Ciência & Saúde Coletiva
ISSN: 1413-8123
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Associação Brasileira de Pós-Graduação em Saúde Coletiva
Brasil

Greenough, Paul
"A wild and wondrous ride": CDC field epidemiologists in the east Pakistan smallpox and cholera epidemics of 1958
Ciência & Saúde Coletiva, vol. 16, núm. 2, febrero, 2011, pp. 491-499
Associação Brasileira de Pós-Graduação em Saúde Coletiva
Rio de Janeiro, Brasil

Available in: http://www.redalyc.org/articulo.oa?id=63018970011

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"A wild and wondrous ride": CDC field epidemiologists in the east Pakistan smallpox and cholera epidemics of 1958

"Uma louca e maravilhosa jornada": epidemiologistas de campo do CDC nas epidemias de varíola e cólera do Paquistão Oriental em 1958

Paul Greenough [1]

Abstract *In mid-April of 1958 the Government of Pakistan summoned the press to announce a grave need for international aid to cope with smallpox and cholera epidemics in East Pakistan. In response, and with the backing of the US State Department, Dr. Alexander D. Langmuir, chief epidemiologist of the CDC, led a team of epidemiologists to assist authorities in Dacca strengthen their immunization programs. Langmuir's superiors hoped for a Cold War advantage, but he saw an opportunity for trainees in the Epidemic Intelligence Service to learn about public health in a developing country. Langmuir later described the episode as a "wild and wondrous ride," but it had been more like a nightmare: the East Pakistan health department had collapsed; a popular movement had taken over vaccination and squandered vaccine supplies; hostile journalists had questioned the Americans' deeper motives; and a professional rivalry opened between the Americans and a British epidemiologist named Aidan Cockburn. By the time the epidemic subsided in July 1958, 30 million Bengalis had been vaccinated for smallpox but another 20,000 had succumbed to the disease. This episode was CDC's first sustained foreign intervention, a precursor to its extensive role in the 1970s helping WHO eradicate smallpox from Bangladesh.*

Key words *Smallpox, Vaccination, CDC, East Pakistan, A.D. Langmuir, Aidan Cockburn*

Resumo *Em meados de abril de 1958, o Governo do Paquistão convocou a imprensa para anunciar a urgente necessidade de auxílio internacional para lidar com epidemias de varíola e cólera no Paquistão Oriental. Em resposta, e com o apoio do Departamento de Estado dos Estados Unidos, Dr. Alexander D. Langmuir, chefe de epidemiologia do CDC em Atlanta, liderou um time de epidemiologistas para auxiliar as autoridades em Dacca a reforçar seus programas de imunização. Os superiores de Langmuir ansiavam por demonstrações de capacidade dos EUA na Guerra Fria, mas ele vislumbrou uma chance para o Serviço de Inteligência Epidemiológica aprender sobre saúde pública em países em desenvolvimento. Langmuir descreveu o episódio como uma "jornada louca e maravilhosa", porém pareceu mais um pesadelo: o departamento de saúde do Paquistão Oriental entrou em colapso; um movimento popular assumiu a vacinação e desperdiçou suprimentos de vacinas; jornalistas hostis questionaram as motivações ocultas dos americanos; e iniciou-se uma rivalidade profissional entre americanos e o epidemiologista britânico Aidan Cockburn. No final da epidemia, em julho de 1958, tinham sido vacinados trinta milhões de bengalis contra varíola, mas outros vinte mil sucumbiram. Esse episódio foi a primeira intervenção sistemática do CDC no exterior.*

Palavras-chave *Varíola, Vacinação, CDC, Paquistão Oriental, A.D. Langmuir, Aidan Cockburn*

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The US Centers for Disease Control played a leadership role in the global eradication of smallpox between 1966 and 1979, offering both its epidemiological expertise and crucial manpower when required in some of the difficult sites of endemic transmission. CDC's future centrality in the final smallpox campaign was not so obvious in the 1950s, however, when CDC was only a small, struggling government agency in a federal system that reserved health administration and disease control to individual states. There were those in Washington and Atlanta, however, who had wider ambitions to see the CDC as a global resource in the Cold War as well as a projection of soft power that would dramatize American values and scientific capacity. An opening came in the spring of 1958, when smallpox and cholera broke out in all 17 districts of East Pakistan.

Epidemics of cholera and smallpox in East Pakistan were not so unusual; both were endemic to the province. Cholera had been declining in morbidity and mortality over the previous ten years, but it always returned in spring; by mid-April of 1958 nearly 700 persons were dying of cholera each week (p.27-30)[1,2]. Smallpox, which was also markedly seasonal, had a five to six-year epidemic cycle, the severity depending on the number and density of susceptible infants and children; by mid-April nearly 1500 persons were dying of smallpox each week[3]. While East Pakistan's surveillance and vital registration systems were too faulty to determine the extent of sickness and mortality, an estimated 20,000 Bengalis died from smallpox alone in 1958—twice as many as the year before. While the numbers were large, they had been larger within recent memory; yet anxiety was unusually great in 1958 because of a sudden scarcity of vaccines and because of administrative and financial troubles that had crippled the East Pakistan Department of Public Health. The department was small and underfunded (25 medical officers were spread across a province of 46 million people), and even at its best the vaccine institute in Dacca (Dhaka) produced only a million doses of smallpox lymph a week. Calamitously, in March of 1958 a rinderpest outbreak led to a shortage of calves in the market; calves were necessary for the production of smallpox vaccine, and its production collapsed at the very moment that smallpox mortality was rising. The scarcity of cholera vaccine, a considerably less efficacious measure of prevention when compared to smallpox vaccine, was less of an issue. Smallpox vaccine was also produced in West Pakistan but never supplied more than a fraction of the eastern province's need in 1958 (p.27-36)[1].

Throughout this same spring–roughly March through June—there was chronic political crisis in East Pakistan: the key point of contention was whether the provincial government in the East could take administrative decisions without direct instruction from the national government based in the West in Karachi. A related flashpoint between the two provinces was the perennial quarrel, structured along party lines, whether Bengali would receive equal recognition in public life as Urdu, the language of West. Pakistan. In Dacca political wrangling took place throughout 1958 in the legislature and on the streets. Appointed governors regularly interfered in administrative matters at the behest of Karachi, the chief ministership turned over repeatedly, and the bureaucracy was sporadically paralyzed. Public services, including public health, were neglected, raising concerns among the middle-and commercial classes in the capital. For many middle-class Bengalis the failure of the Dacca Vaccine Institute to produce smallpox lymph in March was the last straw. For example, the April 9 ***Pakistan Observer*** (Dacca) ran a news story "Smallpox Takes Heavy Toll of Human Lives," which concluded "The utter negligence and inability of the Public Health Department and other District Board and Municipal authorities were said to be responsible for the disaster." While the main institute for vaccine manufacture was in Dacca, subordinate centers of manufacture had been set up in Comilla, Chittagong, Rangpore, Jessore and Rajshahi. At least 600 calves were required each month to meet normal lymph production in Dacca[4].

At the April 9th conference the provincial Health Minister, Mr. D. N. Datta, revealed to the public for the first time the extent of smallpox mortality and the sudden loss of department's capacity to manufacture smallpox vaccine[5]. On April 9th the Chief Minister (Ata-ur Rahman Khan, Awami League) acceded to demands from his supporters and held a conference that concluded by proclaiming a "Citizens' Provincial Epidemic Control Committee." This Committee, consisting of 25 eminent persons—physicians and medical professors, Bengali politicians and officials, and representatives of social, political and welfare organizations in Dacca—was granted powers to fight the epidemic through civil-society means. While the Committee resolved to strengthen the health department's budget and increase its numbers, bureaucratic methods were set aside in the short run so that an army of volunteer vaccinators could be recruited to fan out over the city and eventually the entire province[6]. The Citizens' Control Committee was an unelect-

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ed body but it never broke the link to the East Pakistan Department of Health; it was the latter that received imported vaccine from the foreign donors and passed it to the Citizen's Control Committee which for several months controlled vaccination throughout the province. A foreign observer described the Citizens' Control Committee as a "vigilante" organization (p.2)[2"]. While this may be an exaggeration, the Citizens Control Committee definitely reflected both the shared distress as well as the self-confidence of the capital's elites, and for the next few months it overshadowed the official public health apparatus.

In this time of crisis in the east, the Government of Pakistan (GOP) began to focus on the epidemics, especially on smallpox. Health officials in Karachi first turned to the WHO, which already had agents in Karachi, and they quickly broadcast a global call for vaccine donations. Although there was no well-established mechanism at this time to aggregate and dispatch vaccine from one part of the world to another, 25 donors sent more than 18 million of smallpox vaccine to East Pakistan in the next two months; some shipments arrived packed in dry ice within two weeks. Much smaller amounts of cholera vaccine were forthcoming (p.27-30)[1]. More than 60 percent of the total donations came from the United States, but other major donors included Republican China, France, Canada and the USSR (Table 1). While most of the smallpox vaccine was in liquid form as heat-sensitive lymph requiring refrigeration, a significant fraction was delivered in the freeze-dried format.

South Asia was a regional Cold War theater, and Pakistan was a US partner in two regional military alliances—CENTO and SEATO[7]. In 1958 the Americans already had nearly a dozen International Cooperation Administration (ICA, the antecedent to the US Agency for International Development) staff in Karachi and in Dacca, and were well aware of the collapse of public health in Bengal. They quickly put together an assistance package, which, in addition to the import of large amounts of vaccine, set in motion the appointment of a WHO epidemiologist, Dr. Thomas Aidan Cockburn (1912-81), to assume a novel role as "Advisor in Public Health to the Government of East Pakistan." They also arranged for the dispatch of a research team from the Naval Medical Research Unit (no. 2) in Taiwan to investigate cholera (p.3)[2]. In Atlanta news of American epidemic assistance to Pakistan caught the attention of Alexander D. Langmuir (1910-93), MD, Chief of the Epidemiology Branch and Director of the Epidemic Intelligence Service, the US Communicable Disease Center (CDC, later called the Centers for Disease Control and Prevention)[8]. Langmuir, 48 years old, was the government's leading field (or investigative) epidemiologist. Over the preceding seven years he had built at CDC a field epidemiology training program, the Epidemic Intelligence Service (EIS), that had an enviable record of helping to solve intractable outbreaks anywhere in the US[9-11]. By 1958 Langmuir was chafing to test his field methods and his men—most of them conscripted physicians who owed two years of service to the US government—in deeper waters. In particular, he was looking for opportunities to place EIS trainees in third-world epidemic control situations. He sensed an opportunity in East Pakistan and wrote at once in mid-April to US diplomats in Karachi to inquire if the Pakistan government would welcome a CDC team to assist health officials in the eastern province. While the CDC team worked on smallpox issues, the US Navy's NAMRU-2 bioscience research facility in Taiwan arrived to look into cholera. Behind the scenes Langmuir was being encouraged by the newly appointed Advisor in Public Health to the

Table 1. Major donors of smallpox vaccine to East Pakistan, spring 1958(p.3)[2].

Doses of lymph (wet) or freeze-dried preservation (dry)
United States and US Red Cross Society: 11.81 million, wet
Chinese Red Cross Society (Taiwan) 2.88 million, wet and dry
Soviet Union 2.25 million, dry
World Health Organization 1.72 million, dry
Canadian Red Cross Society 1.4 million, wet
French Catholic Relief Society 1.1, million, dry
Mozambique (Portugal) 0.5 million, wet
India 0.43 million, wet
Turkish Red Crescent Society 0.10 million, wet
Germany and German Red Cross Society 0.69 million, wet and dry

Alex D. Langmuir (1910-93)

Thomas A. Cockburn (1912-81)

Government of East Pakistan, Dr. Thomas A. Cockburn[12]. Like Langmuir, he was one of a handful of well-trained pre-war epidemiologists whose scarce skills became valuable in the post-war world. He worked at CDC from 1948 to 1953 and took US citizenship in 1954. Cockburn was a British physician-epidemiologist of Langmuir's generation who had worked in the Encephalitis Investigations Unit in CDC until he left to join the WHO in 1953; he had been posted by WHO to Ceylon where he had been an Advisor to the Ceylon Government until ICA administrators recruited him for East Pakistan in April of 1958. Langmuir was thus well acquainted with Cockburn, with whom he had coauthored a scientific paper[13]. Thus it is likely that Cockburn had contacted Langmuir in mid-April to suggest that a CDC/EIS team might be helpful in East Pakistan. The State Department, seeing the practical advantages of bringing Langmuir's and Cockburn's skills together in Dacca, agreed to fund the Atlanta team's costs. East Pakistan in spring 1958 was CDC's first team mission abroad, although individual EIS officers had advised foreign governments in the past.

Langmuir and his men arrived in Dacca a month later on May 12. This was the same week that smallpox mortality peaked at 1500 deaths a day and one month after the Citizens' Epidemic Control Committee had begun its volunteer-driven campaign to vaccinate East Pakistan. Accompanying Langmuir was Glenn Usher, MD, an imperturbable physician-epidemiologist who served as Langmuir's deputy, and seven other EIS trainees(p.5)[2]. Their plane from Karachi was loaded with vaccine, and welcoming USIS officers had arranged a blaze of publicity. Representatives from other agencies arrived in Dacca in the same month to assist with epidemic control—a nine-man team from NAMRU 2 as noted, a six-member delegation of academics from the USSR, 20 experienced vaccinators from Afghanistan, and a single French researcher (p.5)[2]. However, the Dacca press was notably non-committal; some papers were openly pro-Communist and anti-American, while others were unenthusiastic simply because the CDC men had arrived under the auspices of the central government—it was a time of elevated anti-Karachi sentiment. In contrast, the Dacca press was warmer in welcoming a team of Soviet bacteriologists that landed a few days later[14,15].

Langmuir quickly realized that the CDC's role in the smallpox control campaign would be unorthodox. On May 18th—just six days after the team arrived—the Chief Minister of East Pakistan (Atur Rahman Khan) called in the press to announce that, given the abundance of epidemiological expertise and the accumulation of supplies of foreign vaccine, his government and the Provincial Epidemic Control Committee had resolved to launch immediately a smallpox and cholera ***eradication*** campaign. The campaign was no longer premised on rebuilding the public health department but on ramping up the number of citizen-volunteers, who, the chief minister promised, would stamp out smallpox and cholera in four months throughout rural East Bengal[16]. A pamphlet distributed at the press conference outlined how eradication would be quickly achieved not just in East Pakistan but throughout Southeast Asia. A million copies of this document in Bengali and English were printed and distributed[17]. The certainty to make such promises rested on volunteer activity in the previous month, when, in the words of a sympathetic European, "the citizens of the country started a vast spontaneous, unplanned, uncoordinated effort to vaccinate themselves" (p.20)[2]. A citizen's movement—not an experts' or bureaucracy's— would prevail. If the CDC men and foreign diplomats muttered among themselves that eradication was a preposterous goal to announce in the middle of an uncontrolled epidemic, they knew there was no mystery where the notion had come from: it was widely known that the Eleventh World Health Assembly of the WHO would be meeting only a few weeks later in June in Minneapolis, Minnesota to discuss a Soviet proposal for global smallpox eradication[18]. The Citizens' Epidemic Control Committee was positioning East Pakistan to steal a march on the rest of the developing world. Langmuir and his team felt themselves maneuvered into seeming to support what they privately considered a completely unworkable plan[19].

A few weeks earlier the Citizens' Control Committee had recruited a small army of urban volunteers, beginning with professors and students at the Dacca Medical College, which was closed for the duration of the epidemics[19]. Their attention was focused on smallpox for which abundant vaccine supplies were coming from abroad. Within a short time the volunteers had vaccinated 300,000 inhabitants of the capital, after which they were sent off to district towns to train others how to vaccinate in villages. The rural program was a mass campaign twice-over: a huge number of immunological susceptibles (counted in the tens of millions) would be vaccinated by a smaller but impressive number of volunteers (counted in the tens of thousands). The latter were given four

rupees daily to pay for their food and lodging and they travelled gratis on the railways(p.4)[2]. By mid-May, subordinate civilian epidemic committees had been established in most district and sub-divisional towns. These sub-committees organized what were in effect health spectacles to galvanize the public and attract volunteers. With the assistance of magistrates, army commanders and other notables, the sub-committees staged parades, made speeches, held band concerts, and in the evenings screened documentary films about health and sanitation. New volunteers were trained in vaccination technique and sent off with a list of villages and boxes of foreign vaccine sent from Dacca; cold chain requirements were often glossed over. In the view of foreign manufacturers in the US and elsewhere, unrefrigerated smallpox vaccine would remain potent for only a day or two, but Cockburn reported that "excellent results were being obtained [in East Pakistan] after a week or longer even with the temperature continually between 80 and 100 [degrees Fahrenheit]" (p.17)[1]. In some places schoolteachers halted their classes to train students to vaccinate; it was pointed out that female volunteers could freely enter Bengali homes and vaccinate women in purdah. Volunteer enthusiasm, when backstopped by encouragement from district officers, resulted in widespread if not universal acceptance of vaccination (p.10-13)[2].

Significantly, the vaccination techniques taught to volunteers were "streamlined until only the bare essentials" of the Health Department's standard practice were retained. For example, swabbing with alcohol was abandoned as was bandaging the vaccinees' slight wounds. In the absence of sufficient medically-purposed vaccination needles or lancets, volunteers were forced to improvise, which led to the purchase abroad and importation of 11 millions ordinary unsterilized sewing needles; these needles were used once (obviating the need for sterilization) and then given away as prizes to vaccinees. There was no common method of inoculation: "all vaccinators soon went their own ways, some making punctures, others making long scratches, while some did elaborate cross hatchings." Record-keeping was minimized, and volunteers were told to keep track of the number of doses they administered without writing down vacinees' names and other information (p.19)[2]. These modifications, made in the interest of speed and simplicity, were suited to an amateur force whose enthusiasm was a key ingredient in the campaign. However, enthusiasm sometimes flagged, and it was sometimes observed that boxes of fresh vaccine had been tossed into ditches (p.11-13)[2]. Government vaccinators also were found at times to have thrown away their vaccines supplies and claim that they had used them properly (p.9)[1]. Nonetheless by the time the epidemic ended in late June, an estimated 30 million Bengalis had been vaccinated by unorthodox means (p.16)[2].

Langmuir had often stated a wish that EIS officers could participate in epidemic relief under third-world conditions; his wish was granted in spades in East Pakistan, yet in unanticipated ways. In the US the reputation of the EIS was based on the careful analysis and dissemination of disease data gathered in the medium term (i.e. surveillance over several weeks and months) or by the swift gathering of sufficient epidemiological facts on-site during an outbreak; in the latter case the investigators were usually qualified and authorized to decide on the necessary interventions to halt the spread of a disease. Neither of these approaches was possible in 1958 in East Pakistan, where routine compilation of disease data was poor to non-existent, East-West politics limited foreign epidemiologists' freedom of action, and an anxious public had come to distrust official expertise. More fundamentally, Langmuir and his men were ignorant of the cultural and political terrain, spoke no Bengali, and depended on their hosts for the most ordinary functions. Under these circumstances, could they do anything of real public health significance? After strenuous discussions, the CDC team agreed to become "the 'eyes and ears' of the smallpox control program" and to prepare a report that would "evaluate the current control campaigns in the districts and identify areas of success and failure ... [and] epidemiological factors of importance to the smallpox control program" (p.37)[3]. This report was promised by the end of June of 1958, by which time the monsoon's arrival would shut down most activities that depended on travel into villages. The Americans were being given an advisory and evaluation role but no line authority.

In late May the EIS men fanned out into East Pakistan, each spending two weeks in one or more districts tracing the vaccine cold chains, observing volunteers in training, counting the proportion of vaccines possessing scars from previous vaccinations, and following up on the extent of coverage. While the bulk of their effort was focused on smallpox, they also made a few special investigations of cholera. Langmuir and Usher stayed behind in Dacca to attend to logistics; when Langmuir returned to the US at the

end of May, Usher remained in charge. The EIS officers were accompanied on their district tours by Bengali physician-translators with whom they for the first time were sharing professional practices. In some districts they found the vaccination work to be going well, but elsewhere there were interruptions like cyclonic storms, indifferent local leadership or inter-party political battles that negated success. Significantly, they found that prior vaccinations did not confer life-long immunity and that volunteers were mostly indifferent to the need to keep vaccine lymph at a constant low temperature. They also found great unevenness in vaccination coverage between districts. Thus they concluded that the people's vaccination movement, while claiming some justifiable success, was failing to find and immunize hundreds of thousands of infants and children. Their district reports, while written discreetly, contained negative accounts of volunteer-based smallpox control[20].

In this period—late-May through June—cordial relations between the CDC team and T. Aidan Cockburn, the public health advisor to the provincial government, came to the brink of collapse. Usher thought Cockburn miscast as a policy-maker because of his inability to stand up to the Bengali politicians and the strong-minded civilians on the Provincial Epidemic Control Committee. Their major disagreement, however, concerned the use of volunteers for serious public health work. In private, the EIS men referred to Cockburn's volunteer-led vaccination program as a "whoop-de-do campaign" and a "wandering minstrels" show. His proclaimed eradication campaign based on volunteers was ridiculed as "Aidan's circus" and "Operation Cockburn Fantastique." These criticisms extended beyond his policy ideas to the man himself, who was mocked as "the madman," as morbidly and unreasonably fearful of communists, as a bumbler who repeatedly made gaffes that angered the Pakistanis, as someone who "hopped up and down" in agitation and "ran out the room," one who badly needed to be tranquilized[21]. They repeated among themselves a rumor that Cockburn continued to receive the favor of Bengali ministers and to enjoy a secondary appointment as Director of the Institute of Public Health, because he had promised Pakistani officials that he could get the Americans to donate $8 million for furnishing and equipping the Institute[21]. In these and other ways they undercut his authority as chief public health adviser and threw cold water on the voluntee campaign. The most likely cause for the escalating criticisms and canards was that their tours in rural areas had shown the vaccination campaign was missing hundreds of thousands of Bengalis, many of whom were children who died unnecessarily. Further, Langmuir, Usher and others from CDC felt vulnerable for being so closely associated with an unprofessional, ineffective and wasteful campaign: ***I've been uneasy all along about the position of our team in relation to this situation, and I'm still uneasy. We are all thoroughly convinced that Aidan's whoop-de-doo campaign is going to fall far short of vaccinating 80% or 90% of the population in four months. But he has announced loudly that <u>he</u> will accomplish this, and in so doing he has antagonized a lot of people, including the entire membership of the Committee*** [...]***When the campaign fails to achieve its goal in the allotted time, they will hit him hard and I'm afraid we'll get splattered with some of the mud***[22].

Yet, despite their unhappiness, the appearance of civility was maintained; there was no knockdown battle with Cockburn, who continued to enjoy the favor of both the ICA and the State Department as well as leading Pakistani politicians.

Absorbing the lessons of the East Pakistan smallpox epidemic

After Usher and other EIS officers returned to Atlanta, Usher and Langmuir continued to exchange information with Cockburn and East Pakistan officials. (Cockburn continued on the ICA budget in Dacca through 1960.) It was agreed that Langmuir and Usher would prepare for publication an article that summarized the CDC's team's findings, while Cockburn would prepare a parallel article from the East Pakistan perspective. For several months Usher and Langmuir discussed what to put into their paper, deciding finally to suppress any reference to their many misgivings and to simply focus on the question, what light did the East Pakistan campaign in 1958 shed on the movement underway toward a global smallpox campaign? The aim of their paper was given in its title—"The Feasibility of Smallpox Eradication." In the end Langmuir declined authorship and only Usher was named[3]. As can be imagined, this article was emphatically negative about the East Pakistan volunteer model as the basis for eradication. Cockburn, for his part, prepared his own article, "Epidemic Crisis in East Pakistan, April-July 1958," which was considerably more upbeat (p.27-36)[1]. Unusually, the two articles ap-

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peared side by side in January of 1960 in ***Public Health Reports***, the official journal of the US Public Health Service (since 1999 has been published by the Association of Schools of Public Health).

Usher's "The Feasibility of Smallpox Eradication" begins with the numerical data collected in the rural districts of East Pakistan in May-June of 1958; in summary tables and figures it states the total smallpox mortality, the overall rates of mortality, and the broad age- and sex-specific mortality rates. It also compares smallpox mortality in 1958 with previous epidemics. A discussion section follows that addresses the special circumstances that made East Pakistan a challenge to eradication. One such circumstance was that smallpox was so deeply endemic in the population, that despite high rates of vaccination –even 80 to 90 percent—investigators were "unable to find any correlation between the proportion of the population that had been vaccinated and either the time of onset or the intensity of the epidemic in various districts (p.38-39)[3]". In other words, the spread of smallpox in East Pakistan was not constrained by so-called "herd immunity" that in other countries had been shown to have a moderating effect on the severity of epidemics. In explanation of this anomaly, Usher pointed to the very high density of the rural districts, such that "the time of epidemic onset and the intensity of the epidemic were more closely related to population density than to vaccination status(p.38-39)[3]". This argument may have come from Cockburn's investigations, as he was known to have formulated in the 1950s "the hypotheses and formulae expressed in his books, relating density and size of populations to the maintenance and recurrence of different epidemic diseases(p.328)[23]". Further, the long-term persistence of antibodies after a primary vaccination, which in other places usually provided a degree of protection, did not have the same effect in East Pakistan; many Bengalis who were stricken by the disease in 1958 had been vaccinated previously, as evidenced by vaccination scars. Thus for practical purposes, Usher recommended that epidemiologists should seek to determine the proportion and density of unvaccinated susceptibles rather than the proportion and size of the population that had been previously vaccinated (p.41)[3].

These issues—surveillance data, immune status, endemicity and epidemicity—were important, bread and butter concerns for field epidemiology, and Usher's article put the 1958 epidemic on a firm numerical and scientific basis. However, Usher also attempted to answer the question, how should smallpox be tackled in a poor, politically unstable, densely rural country where smallpox was so deeply entrenched? In answering this question, Usher (with Langmuir right behind him) launched a recommendation that took an unexpected turn: eradicators must be ready to apply constraint and possibly coercion, especially against "groups that [responded] poorly to vaccination campaigns and experienced high attack rates (p.40)[3]". To quote Usher at some length: ***In the surveillance or 'firefighting' phase of an eradication program selective vaccinating of exposed persons (sometimes referred to as 'ring containment') is, of course, desirable, but it is not considered advisable to rely entirely upon this for the emergency containment of outbreaks. This is especially true in a country like East Pakistan where health services are not fully developed, and there is a shortage of qualified personnel for the performance of contact investigations. In such circumstances it seems essential to rely on 'area containment,' that is, an immediate, very intensive campaign to raise to the highest possible level the vaccination status of a community where an outbreak has occurred. The successful execution of the 'firefighting' phase of the eradication program where the problem is as difficult as it is in East Pakistan may require rather drastic measures, such as area quarantine, during the time required to vaccinate a community in which an outbreak has occurred. Enforcement of emergency measures will need to be determined and persistent***" (p.41)[3].

What were the grounds for this recommendation of "rather drastic" emergency measures in East Pakistan? What had Usher and other EIS men seen there that convinced them that such measures would be necessary in the future? From unpublished documents it is clear that Langmuir, Usher and the rest of the CDC team in East Pakistan had been appalled by the circus-like atmosphere that was whipped up around a "citizens" vaccination campaign. Occasionally, some of the EIS men could be persuaded to see matters as Cockburn did. For example, Dr. Bruce Dull noted in June 1958 that "Our contacts have convinced us all that the basis of any campaign must be local volunteers and not a handful of foreigners speaking at best only a few polite phrases in Bengali"[24]. What was needed, according to Usher, was a stable public health administration with a high degree of professionalism and holding in reserve the firmness that would sometimes be needed to apply "drastic measures." Voluntary methods, by definition, were incapable of the necessary degree of discipline.

Cockburn's article, "Epidemic Crisis in East Pakistan, April-July, 1958[1]", could not have been more different. While acknowledging the CDC team's help in collecting surveillance data and organizing special studies of the epidemics, he was much more respectful of the volunteer approach taken by the Citizens Epidemic Control Committee and its methods. In a key passage he wrote that ***Smallpox is easy to prevent; vaccination is simple and can be done by illiterate people. The vaccine is cheap and can be mass-produced. It should be possible for each country in Southeast Asia to vaccinate 90 percent of its people within a year and to repeat the operation every 3 to 5 years. The resulting level of immunity would probably cause the disease to disappear completely*** [...]***mass vaccination is not basically a medical undertaking but a layman's job of organization, propaganda and logistics***. [...](p.32)[1]

These were the same views that had driven Langmuir and his CDC colleagues to distraction. The neglect of sterile inoculations, cold chain integrity, surveillance work and careful record keeping had all been all defects of the East Pakistan campaign, but the assertion that smallpox control was inherently easy, a matter for laymen and school-children ("The children easily picked up the vaccination technique from their teachers") was infuriating. On the draft text of Cockburn's article sent to CDC before publication, an EIS officer who had been to East Pakistan scribbled ***Cockburn is still fighting us*** [...] ***I'm getting sick & tired of Cockburn's brief ridiculous letters—we probably should end all correspondence with the idiot—there seems no point in continuing these nonsensical arguments***[25].

In this burst of feeling one sees a clash of visions about how and by whom smallpox eradication would occur.

Conclusion

More than fifteen years after the 1958 smallpox epidemic, EIS field epidemiologists returned to Bangladesh in 1975 to join in the final push to halt transmission in Asia before the final drive to global eradication in East Africa in 1977. The South Asia eradication story has been skillfully told in recent studies by Bhattacharya and others[26,27], and historians of health now have the opportunity reexamine that account, not so much as a record of failures and success, but as marking important steps toward the evolution of the more collaborative, decentralized and population-based methods nowadays associated with global health. In the practice of "global health," as opposed to "tropical medicine," citizen participation and the active presence of NGOs in public health campaigns are taken for granted. Cockburn was more visionary than Langmuir and Usher in seeing that eradicating or simply controlling a contagious disease is as much a matter of political and social mobilization as of professionally applying epidemiological findings and public health restrictions. In the practice of global health the boundaries of disease are not set by biological phenomena alone; there are also linguistic, gender and ethnic considerations, and epidemics are set in particular cultural and environmental contexts. Cockburn, perhaps sensitized by his earlier assignment with WHO in Ceylon, was acutely aware of such considerations, whereas the CDC men had never before worked abroad. On the other hand, Langmuir, Usher and the CDC were surely right to emphasize the great difficulty eradication would actually entail, especially in East Bengal, and it's no an accident that the very last cases on earth of ***Variola major*** were stamped out in Bangladesh—the former East Pakistan—late in 1975. Langmuir and Usher were clear in their own minds in 1958 about the occasional need for coercion that was in fact a feature of the final push in both India and Bangladesh in the 1970s[28].

Looking back on 1958 from the present, one can suggest that the CDC team was attempting to apply the swift methods of surveillance epidemiologic in a setting that today would be called a complex health emergency—where health issues were compounded by political instability and the breakdown of some parts or all of lawful administration. Unlike many complex emergencies in the present, however, there were political parties and civic organizations in East Pakistan ready to step forward and suggest a way out of various entwined crises by volunteer methods and non-governmental forms of agency. The fact that such methods and agency were not completely successful should not be taken as a reason to condemn their spontaneous appearance. In the turn to "citizen" leadership and voluntary efforts there is an anticipation of the more collaborative, ethical and human rights-regarding approach to public health that has emerged within global health practice in the present.

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Artigo apresentado em: 31/08/2010
Aprovado em: 22/10/2010
Versão final apresentada em:29/10/2010