mother liked to comb forward so that the bangs rimmed his round face. His family lives in the southern Indian state of Karnataka, in a village called Upparahalla, along the Tungabhadra River. Dry mountains of teetering rocks can be seen in three directions from the village. It has no running water and little electricity. The boy's mother is illiterate; the father can read only road signs. They are farm laborers, and they live with their three children in a single-room hut of thatch and mud. But the children are well nourished. The mother wears gold and silver earrings. Once in a while, they travel.

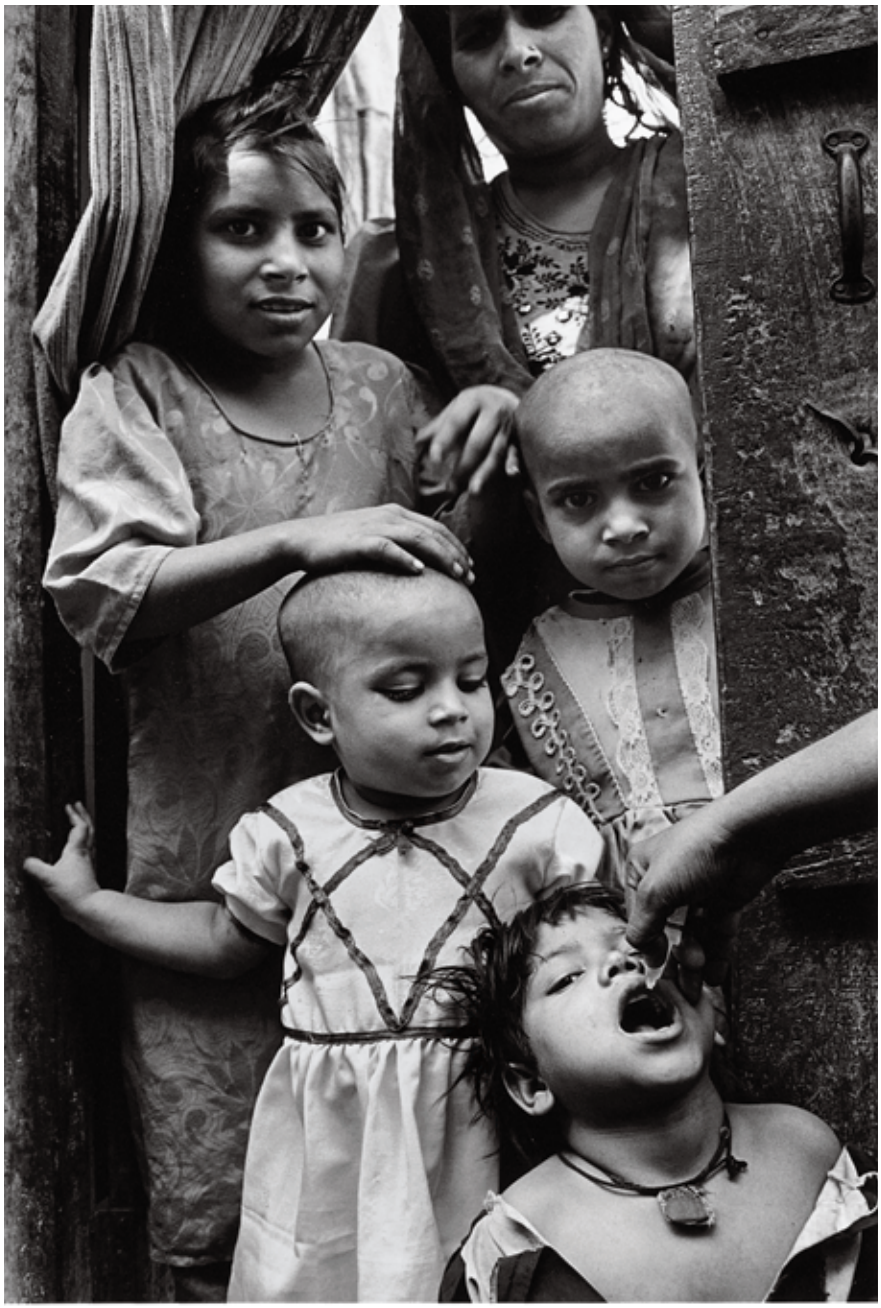
In April last year, the family took a trip north to see relatives. Shortly after they returned, on May 1st, the boy developed high fevers and racking bouts of nausea and vomiting. His parents took him to a nearby clinic, where a doctor gave him an antibiotic injection. Two days later, the fevers subsided, but he became unable to move either of his legs. In a panic, the parents took him back to the doctor, who sent him to the district hospital in Bellary, about forty miles away. As the day progressed, the weakness spread through the boy's body. His breathing grew shallow and labored. He lay flat and motionless in his hospital cot.

A doctor at the hospital, following standard procedure in cases of sudden childhood paralysis, phoned a surveillance medical officer with the World Health Organization in Bangalore, the capital of Karnataka. The medical officer made sure that proper cultures were taken and sent to a national laboratory in Mumbai. On June 24th, the laboratory results came back. A young technical officer with the W.H.O. in New Delhi got the call; it was a confirmed case of polio, a disease thought to have been eliminated from southern India, and it set off an alarm.

The World Health Organization is in the sixteenth year of a campaign to eradicate polio from the world. If the campaign succeeds, it may be mankind's single most ambitious accomplishment. International organizations are fond of grand-sounding pledges to rid the planet of this or that menace. Such pledges make the organizations feel that they are doing something important. But they nearly always fail. The world is too vast and too various to submit to dictates from on high.

A handful of serious attempts have been made to eliminate individual diseases from the world. In 1909, the newly established Rockefeller Foundation launched the first global eradication campaign, an effort to end hookworm disease, using anti-helminthic drugs, in fifty-two countries. It didn't work. Today, a billion people—a sixth of the world's population—are infected with hookworm, an intestinal parasite that feeds on human blood. A seventeen-year campaign against yellow fever, led by the Rockefeller Foundation and the United States armed services, had to be abandoned in 1932 when yellow fever was found to have a reservoir outside human beings. (The yellow-fever virus persists in mosquitoes' eggs.) In 1955, the W.H.O. and UNICEF began a campaign to end yaws, an infectious disease causing painful, purulent skin ulcers; workers screened a hundred and sixty million people in sixty-one countries for the disease, and treated every case they found with penicillin. A dozen years later, the campaign was dropped when it turned out that silent, subclinical infections were continuing to propagate the disease. Billions of dollars were spent in the fifties and sixties to eradicate malaria; today the disease afflicts more than three hundred million people a year.

In the course of a century, the only successful attempt at disease eradication has been the battle against smallpox—a mammoth undertaking that was, however, decidedly simpler than the campaign against polio. Smallpox, with its distinctive blisters and vesicles, could be easily



It may cost $200 million to stop the very last case. Photograph by Sebastião Salgado.

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and quickly identified; the moment a case appeared, a team could be dispatched to immunize everyone the victim might have come into contact with. That strategy, known as "ring immunization," eradicated the disease by 1979. Polio infections are far harder to identify. For every person who is paralyzed, between two hundred and a thousand infected people come down with little more than a stomach flu—and they remain silently contagious for several weeks after the symptoms abate. Nor is every case of childhood paralysis polio; and it usually takes a couple of weeks for stool specimens to be obtained, delivered to a laboratory, and properly tested. By the time one case has been identified, scores more people have been infected. As a result, the area targeted for polio immunization must be far larger than that for smallpox. And, whereas people needed to be vaccinated against smallpox only once for immediate protection, a single dose of polio vaccine does not always take—children with diarrheal illnesses tend to pass the vaccine straight through—and so a repeat round of immunization is required within four to six weeks. In logistical terms, it's the difference between extinguishing a candle flame and putting out a forest fire.

Despite all these obstacles, the campaign against polio has made immense progress. In 1988, more than three hundred and fifty thousand people developed paralytic polio, and at least seventy million were infected with the virus. In 2002, only 1,919 cases were identified. The whole of the Americas, Europe, and the western Pacific, along with nearly all of Africa and Asia, are currently free of the disease.

India is the one country where polio infections have substantially increased in recent years, from a low of two hundred and sixty-eight in 2001 to sixteen hundred in 2002, when it accounted for four-fifths of the world's remaining cases. With its vast population, areas of severe poverty, and varied cultures and geography, it is the place where the campaign against polio is at greatest risk of failure. The outbreak in 2002 was a serious setback, but it was at least confined to a handful of northern states. Now a boy in south India had the disease—Karnataka's first case in almost three years—and if it wasn't checked there it would blaze across the country all over again.

On June 25th, less than twenty-four hours after the report of the Karnataka polio case came in, Sunil Bahl, a W.H.O. physician and technical officer in the Delhi office, sent an e-mail to key people at the W.H.O., at UNICEF, and in the Indian government. It was his job to provide the initial assessment of the facts on the ground. "The case is in an area that has a history of being the worst in Karnataka," he wrote; it had the most polio cases in the early years of the campaign, and poor routines of immunization. "Risk of establishment of virus in the area high, unless quick wide and strong measures in the form of a wide mop-up are taken." A "mop-up" is W.H.O. lingo for a targeted campaign to immunize all susceptible children surrounding a new case. It's what is done in an area that has been rendered polio-free but is facing a new infection that threatens to bring the disease back. The campaigns are highly targeted, and are carried out rapidly, in just three days, to insure that children are not missed and to make it easier to recruit volunteers.

Sunil Bahl sent around a map of the proposed area for the mop-up operation, an area covering fifty thousand square miles. Working around the summer holidays and festivals, government officials selected July 27th for the start of

the first immunization round. The second round would follow a month later. Brian Wheeler, a thirty-five-year-old Texan who is the chief operations officer for the W.H.O.'s polio program in India, explained the logistics to me. The Indian government would have to recruit and organize teams of medical workers and volunteers, he said. They would have to be trained in how to administer the vaccine, and provided with transportation, vaccine, and insulated coolers and ice packs to keep the vaccine cold. And they would have to fan out and vaccinate every child under five years of age. Anything less than ninety-percent coverage of the target population would be considered a failure.

I asked him how many people that would involve.

He checked his budget sheet. The plan, he said, was to employ thirty-seven thousand vaccinators and four thousand health-care supervisors, rent two thousand vehicles, supply more than eighteen thousand insulated vaccine carriers, and have the workers go door to door to vaccinate 4.2 million children. In three days.

Polio is caused by an intestinal virus; the virus must be ingested to bring about an infection. Once inside the gut, it passes through the lining and takes up residence in nearby lymph nodes. There it multiplies, produces fevers and stomach upset, and passes back into the feces. Those infected can contaminate their clothing, bathing sites, even supplies of drinking water, and thereby spread the disease. (The virus can survive as long as sixty days outside the body.)

Poliovirus infects only a few kinds of nerve cells, but what it infects it destroys. In the most dreaded cases, the virus spreads from the bloodstream into the neurons of the brain stem, the cells that allow you to breathe and swallow. To stay alive, a person has to be fed through a tube and ventilated by machine. The nerve cells most commonly attacked, though, are the anterior horn cells of the spinal cord, which control the arms, the legs, and the abdominal muscles. Often, so many neurons are destroyed that muscle function is eliminated altogether. Tendon reflexes disappear. Limbs hang limp and useless.

The first effective vaccine for polio was introduced in 1955, after the largest clinical trial in history. (Jonas Salk's vaccine, made from killed poliovirus, was given to four hundred and forty thousand children; two hundred and ten thousand received a placebo injection, and more than a million served as unvaccinated controls.) Five years later, Albert Sabin published the results of an alternative polio vaccine he had used in an immunization campaign in Toluca, Mexico, a city of a hundred thousand people, where a polio outbreak was in progress. His was an oral vaccine, easier to administer than Salk's injected one. It was also a live vaccine, containing weakened but intact poliovirus, and so it could produce not only immunity but also a mild contagious infection that would spread the immunity to others. In just four days, Sabin's team managed to vaccinate more than eighty per cent of the children under the age of eleven—twenty-six thousand children in all. It was a blitzkrieg assault. Within weeks, polio had disappeared from the city.

This approach, Sabin argued, could be used to eliminate polio from entire countries, even the world. Curiously, the only person in the West who took him up on the idea was Fidel Castro. In 1962, Castro's Committee for the Defense of the Revolution organized 82,366 local committees to carry out a succession of week-long, house-to-house national immunization campaigns using the Sabin vaccine. In 1963, only one case of polio occurred in Cuba.

Despite those results, Sabin's grand idea did not catch on until 1985, when the Pan American Health Organization launched an initiative to eradicate polio from the Americas. (Six years later, Luis Fermin Tenorio, a two-year-old boy in the town of Pichinaki, Peru, became the last polio victim in the Americas.) In 1988, spurred by the campaign's growing success, the W.H.O. committed itself to eradicating polio from the world. That year, Rotary International pledged a quarter of a billion dollars for the effort (it has since provided three hundred and fifty million dollars more). UNICEF agreed to organize the worldwide production and distribution of vaccine. And the United States made the campaign one of the C.D.C.'s core initiatives, supplying both expertise and considerable additional funding.

The centerpiece of the effort has been what are called national immunization days—three-day periods when all children under five in a country are immunized, regardless of whether they have received immunization before. In one week in 1997, two hundred and fifty million children were vaccinated simultaneously in China, India, Bhutan, Pakistan, Bangladesh, Thailand, Vietnam, and Burma. In each of the past three years, national immunization days have reached more than half a billion children—almost a tenth of the world's population. Through such efforts—and a reliable network of monitors to detect outbreaks—the W.H.O. campaign has brought the

incidence of polio in the world to less than one per cent of what it used to be.

The striking thing is that the W.H.O. doesn't really have the authority to do any of this. It can't tell governments what to do. It hires no vaccinators, distributes no vaccine. It is a small Geneva bureaucracy run by several hundred international delegates whose annual votes tell the organization what to do but not how to do it. In India, a nation of a billion people, the W.H.O. employs two hundred and fifty physicians around the country to work full time on polio surveillance. The only substantial resource that the W.H.O. has cultivated is information and expertise. I didn't understand how this could suffice. Then I went to Karnataka.

For the three days of the mop-up, I travelled through Karnataka with Pankaj Bhatnagar, a W.H.O. pediatrician, whose job was to see that the operation was properly executed. He is in his forties, with a slight paunch and an easy, genial manner. This can be a tricky business, he explained as we waited in Delhi for our flight to Karnataka. The W.H.O. provides much of the money for mop-up operations. UNICEF provides the vaccines. Rotary of India prints the banners and advocates locally for the cause. But the operation itself is run by government health officials: they are the ones who must hire the thousands of vaccinators, train them properly, and send them from house to house.

We took a plane to Bangalore, then travelled eight hours overnight by train to Bellary, a crowded, dusty town that is the district seat for Upparahalla. At a small, strange hotel there (it had a safari theme), Pankaj convened the members of his team over breakfast. To monitor the immunization of four million children, he had just four people: three young medical officers and himself. They were the only ones available who spoke Kanada, the local language. The medical officers finished their breakfast of *idli* and *dosa,* and lit up cigarettes (in India, it seems, half the doctors who work in public health smoke), and then Pankaj asked for a status report.

Since the index case was identified, he was told, four more cases of confirmed polio had appeared in the region, and four "hot" cases were awaiting confirmatory testing. Of the thirteen districts targeted for mop-ups, Bellary accounted for all but one of the cases.

"Then we must concentrate our monitoring in this district," Pankaj said. "This is now the place with the most intense transmission of polio in the world." Another doctor pulled out some figures on the area. Bellary district, he told Pankaj, has a population of 2,965,459, with five hundred and forty-two villages and nine urban towns. Fifty-two per cent of the males and seventy-four per cent of the females are illiterate. There are just ninety-nine doctors in the public-health system. He turned to a map. The polio cases, he said, were clustered in a triangle of villages around Siriguppa, a small, slum-ridden town about forty miles away.

Pankaj made his assignments. For the mop-up, he would cover at least Upparahalla; a village called Sirigere, where polio had appeared; the two urban areas with hot cases; and a mine in Chitradurga, where vaccinators might have particular difficulties gaining entry, because the housing was on the property of a private company. He divided the others among the remaining villages and asked them to follow up behind him for a second check in Upparahalla and the urban areas. The group then split up. By eight-thirty in the morning, Pankaj and I were on the road.

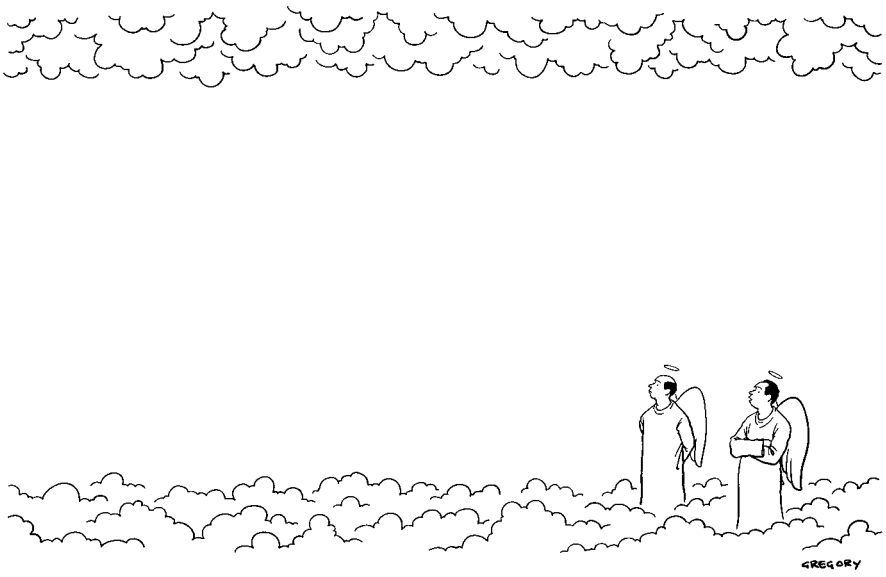
We had a rented four-wheel-drive Toyota and a betel-nut-chewing driver who waited until we were an hour down a pitted road to tell us that the battery was dead. Whenever the engine was turned off, he said, we'd need to push-start the car. Pankaj thought this was funny.

The terrain outside the windows was baked by the hot sun, and the hills were desert-lizard brown. The monsoon had failed to come this year. Only the few fields that had drip irrigation looked green. It took us about two hours to travel the thirty-five miles to Sirigere, a village of mud-walled huts jammed up against one another. There was garbage in the alleyways, and dusty-faced children were playing everywhere. Pankaj had the driver stop at a group of dwellings seemingly at random. Marked in chalk on each door was a number, a "P," and that day's date. The number was the house number. The "P" meant that the vaccinators had come, identified all the children under the age of five who lived in the house, and vaccinated them—that very day, according to the date marked. Pankaj took out a pad of paper and strode over to one of the huts. He asked the young woman at the door how many children lived there. One, she said. He asked to see the child. When she found him, Pankaj took his hand and noted the black ink mark on the nail bed of his little finger—it's how the vaccinators tag the children who have received polio drops. Was any other child in the fields? Away at a relative's? No, she said. He asked if her boy had received routine immunizations before today. No, she said. Had she heard about the polio case in town? She had. Had she heard about the vaccination team before the workers arrived at the door? She had not. He thanked her and wrote all the information down on a form before moving on.

So far, the workers had done their job, Pankaj said, several houses later. But he was disturbed that no one knew the vaccinators were coming that day. In addition to banners (we'd seen a couple hanging as we came into the village), they were supposed to use "miking" to reach the illiterate—auto-rickshaws with loudspeakers playing tapes announcing the upcoming campaign. Without that warning, some people would turn the vaccinators away.

Going around to a few more huts, we bumped into a vaccination team—a social-welfare worker wearing sandals, a blue sari, and a flower in her hair, and a younger, college-student volunteer with a flower in her hair, too, and a square blue cold box of vaccine slung over her shoulder. They were standing in front of a hut they'd marked with an "X" instead of a "P"—the woman of the house had said that three children lived there, but one was absent and could not be vaccinated. Pankaj asked the vaccinators to open their cold box. He checked the freezer packs inside—still frozen, despite the heat. He inspected the individual vaccine vials—still fresh. There was a gray-and-white target sign on each vial. Did they know what it meant? That the vaccine was still good, they said. What does it look like when the vaccine expires? The white inside the target turns gray or black, they said. Right answer. Pankaj moved on.

We went to the home of the village's recent polio case. The girl was eighteen months old and silent. The mother, pregnant and with a three-year-old boy clinging to her side, laid her down on her



"That's where the celebrities are."

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back so that we could examine her. Neither leg would move. Lifting each one, I felt no resistance in the child's hips, her knees, her ankles. Only four weeks had passed since she was stricken. She almost certainly was still contagious.

Pankaj found three children visiting the house. He checked each of their hands. None had received polio drops yet.

We gave the four-wheel-drive a push and made our way to Sirigere's primary health center, a few miles outside the village. It was a drab, unpainted, three-room concrete building. The center's medical officer met us at the door. About forty years old, with ironed slacks, a buttoned short-sleeve shirt, and the only college education in the area, he seemed eager to have our company. He offered tea and tried to make some small talk. But Pankaj was all business. "May I see your microplan?" he asked before we had even sat down. He was referring to the block-by-block plan drawn up by each local officer. It is the key to how the operation is organized.

The medical officer's microplan was a sheaf of ragged paper, with marker-drawn maps and pencilled-in tables. The first page said that he had recruited twenty-two teams of two vaccinators each to cover a population of 34,144 people. "How do you know this population estimate is right?" Pankaj asked. The officer replied that he'd done a house-to-house survey. Pankaj looked at the map—the villages in the area were spread out over more than ten miles. "How do you distribute the vaccine to the vaccinators who are far away?" By vehicle, the officer said. "How many vehicles do you have?" Two, he said. "What are the vehicles?" One was an ambulance. The other was a rented car. "And how does the supervisor get out to the field?" There was a pause. The officer shuffled through the microplan. More silence. He did not know.

Pankaj went on. Twenty-two teams would require about a hundred ice packs per day. "Why did you budget for only a hundred and fifty ice packs?" We are freezing them overnight for the next day, the officer explained. "Where?" He showed Pankaj his deep freezer. Pankaj opened it up and pulled out the thermometer, which revealed that the temperature was above freezing. The electricity goes out, the officer explained. "What is your plan for that?" He had a generator. But when pressed to show it he was forced to admit that it wasn't really working, either.

Pankaj is not a physically imposing man. He has a boyish mop of thick black hair, parted almost down the center, and sometimes it sticks up. He has programmed his cell phone to play the James Bond theme when it rings. When we're driving, he points out the monkeys we pass. He makes jokes. He laughs with his head tilted back. But in the field his demeanor is grave and taciturn. He doesn't tell people if their answers are good or bad. He keeps everyone on edge. I had an impulse to tell the medical officer that he was doing fine. But Pankaj seemed to make a point of saying nothing to fill the silences.

Later, in Siriguppa, where two of the hot cases had appeared, we walked the neighborhoods with another medical officer. Siriguppa is a dense, urbanized town of windowless concrete-block tenements, rusting corrugated-metal leantos, and some forty-three thousand people. We had to fight our way through narrow streets crowded with water buffalo, motorcycles, braying goats, and fruit sellers. There was electricity here, I noticed, running through wires that drooped from tilting utility poles, which were scattered around like crooked teeth, and the sound of televisions poured out from some of the houses we visited.

The two hot cases, we found, were in a small Muslim enclave that had sprouted up a few months earlier. Going door to door, Pankaj learned that almost none of the enclave's children had received routine immunizations. Some of the families seemed suspicious of us, answering questions tersely or trying to avoid us altogether. We found one boy whom the vaccinators had missed. The previous year, rumors had circulated widely among Muslims that the Indian government was giving different drops to their male children in order to make them infertile. The rumors were thought to have been quashed by an education campaign and greater Muslim involvement in the immunization program. But one had to wonder.

Walking with a local doctor and a vaccination team through a village called Balkundi, we came to the home of a small, pretty woman, who had rings on her toes and a baby held loosely on her hip. Another child, a boy of about three, stood nearby, staring at our little crowd. Neither child had been vaccinated, so Pankaj asked if we could give them the polio drops. No, she said. She did not appear angry or afraid. Pankaj asked if she knew that a case of polio had appeared in her neighborhood. Yes, she said. But she still didn't want the drops given. Why? She would not say. Pankaj said O.K., thanked her for her time, and moved on to the next house.

"That's it?" I asked.

"Yes," he said.

The local doctor had stayed behind, however, and when we looked back he was shouting at the mother: "Are you stupid? Your children will become paralyzed. They will die."

It was the one time I saw Pankaj angry. He walked back and confronted the doctor. "Why are you shouting?" Pankaj demanded. "Before, she was listening, at least. But now? She's not going to listen anymore."

"She is illiterate!" the doctor shot back, embarrassed to be rebuked so openly. "She doesn't know what is right for her child!"

"What does that matter?" Pankaj replied. "Your shouting doesn't help anything. And neither does a story going around that we are forcing drops on people."

So far, few were refusing the drops, and that was good enough, he told me later. A single nasty rumor could destroy the whole operation.

One difficult question came up repeatedly—from local doctors, from villagers, from workers trudging house to house. The question was: Why? Why this huge polio campaign when what we need is—fill in the blank here—clean water (diarrheal illness kills five hundred thousand Indian children per year), better nutrition (half of children under three have stunted growth), working septic systems (which would help prevent polio as well as other diseases), irrigation (so a single rainless season would not impoverish farming families)? We saw neighborhoods that had had outbreaks of malaria, tuberculosis, cholera. But no one important had come to visit in years. Now one case of polio occurs and the infantry marches in?

There are some stock answers. We can do it all, goes one. We can eradicate polio and do better on the other fronts. In reality, though, choices are made. For that whole week, for instance, doctors in northern Karnataka had all but shut down their primary health clinics in order to carry out the polio-vaccination work.

Pankaj relies on a somewhat more persuasive line of argument: that ending polio is, in fact, worth diverting resources for. In one village, I watched a resident demand to know why the government and the W.H.O. weren't combating malnutrition there instead. There was only so much they could do, Pankaj said. "And, if you're starving, becoming paralyzed certainly isn't going to help."

Still, you could make the same claim for almost any human problem that you decide to tackle—blindness or cancer or, for that matter, kidney stones. ("If you're starving, kidney pain certainly isn't going to help.") So far in the sixteen-year polio campaign, an estimated five million cases of paralytic polio have been averted, and that is an extraordinary achievement. But the campaign has already cost three billion dollars, more than six hundred dollars a case. To put that in perspective, the Indian government's total budget for health care came to four dollars per person last year.

Even if the campaign succeeds in the eradication of polio, it is entirely possible that more lives would be saved in the future if the money were spent on, say, building proper sewage systems or improving basic health services. What's more, success is by no means assured. The W.H.O. has had to extend its target date for eradication from 2000 to 2002, and then to 2005. In these final years of the campaign, more and more money is spent chasing the few hundred cases that keep popping up. A certain weariness settles in. Around twenty-four million children are born in India each year, creating a new pool of potential polio victims the size of Venezuela's entire population. Just to stay caught up, a mammoth campaign to immunize every child under the age of five has been planned for this month. Stopping the very last case of polio, one official told me, might cost as much as two hundred million dollars. The truth is, no cost-benefit calculus will tell us whether all that money is well spent.

There is, nonetheless, a kind of greatness in the elimination of a terrible disease. We as a civilization have few things we can accomplish of genuinely lasting significance for mankind: we have built no pyramids, no Great Walls to stand for thousands of years. It is, instead, through medicine that we may create our enduring monument. The eradication of smallpox and now, perhaps, polio will stand as our pyramids.

But this means we must actually get down to that final polio case. Otherwise, the efforts of the hundreds of thousands of volunteers, the billions spent will have amounted to nothing, and perhaps worse than nothing. To fail at this venture would put into question the very ideal of eradication.

Beneath the ideal is the gruellingly unglamorous and uncertain work. But there is a system, and it has eradicated polio in countries with far worse conditions than I was seeing in India—for example, in Bangladesh, in Vietnam, in

"I don't like hearing happy stories."

Rwanda, in Zimbabwe. Polio was eradicated from Angola in the midst of a civil war. An outbreak in Kandahar in 2002 was halted by a W.H.O.-led mop-up operation despite the Afghan war. New mop-ups are now under way in northern Nigeria, where an outbreak recently appeared and spread into neighboring countries. In India, Pankaj told me, there have been campaigns on camels in the Thar Desert of Rajasthan, in jeeps among the tribal communities of the Jharkhand forests, on power boats through flooded regions of Assam and Meghalaya, on Navy cruisers travelling to remote islands in the Bay of Bengal. We covered about a thousand miles in our Toyota in the three days of going town to town. Outside the village of Balkundi, we came upon several makeshift shanties for migrant laborers, about four miles apart and not on any maps. When we checked the children, though, they all had the vaccinators' ink marks on their pinkies. At Chitradurga, we found the mines in decay, but state officials had made sure that the company gave the vaccinators access to the workers' compound. With some searching, we discovered a few children here and there. Every one of them had received the vaccine, too.

By the end of the mop-up, UNICEF officials had bought more than five million doses of fresh vaccine and distributed them through the thirteen districts. They had blanketed television, radio, and local newspapers with public-service announcements. Rotary of India had printed and delivered twenty-five thousand banners, sixty thousand posters, and more than six hundred and fifty thousand handbills. And four million of the targeted 4.2 million children had been vaccinated.

India has had just thirty-six cases of polio in the past three months because of such efforts. There have been almost no cases during that time in northern India, a region that had more than a thousand cases in 2002. Pankaj and his colleagues believe that they're finally close to their goal of eradication. And as India goes, so, we can expect, will the world.

Pankaj says that he has seen more than a thousand cases of polio in his career as a pediatrician. When we drove through the villages and towns, he could pick out polio victims at a glance. They were everywhere, I began to realize: the beggar with two emaciated legs folded under him, rolling by on a wooden cart; the man dragging his leg like a club down the street; the passerby with a contracted arm tucked against his side.

On the second day of the mop-up, we visited Upparahalla, the village where the Karnataka outbreak had started. The first, index case of polio was now a fourteen-month-old boy with a healthy, almost muscular thickness about his upper body; after the first few days of his infection, his breathing had returned to normal. But when his mother put him down on his stomach you could see that his legs were withered. With the exercises the nurses had taught her to do with him, he had regained enough movement in his left leg to be able to crawl, but his right leg dragged limply behind him.

Making our way around the open sewage, the mud-covered pigs, the cows resting curled up like cats with their heads on their hooves, we found the neighbor girl who had come down with polio after the boy. She was eighteen months old, with a big worried face, perfect white teeth, and short spiky hair. She was wearing small gold earrings and a yellow-and-brown checked dress. She squirmed in her mother's arms, but her legs only dangled beneath her dress. Her mother wore an impassive expression as she stood before us in the sun, holding her paralyzed child. Pankaj gently asked her if the girl had had polio drops before—perhaps she'd received the vaccine but it had not taken. The mother said that a health worker had come around with polio drops a few weeks before her daughter became sick. But she had heard from other villagers that children were getting fevers from the drops. So she refused the vaccination. A look of profound sadness now swept over her. She had not understood, she said, staring down at the ground.

Eventually, Pankaj continued onward, checking on the vaccinators going door to door. Then, when he was finished, we left. The road heading out of the village was a red dirt track and we rattled over it with our wheels in the ruts that the bullock carts had made.

"What will you do when polio is finally gone?" I asked Pankaj.

"Well, there is always measles," he said. ♦