Public Health Chronicles

In breathless prose now uncommon in most scientific journals, a public health pioneer shares his extraordinary experiences in 1950s Nepal. George Moore, a U.S. Public Health Service physician, spent the early part of that decade in the mountains of Nepal, delivering a variety of personal and public health services to local populations living thousands of feet above sea level, in conditions resembling, according to Moore, the 16th century. In an area virtually devoid of services and where the average age at death was 35, Moore organized a system of personal health care, including cataract surgery, treatment for infections, and maternal and child health services. Traveling on elephants through tall weeds, he battled epidemics of malaria through the use of DDT and other insecticides.

In this intimate portrait of life in rural Nepal, Moore provides us with more than the dry statistics that sometimes drain the life out of important articles. Rather, he imbues us with the urgency, morality, and passion of his mission to serve the people. Whatever qualms we may have today about the nearly unrestricted use of DDT, or the sometimes paternalistic nature of the care provided, we learn through this essay that being a public health officer in the 1950s was more than a job—it was a calling.

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SILVER BIRD: HOW THE DC-3 CONTRIBUTED TO PUBLIC HEALTH IN 1950s NEPAL

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In 1951, Nepal opened its borders to the outside world for the first time in more than 100 years. Since 1846, the Rana Maharajas had kept a tight reign over Nepal, keeping it isolated from external influences. When the Maharaja was deposed, King Tribhuvan, who had escaped to India for asylum, was restored to the throne and sought international assistance to improve the social and health conditions of the Nepalese people. I was a commissioned medical officer of the U.S. Public Health Service and was appointed head of the Public Health Mission in Nepal, a program coordinated by the U.S. State Department's Technical Cooperation Administration. My mission was to assess public health problems and implement programs to solve them, including the rampant insect-borne diseases.

When my family and I arrived in Delhi, India, in September of 1952, our travel on comfortable Pan-American planes came to an end. We anticipated that traveling into and around Nepal would be difficult. There were no roads into the country, and the few vehicles in the Kathmandu Valley had not been driven

there, but carried by porters over the mountain passes. Elephants or horses were options in some areas of the country. Trains could carry us close to the Indian-Nepalese border, but from there we were told our best option would be to hike to Kathmandu. This option, even with a contingent of porters, would be difficult for my wife, Connie, and our 4-year-old daughter, Barbara. We also had more than 300 pounds of luggage and medical supplies to transport into the country.

During the final briefing for my mission at the American Embassy in Delhi, I learned that the restored king of Nepal had just acquired three surplus DC-3s and was in the process of developing an air service between various spots in India and an airstrip of sorts in Kathmandu. The new airline was called Himalayan Aviation and was being organized by a Polish pilot who had flown for the Royal Air Force (RAF) during World War II (WWII). He spoke confidently of his planes and the other RAF officers employed to pilot them, and we gladly accepted his offer to fly us to Kathmandu. I had heard about the DC-3s' legendary adaptability to fly and land in adverse circumstances, and my experiences as a copilot and passenger over the next two years working in Nepal confirmed it.

The first Douglas DC-3 flew in 1935. By the end of 1944, nearly 11,000 had been built. It was the first plane to incorporate retractable landing gear, wing flaps, variable pitch propellers, stressed-skin structure, and flush riveting with 500,000 rivets. It had two cowled

900-horsepower radial engines and could fly at 23,000 feet. The plane carried 21 passengers at a cruising speed of 207 miles per hour. Its maximum range was about 2,000 miles. According to reports from the field, the cantilevered wings were so strong that steamrollers driven over them would not damage them. Douglas built them for the war effort, and President Eisenhower declared that the DC-3 was among the equipment “most vital for success.” Many of these planes were used in WWII in the Burma theater, and the surplus planes were later made available for sale.

On October 21, 1952, both apprehensive and relieved to be flying, instead of walking, to Nepal, we made our first trip on a DC-3. The pilot was an RAF-trained Sikh. The engine rumbled as we ascended with erratic lurches and bumps up into a clear sky. We made stops at Benares, Lucknow, and then Patna, where the pilot worked on some engine problems. Even in India, some airports were primitive, and in the Patna airport we waited for hours in a sweltering hut plagued by hornets, not daring to eat the food or drink the water. When we finally boarded for the remaining 140 miles to Kathmandu, it was with relief. We soon

found ourselves flying over Nepal’s Terai, fertile plains that I knew were ripe with malaria, and then onward into the rugged mountain ranges. The plane dipped and bumped among the peaks, skimming the tops of some mountains by about 100 feet. We could see the snowy peak of Mt. Everest in the distance. As we flew over Kathmandu Valley, the patterned green and brown steppes used for farming gave way to a mottled gray terrain dotted with temples and pagodas.

We circled over Kathmandu and I spotted the “airstrip.” It was nothing more than a small patch of dirt located precariously near the edge of a cliff. The pilot skimmed the last hill and dropped sharply to the runway. The plane landed with a screechy, abrupt jolt, about 50 feet from the edge. There was no control tower and no radio service. The few pilots who ventured to Kathmandu landed and took off using their own judgment. Soon, the unfenced field was throbbing with curious people who surrounded the plane, wanting to fondle the “big bird” for good luck. Many had never seen a plane up close and wondered if it had feathers. A few boys scurried to help us collect our baggage.

We soon learned firsthand that Nepal was a rugged

Kathmandu, Nepal, Airport, 1953. A DC-3 Dr. Moore used for his medical mission in Nepal in the early 1950s.

Himalaya Mountains, Nepal, 1953. The DC-3s flew through these ridges at 12,000 to 14,000 feet elevation. There were not too many to places to land, if necessary, where the mountains were steep.

country whose people struggled in a medieval-like existence without education, technological advancement, or awareness of the rest of the world. Several fellow Americans, the agriculturalists on our team, had arrived earlier and were on hand to greet us and take us to our accommodations when we arrived. As there were no hotels, my team and I leased part of a rundown palace from the deposed maharajah's Wife Number Nine, who lived in one section of the palace with her daughters. On the other side of the palace, we were able to convert the large, dirty rooms empty of furnishings into makeshift apartments and a clinic. We drew water from the fishpond, filtered sharp mica crystals from it, and boiled the water on a kerosene stove to make it safe for drinking. We hired two Nepalese boys to help with cleaning, cooking, and collecting wood for the fireplace in the kitchen. After we were relatively settled, I began to survey the country to assess the health condition of the Nepalese people. In addition to hiking and riding elephants, I again depended on DC-3s for transportation to some areas of Nepal as well as to India.

SUPPLIES FROM CALCUTTA

I made arrangements to fly to Calcutta for supplies. I had recruited a couple of eager young Nepalese men to train in malaria control but, of course, no medical supplies whatsoever were available in Kathmandu. We also had not received any of the items I had requested from Washington, D.C. I hoped to purchase a microscope, Bunsen burners, glassware, scales, a kerosene-operated refrigerator, a centrifuge, and other items necessary for a small laboratory.

I boarded the DC-3 as the only passenger. The Sikh who piloted the plane was a familiar face and invited me to sit beside him as the copilot while he entertained me with his stories as a fighter pilot. He maintained an altitude of only 12,000 feet, but knew his way around the peaks and through the narrow passes of the mountains. Often it seemed our wings brushed rather close to the trees as we weaved from valley to valley. I had heard that a DC-3 could fly on one engine, if necessary, and asked him if this was possible. Smiling, he pulled the throttle on one engine. The propeller came to a stop. I was a bit shaken but

could feel that the plane was in control. I looked at the pilot, expecting him to start the engine again. He reached again for the throttle but *turned off* the other engine. We were now gliding without power and of course losing altitude. I thought that we might be in trouble, but my friend was still smiling. At a critical moment, he expertly switched on both engines and we roared back toward the sky. My question had been answered, but I vowed never to ask the same question again to any other pilot.

We stopped briefly in Patna, India, and when we took off for the remaining part of the trip, the pilot wanted to show me one more DC-3 attribute. He raced the engines at top speed and as the plane lifted from the ground, he made a tight turn near a grove of coconut palms. He maneuvered the plane so that one wing whacked off the tops of the tallest palms before pulling it sharply up in a quick ascent. After landing in Calcutta, I examined the wing and found a palm frond embedded in the wing-flap.

I successfully located basic but serviceable lab supplies in an offbeat part of the city near the University of Calcutta. The flight back to Kathmandu, with the same pilot, was without surprise. Once again, the plane dropped sharply before screeching to a halt, but this time I was prepared. It had become clear to me that the DC-3 would be an indispensable part of my medical adventures in Nepal.

LANDING AT POKHARA

Our medical initiatives required the establishment of five village development centers spread throughout Nepal. The centers would represent the foci of our program's joint efforts in health, education, and agriculture. Pokhara, about 100 miles from Kathmandu in northwestern Nepal, served as one of these sites. We needed to transport supplies, equipment, and personnel to Pokhara, but hiking with porters would take several days. There was not even a rudimentary airport at Pokhara, but the Polish pilot believed he could fly us there in about 30 minutes. He sent foot-runners ahead to locate and "prepare" a suitable landing strip, which meant cutting trees and removing as much brush as possible, all by hand. The runners were also told to mark the area with red cloths or flags that would be visible from the air. When we received word that the strip was ready, the pilot invited me to be his navigator and we took off. I sat in the copilot's seat with a map that had been prepared in 1925 by a British survey team. We had been informed that the new airstrip was next to a river that was south of the

town and that we would easily recognize the landing area marked with red flags.

The day was clear, but when we arrived, we could not find the landing field. We flew low in wide circles but still did not see it. I checked the map and found the river. We followed it back and forth, but there was no landing strip, not even a trail or sign of human habitation. Some 20 or 30 minutes passed and the pilot became quite agitated. We had to land somewhere, and soon. I rechecked the map and wondered if the river below had been mapped correctly, as it vaguely showed an old riverbed to the south; I suggested that we follow it. Suddenly, a patchy green field appeared that looked promising. Could we land there safely? It would be impossible to navigate entirely around holes, rocks, or briars in the unfamiliar field, but the pilot thought we should give it a try. He was anxious to conserve enough gas for a return trip to Kathmandu. It was an all-or-nothing decision.

We braced for a rough landing as the plane descended. The terrain was uneven and the landing bumpy. Finally, the plane came safely to a halt. We were down, but where were we? There was no sign of human life as we peered out of the plane. We climbed out to look around and within moments were cheered by several men bounding toward us. They had been lolling in the trees waiting for us to land and now greeted us like lost comrades. Apparently, they had thought our flying back and forth was typical landing protocol and had not bothered to leave the comfort of their shady trees until we were on the ground. We never learned why they had not planted flags designating the airstrip. In any case, we had landed safely at the right place.

The workers and I carried the supplies and equipment to an improvised hut that would temporarily protect them from the elements. The runners and villagers worked to further clear the landing strip of brush and rocks and to make it visible from the air. As I became more acquainted with the customs and perspectives of the Nepalese people, for whom our white skin and fancy machines were objects of wonder, I understood that I could take nothing for granted. Our goal was to bring 20th century technology and medicine to a people who had been sequestered from the world for more than a century. Our plane to them was a legendary Hindu bird, and we were aliens from another world. Our work to improve their lives would require patience and foresight.

Our few days in Pokhara allowed us to establish it as a key center for our health, education, and agriculture projects. We promised the villagers we would return soon in our silver bird.

FLYING TO CALCUTTA WITH SIR EDMUND HILLARY

In June of 1953, I again needed to travel to Calcutta for medical supplies and first aid kits. Dr. George Brooks, the entomologist, was now identifying insect vectors not only for malaria, but also for Kala-azar, a potentially fatal parasitic disease caused by sand fly bites, and for filariasis, an infection of filarial worms transmitted to humans through mosquitoes, which can cause elephantiasis. We were treating the Nepalese people for these diseases as well as tuberculosis and eye diseases. Our two Nepalese men had been well-trained and another 12 men were ready to join my cadre of malaria technicians. I also planned to buy gray fabric for the uniforms that my teams would wear in the field.

The monsoon was almost upon us and air travel would soon be impossible when the dirt airstrip at Kathmandu turned into mud. I hurried to the field and found Sir Edmund Hillary waiting to board the same plane. On May 29, 1953, Hillary and his Sherpa guide, Tenzing Norgay, had become famous by being the first mountain climbers to reach the summit of Mt. Everest. He and I were the only passengers, and our pilot was the familiar Sikh. In a blinding rain, he started the engines, and as the plane rolled and turned, we heard a heart-stopping crash. The plane stopped abruptly. Our pilot appeared from the cockpit and opened the door to the outside. Hillary and I followed him to the ground to see what had happened. The aircraft had skidded in the mud and the tail section had struck a

Kathmandu, Nepal, Airport, June 1953. Sir Edmund Hillary on left, Dr. George Moore in center, Everett Sanders on right (Sanders' children on left). Sir Edmund Hillary and Tenzing Norgay had reached the summit of Mt. Everest in May of 1953.

wooden stake. Both the elevator and the rudder were visibly damaged.

The pilot examined the bent metal and fabric tears, shrugged his shoulders, and suggested he could still fly the plane. He wanted our opinion, however. With just a moment's hesitation, Edmund and I looked at each other and smiled. We shook hands and instructed the pilot that we were ready to go. Take-off was tense, and Hillary and I both sat quietly, holding our breath. No one spoke as the plane sputtered and coughed, then lifted unsteadily off the ground. I expected to hear the tail flutter, but once we were airborne, rising level with the snow-capped peaks, the plane seemed unaffected by the damage. The wounded DC-3 performed beautifully, and we landed in Calcutta as scheduled.

This time, I knew where to find the necessary supplies, secured them quickly, and headed back to the plane alone, where the pilot was waiting to fly back to Kathmandu. During the windy flight, I realized that I had trusted both Hillary's charm and sense of risk, and that we both had trusted the sturdy DC-3 and the pilot. We landed at Kathmandu just in time to avoid another monstrous downpour.

OPENING THE EYE CLINIC IN TANSEN

Bhairawa was the last stop for air service on our way to a very important mission in Tansen, a remote village high in the Mahabharat Mountains, where I was to open a clinic for eye diseases. I had examined children in Kathmandu Valley with trachoma, a highly infectious disease that resulted in corneal scarring and blindness. Tetracycline ointment was effective and my team and I dispensed thousands of tubes through local workers. Another problem was the early onset of lenticular cataracts among adults, possibly as a result of anemia and high-altitude ultraviolet light exposure.

An Indian eye surgeon, Dr. G.C. Sood, had appeared on my doorstep one day and asked for my assistance with treating eye diseases. We began to work together and our eye clinics in Kathmandu were immensely successful. Dr. Sood, an Oxford-trained physician, could perform a cataract operation in three minutes, or about 15 patients per hour. People who had been blind for years could suddenly see again. We arranged to open an eye clinic in Tansen, where Sood was certain that many people suffering from high-altitude blindness would benefit from cataract surgery. Because Tansen had been the site of recent unrest after the district governor had jailed communist agents there, King Tribhuvan used our mission to reinforce his political authority. Accompanying us would be Khadgaman Singh, His Majesty's Prime Minister for Foreign Affairs;

B.P. Lacoul, Director of Food; Swami Krishnanand, a Hindu spiritual leader; and L.P. Devkota, Nepal's national poet, who would inaugurate the clinic's opening with a ribbon-cutting ceremony.

Our journey began with the 40-minute flight to Bhairawa piloted by the Polish refugee. As the entourage boarded the plane, the pilot confessed to me that he had no idea where the new landing strip was at Bhairawa. The copilot's seat was empty, but I could not help him navigate. Before starting the engines, he addressed the passengers to find someone who could direct him. An elderly Indian, presumably from Bhairawa, raised his hand and before he could speak was escorted to the copilot's seat. This flight was the gentleman's first. He had made the journey from Kathmandu to Bhairawa many times, but always on foot. Would he be able to recognize the route from the air? With the pilot's expert handling of the plane at a low altitude, the elderly assistant navigated the plane to our destination and managed to guide it to the grassy landing strip. We all climbed out of the DC-3, applauding the old gent on his expert copilotting, and were immediately surrounded by a mob of curious people. This was only the second appearance of an airplane at Bhairawa, and again villagers swarmed around it, wanting to touch the mythical bird. Jeeps awaited us for the 14-mile drive to Butwal; from there we would then hike the remaining 20 miles over the Mahabharat Mountains to the remote town of Tansen.

The afternoon we arrived at Tansen, Khadgaman Singh inaugurated Dr. Sood's eye camp at a school ground. After the ribbon was cut, the VIPs followed Dr. Sood to watch the first operation. A tent with two tables served as the operating room. The eye surgeon seemed unfazed by the commotion, including stray dogs wandering in and out. During the three-day camp, Sood performed 97 cataract operations and treated 375 cases of trachoma and other ocular problems. I also set up a clinic to learn what diseases were prevalent there. I examined 322 patients and found tuberculosis, venereal diseases, anemia, and intestinal infestations with myriad worms and amoeba. The Prime Minister declared our visit to Tansen a success, which set the groundwork for future medical programs there.

FIGHTING MALARIA WITH DDT

Our most effective tool in exterminating the vast and deadly population of malarial mosquitoes was dichlorodiphenyltrichloroethane (DDT). Chester Bowles, the U.S. ambassador to India, had ordered a tremendous amount of DDT in 1951 in anticipation of my work in Nepal. Much of it, however, had sat on the Calcutta

docks and turned to hard cake before we could retrieve it. Our staff used mallets and rollers to break it up into powder to keep it from clogging the compression sprayers. We flew the barrels of DDT and hundreds of compression sprayers from the Calcutta docks to our outpost in Kathmandu and then carried it, mostly by foot, sometimes by elephant, to villages throughout the jungles and the Terai plains. On a few occasions we were able to fly to our destination. One such trip was to Bhairawa in the Chitwan Valley, where I would train a team to use the sprayers.

I boarded the plane in Kathmandu and an Anglo-Indian pilot welcomed me to sit with him. This time, the cabin was equipped to handle cargo. We were also transporting a contingent of Gurkha soldiers with their officers and gear to a training camp. Bucket seats along the sides of the plane accommodated the soldiers and their equipment, and their weapons were strapped to the floor of the cabin. Before take-off, the pilot asked me to check on the soldiers and store any loose gear. It was a delight seeing these soldiers up close. Gurkhas were widely acclaimed as the world's best fighting men. Most had served in the British Army and as many as six divisions fought in WWII. In jungle warfare, they had no equal.

Ominous clouds loomed over the horizon, but the pilot seemed confident. Because visibility was limited, we flew at 14,000 feet—higher than usual—to stay above the clouds, but still below many of the tallest peaks. Suddenly, we hit a violent downdraft. Everything loose in the cockpit hit the ceiling with a crash. My body pulled against my seat belt as the plane lurched, and I gasped for breath. The pilot, though, maintained control through the turbulence and was able to gain altitude again without catastrophe. As our plane leveled off, he asked me to check on the Gurkhas. I opened the door to the cabin and was amazed. Some soldiers were sprawled on the floor. Others appeared dazed in their bucket seats. Litter and debris were scattered everywhere. Some of the men had taken a break when the calamity occurred and had literally hit the ceiling before thudding to the floor. They looked miserable; however, I did not hear a cry of pain or anguish, not even a whimper from those who appeared to be hurt. When they realized that I was there, they picked themselves up—helping each other as they could—and saluted me. They were soldiers through every moment of the turmoil and, like the DC-3, had passed the test of strength and endurance commendably.

My introduction to the Gurkhas' discipline and

resolve on this flight led to my recruitment of Gurkhas to assist us on our many ventures throughout Nepal. They knew how to navigate the Terai and the mountains, fend off wild animals and bandits, and find the best sites for setting up camp. Their respected presence guaranteed us the people's cooperation in every village we visited, including this trip to Bhairawa.

We landed at Bhairawa, unloaded the barrels of DDT and compression sprayers, and began training the recruits to use them. We knew that a female mosquito sucked blood from a person with malaria at night, and then rested on the ceiling and walls of the dwelling to digest the blood. By spraying DDT on the inside ceilings and walls of all village houses at the same time, we killed the infected mosquitoes and halted the transmission of malaria. Convincing the villagers to allow us to spray their homes was easy once our Gurkha partners persuaded the village leader or cleric to be first and set the example. Our strategy was so effective that malarial transmission decreased by 70% in the first year.

Bhairawa was also selected as a village development center, and once we established air service there, we were able to make many trips, ensuring that our health, education, and agriculture programs flourished.

CONCLUSION

My work in Nepal in the 1950s was successful in part because of the consistent strength and reliability of the DC-3, which today remains legendary. The results of our efforts were manifold and set the groundwork for continued success. The medical initiatives were firmly established in both the research of existing problems and the subsequent programs to treat illnesses and prevent their onset. Examination of people in villages throughout Nepal provided me with information sufficient to convince the king and the American government that my five-year plan would significantly improve the health of the Nepalese people. In particular, my study of malarial transmission in the Terai allowed us to be more effective in our attempts to exterminate the mosquitoes that transmit the disease. The 1944 vintage planes were a part of the landscape for many years and were indispensable to the growth of Nepal. I am grateful for being granted the copilot's seat in my days over the Himalayas.

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