Control, containment and health education in the smallpox-vaccination campaigns in Mexico in the 1940s

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Abstract

This article examines some of the changes that the Mexican vaccination programs underwent starting in 1943, the year when the National Smallpox Campaign (Campaña Nacional contra la Viruela) was established. It analyzes why a uniform and coordinated vaccination method was adopted to counter the outbreaks of this endemic disease, especially in central Mexico; the actions of its numerous and heterogeneous staff; and the reasons why smallpox vaccination was considered critical to establish a culture of prevention. In summary, the article examines why selective vaccination was chosen and the expansion of the health-education programs, topics that have been seldom addressed in historical research.

Keywords: vaccination; smallpox; health education.

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The first half of the twentieth century witnessed numerous fundamental changes and innovations in the design, organization and implementation of smallpox-vaccination programs regionally, nationally and internationally and the participation of multiple and diverse actors (Bhattacharya, 2006, 2007, p.1113-1129; Stepan, 2011). In 1967, the World Health Organization (WHO) implemented the worldwide smallpox-eradication program, and in 1980, it declared that the world had finally eradicated this long-feared and fatal disease (Henderson, 2009; OMS, 1980). Smallpox was eradicated due to different elements involving multiple factors, such as the nature of the disease itself, the long history of smallpox vaccination and the protection that the vaccine afforded to populations. Technological innovations in the production, conservation, quality and application of the vaccine, as well as a closer and more regular international and regional collaboration among other elements that have been carefully studied, examined and exposed in recent years, were also important factors (Moulin, 2003, p.449-517; Bhattacharya, Brimnes, 2009, p.1-16).

In the specific case of Mexico, the health authorities declared the eradication of smallpox in 1952 and multiple researchers have conducted historical examinations of smallpox and vaccination in the country. One element that is often repeated in Mexican historiography is that starting in the early nineteenth century, with the arrival in 1803 of Francisco Xavier de Balmis' Royal Philanthropic Vaccine Expedition in New Spain, the containment of smallpox was constant and undeniably successful (Fernández del Castillo, 1982; Mark, Rigau-Pérez, 2009, p.63-94). The historiography has also perpetuated other questionable statements and generalizations, for example the insistence on characterizing the fight against that disease as a result of the inevitable and linear progress of medical science or, likewise, the idea that smallpox eradication in Mexico was possible due to the compromise, efforts and agreements among the different governments and health authorities in power after the military phase of the Mexican Revolution (1910-1920). Therefore, the predominant image in different historical accounts has been one of a continuous struggle in which there were no disagreements and debates concerning how to organize and proceed with the vaccination campaigns. Similarly, the history of the fight against smallpox has been presented as an enterprise with uniform vaccination strategies in which multiple homogeneous actors participated in both rural and urban settings during the course of the first half of the twentieth century.

This article premises that smallpox vaccination was not implemented in a uniform manner or in the same way in all geographic and cultural contexts, and its purpose is to present some partial and preliminary results of a wider investigation that examines both continuities and ruptures in the vaccination programs organized in Mexico from the late nineteenth century up to the 1960s. This paper focuses on why what was sought was to implement a uniform, coordinated and frontal method to contain the disease's outbreaks throughout the 1940s. Close attention is given to the wide range of individuals who participated in the campaigns, to the different procedures, strategies and techniques adopted, as well as to the importance that health education acquired and regarded as a tool that would help to strengthen and expand vaccination throughout the country. In summary, this paper will shed light on the difficulties, problems, challenges and innovations that accompanied the vaccination endeavor in Mexico throughout the 1940s, topics that as stated earlier, have not occupied a central place in historical research.

This article is divided into three sections. The first examines why, in 1943, the Health and Assistance Secretariat (Secretaría de Salubridad y Asistencia, SSA) set up the National Campaign to Combat Smallpox (Campaña Nacional Contra la Viruela, CNV) whereby it attempted to organize two complementary vaccination methods – background campaigns and emergency campaigns, abandoning the approach of solely eliminating smallpox foci. The new vaccination strategy, the article will show, favored selective and persuasive vaccination over mass and coercive vaccination; it required consistency to identify smallpox, and to train a broad, diverse group of workers, whose duties and obligations were delimitated on a daily basis.

The second section focuses on the diverse actors that comprised the unequal and diverse personnel involved in the National Campaign to Combat Smallpox (doctors, vaccinators, epidemiologists, auxiliary vaccinators, indigenous intermediaries, teachers and nurses, among others), and demonstrates why a central aspect of their work was to provide health education to men, women and children in rural Mexico in order to establish a true culture of prevention.

The third and final section refers to some of the problems that the smallpox vaccination campaign staff faced, such as technical limitations for transporting and conserving the vaccine and the resistance and objections to be vaccinated among different populations in order to highlight some of the challenges that were part of the vaccine enterprise and that have not been sufficiently addressed in historical analyses.

From routine vaccinations to background and emergency campaigns

At the conclusion of the military phase of the Mexican Revolution (1910-1920), the health authorities were particularly keen on containing the spread of smallpox given the fact that the disease not only led to the death, deformity and disability of numerous individuals, but also because that there was an effective method to contain the disease: a vaccine. Smallpox vaccination and revaccination of the greatest possible number of people became an urgent task during the administration of General Plutarco Elías Calles (1924-1928) and led, in 1925, to the enactment of the Vaccination and Revaccination Act (Reglamento de vacunación y revacunación). The act reiterated the mandatory requirement to vaccinate and then to revaccinate every five years (Reglamento..., 1925). One year later, when the first Mexican Health Code (Código Sanitario de los Estados Unidos Mexicanos) of post-Revolutionary Mexico was enacted, the authorities established federal and state health guidelines for the containment of infectious diseases; regulated the application of blood serum and vaccines; the disinfection of clothes and home environments, and laid out the plans for organizing regular and special revaccination programs. Likewise, the government considered that special vaccination health brigades should be set up and declared that the general public, as well as local, municipal and state health authorities were obliged to report any known smallpox cases to the federal authorities (Código…, 1926). Eight years later, the Health Code that entered into force in 1934, reiterated earlier pronouncements but also proceeded to emphasize that vaccination should be extended to rural regions.

During the 1930s, in particular during the presidency of General Lázaro Cárdenas del Río (1934-1940), smallpox vaccination became an integral part of the work pursued by numerous federal, state and municipal health authorities and services. Medical and health workers from

large cities, staff of the Rural Health and Social Medicine Services, workers of the Cooperative Rural Medical Services, health workers at clinics at ports, borders and general transportation routes, as well as medical students performing their social service in rural areas, all actively participated in routinely protecting populations and eliminating epidemic outbreaks (Siurob, 1941; Agostoni, 2010, 2013). It was also in 1935 when the Federal Health Service's set up mobile brigades staffed by doctors and nurses. In addition, volunteers and auxiliary vaccinators were also involved, and were responsible for applying six million vaccine doses between 1935 and 1936 (Erosa-Barbachano, 1977, p.561).

Notwithstanding, in the early 1940s a number of long-term limitations prevailed, and smallpox vaccination was incomplete, sporadic and, in some cases, non-existent. The lack of financial resources, the absence of a numerous and properly prepared staff to apply the vaccine and to identify and distinguish smallpox from chickenpox or other vesicle-producing diseases, as well as a limited number of nursing assistants, vaccine analysts and epidemiologists were all factors that contributed to vaccination shortcomings. Furthermore, what predominated at the time was a general disorganization among the different federal, state and municipal authorities as to how, in what manner and when to vaccinate, as well as numerous technical problems for properly transporting the vaccine to guarantee its strength and effectiveness.

Given this scenario, in the early 1940s, one of the most pressing priorities of the government's health enterprise to curb epidemic smallpox outbreaks in different Mexican states consisted in finding the means to organize a coordinated, frontal and systematic attack to constrain its epidemic manifestations throughout the country. In 1942, the health authorities reported the highest mortality rate per 100,000 inhabitants on record since 1934. In 1934, Mexico reported 52.8 deaths per 100,000 inhabitants; six years later, in 1940, this figure dropped to 6.8; but in 1942, this figure jumped to 20.2 (Guevara Rojas, abr. 1947, p.333). According to the health authorities, this meant a state of "extreme vulnerability" of the population, particularly among rural dwellers where vaccination was not systematic. The scarce protection of the population was evident due to recurring smallpox outbreaks in the states of Puebla and Tlaxcala and in the expansion of cases in rural and semi-rural areas in the states of Aguascalientes, Coahuila, Durango, Guerrero, Hidalgo, Michoacán, Oaxaca, Veracruz and Zacatecas (p.333-334).

Even though the geographic conditions of many rural areas and the absence of roads and other communication routes were elements that might have favored smallpox containment, those natural barriers were not strong enough to prevent contagion and represented serious obstacles to the work of the vaccination brigades. The health authorities deemed urgent to organize a frontal and coordinated attack, taking into consideration the administrative, financial, technical and staffing needs, while not abandoning routine vaccination work in health centers, clinics, hospitals and schools.

In 1943, the same year when the Health and Assistance Secretariat was created from a merger of the Public Health Department (Departamento de Salubridad Pública) and the Public Assistance Secretariat (Secretaría de Asistencia Pública), planning got underway for the National Campaign to Combat Smallpox, and the slogan adopted was "Coordination, Uniformity and Generalization" (Viniegra, 1946, p.2). This was a direct response to the epidemic of *variola major* that broke out between 1942 and 1943, causing the death of at

least 8,000 individuals. Combating this disease became one of the most pressing objectives of the newly created secretariat. The Coordinated Health Services Bureau (Dirección de Servicios Coordinados de Salubridad) set up a committee to study the best way to organize a coordinated fight against the disease. The committee, presided by Dr. Gustavo Viniegra and whose members included doctors Guillermo Román y Carrillo, Felipe García Sánchez and Alejandro Guevara Rojas, established it was necessary to organize two types of vaccination campaigns: background campaigns and emergency campaigns. Furthermore, and unlike the earlier organization of immunization programs, namely mass and non-selective vaccination programs, the committee deemed that smallpox vaccination would always need to be based upon:

> (1) the precise and timely knowledge of geographic, climate, political and health conditions of each entity; (2) a study of the disease through statistics like morbidity and mortality rates, trends, endemic indices and dispersion rates for the state overall as well as for each political unit (the municipality); (3) the state of protection via local, regional and state surveys; (4) a plan of action establishing the extent, duration, cost, personnel and smallpox-lymph requirements for the campaign; (5) training for directors, technical corps, auxiliary staff and administrative workers; and (6) organization of government measures to move personnel, deliver supplies and gather data (Guevara Rojas, abr. 1947, p.334).[1]

The new vaccination strategy centered on abandoning the classic method of extinguishing the outbreak of cases and mass and non-selective vaccinations, and that instead vaccination efforts should be based on timely knowledge of the health, economic, material and epidemiological conditions of the different regions of the country. Based on that information, the authorities would determine where, when and how to vaccinate (Viniegra, 1946, p.1-5). Furthermore, the authorities declared that only those previously trained in vaccination techniques, in reading results and in producing proper and timely reports, and who had the equipment required to properly conserve the vaccine lymph, could participate.

The proposal to implement two complementary strategies during the vaccination programs (background and emergency campaigns), alluded to the concept of eradication. The difference between control and eradication had been established in 1915, when one of the proposals of the Rockefeller Foundation International Health Commission regarding yellow fever had been to eliminate the disease, not just to control or contain it (Henderson, 1980; Soper, 1960). The US physician Fred Lowe Soper (1893-1977), who had headed the Rockefeller Foundation's campaign against yellow fever in Brazil in the 1930s, was one of the main advocates of the concept of eradication, defining it as "the concept of managing to free a limited area from the disease and extending the area indefinitely, that is eradication" (Soper, 1960, p.122). According to Soper, local eradication was the prelude to national, international, continental and worldwide eradication (Soper, 1960; Stepan, 2011). In 1948, when Soper was named director of the Pan American Sanitary Bureau (1947-1958), he tirelessly promoted and succeeded in getting a smallpox eradication program passed in the Americas (Etheridge, 1992; Stepan, 2011), ten years before the WHO launched its worldwide smallpox eradication program.

In Mexico, the National Campaign to Combat Smallpox committee determined that background and emergency campaigns would be pursued simultaneously and complementarily in those states, municipalities and villages with generalized or localized outbreaks, and also, that it would always be necessary to take into consideration the extent of the outbreak, the natural barriers to the disease's spread and the impact of the disease. The committee also declared that background campaigns would be carried out in all states that did not present a serious smallpox problem, and that they would include both systematic and routine vaccination work. The background campaigns were also recommended for those locations where earlier emergency campaigns had been implemented in order to boost smallpox protection rates. Likewise, these methods were to be pursued in villages and small rural communities "situated in and around train tracks and other communication routes; along customary or eventual migration routes used for religious festivals, trade and fairs; and along routes were smallpox customarily spread" (Instrucciones..., sep. 1935-oct. 1945).

On the other hand, the emergency campaigns were recommended in states where smallpox erupted in localized or general epidemics and wherever scarce population immunity meant risk of smallpox invasion from surrounding areas. Therefore, the proposal was to locate and eradicate smallpox foci by "setting up peripheral safety barriers to block the spread of smallpox." In addition, vulnerable populations would only be immunized if specific plans of attack and prior smallpox mortality and morbidity studies had taken place (Instrucciones..., sep. 1935-oct. 1945).

Another key factor in the new strategy pursued was to carry out vaccination campaigns without taking into consideration "interstate political divisions;" instead, what would be considered was the entire affected or potentially affected area "from the point of view of the epidemiological region and not the corresponding sanitary or political jurisdiction" (Instrucciones..., sep. 1935-oct. 1945). Furthermore, all emergency campaigns would have to be complemented by a background campaign to ensure the population's broadest and fullest protection. Based on these guidelines, on February 27, 1944, the then President General Manuel Ávila Camacho (1940-1946) established by decree the National Smallpox Campaign Bureau (Jefatura de la Campaña Nacional contra la Viruela). The technical office of the campaign rested on the General Epidemiology Bureau (Dirección General de Epidemiología) and the Bureau of Health and Assistance (Dirección General de Higiene y Asistencia) operating in the states and territories was responsible for implementing the new guidelines. The Office of Epidemiology and Prevention of Infectious Diseases (Oficina de Epidemiología y Profilaxis de las Enfermedades Transmisibles), under the General Epidemiology Bureau, was entrusted with the task of systematizing all epidemiological data from the different states and analyzing the monthly and weekly reports of infectious diseases that the country's health offices were obliged to submit (Secretaría..., 1944).

It is evident that the plan of action to combat smallpox demanded constant and close collaboration and communication among federal, state and municipal authorities as well as precise and timely coordination and consistency of methods. Nevertheless, in order to ensure this vast supervision and analysis of health, hygiene and epidemiological conditions, and in order to control and follow up on the health of vaccinated individuals, there needed to be a

broad, diverse, well-trained staff as well as the promotion and encouragement of a widespread health campaign among the general public, topics that will be addressed in the next section.

Doctors, epidemiologists, vaccinators and health education

One key factor in the renewed strategy to combat smallpox during the 1940s was to encourage careful collaboration among the different federal, state and municipal authorities and institutions to order to ensure that the staff of the National Campaign to Combat Smallpox comprised persons duly prepared to vaccinate, take vaccination readings, draft reports and prepare epidemiological statistics. Mexico's School of Public Health (founded in March 1922) and the training stations established by the Rockefeller Foundation in Mexico City during the early 1930s (as well as in the states of Morelos, Veracruz and Monterrey), were entrusted with training physicians, nurses, officials and epidemiologists in everything related to the conservation and application of the vaccine, as well with promoting educational exchange among Mexican and foreign institutions.

One particularly relevant transformation was the designation of an epidemiologist to head the fight against smallpox in the states were actions were to be coordinated to ensure consistency of vaccination methods and accurate reading of the results. Another task also entrusted to the epidemiologists was selecting the people who would comprise the health brigades, a responsibility shared with the officers of the coordinated and cooperative health services in the different Mexican states. The criteria for choosing staff included age, sex, state of health, personal appearance and education (they had to at least know how to read and write), and candidates were asked to present a letter of recommendation. Another selection criteria was that vaccinators, vaccination readers, medical students and residents, regular staff and extra staff could only participate after undergoing training that included how to conserve and transport the vaccine, how to read results, how to identify smallpox, and how to differentiate smallpox from other diseases (Instrucciones..., sep. 1935-oct. 1945).

At the same time, rural teachers and students – especially medical and nursing students – were encouraged to participate, and the collaboration of rural and workers' organizations was thought would be "extremely useful for gaining the population's support and aiding vaccination efforts" (Instrucciones..., sep. 1935-oct. 1945). As mentioned earlier, the staff was trained at the School of Public Health in Mexico City, at the better-organized clinics, health centers and rural clinics, at the Xochimilco Training Center that began to operate in 1934, and at the Tropical Diseases Training Center in Boca del Río (Veracruz) as of 1946.

One complementary and particularly important undertaking of the vaccination brigades was to intensify health education programs throughout the villages, towns or communities at which they arrived, no matter how small. While the federal government increased health education efforts in rural, indigenous and peasant populations in the 1920s and 1930s, it was during the 1940s when health education was considered an essential element that would aid the vaccination brigades and fortify a culture of prevention between peasant and indigenous populations. Health authorities believed health education had to be part of people's everyday lives; therefore, the support and participation of local authorities, teachers, societies and

associations was vital, and the organization of health education programs during local festivities, both civil and religious in nature, was paramount.

One objective of expansion the hygienic educational programs was "to prepare propaganda before vaccination was carried out, and to improve the notification of smallpox cases – also including chickenpox – among doctors, authorities and the general public" (Instrucciones..., sep. 1935-oct. 1945). Therefore, stress was placed on establishing cordial relations between the vaccination brigades and the local doctors (if there were any), "inspiring trust and stressing that the brigades would not snatch their patients and, that if necessary, diagnostic rectifications would be completely confidential" (Instrucciones..., sep. 1935-oct. 1945). In addition, conferences and public demonstrations regarding the vaccine and smallpox were organized for doctors that worked at the Public Education Secretariat (Secretaría de Educación Pública); articles on infectious diseases were sent to the newspaper *Salud*, and drafted guides to be recited over radio on medical and health topics related to vaccination were also elaborated (Secretaría..., 1944, p.184). Furthermore, movies about health and medical topics were displayed at both indoor and outdoor venues. Some of the films bore the following titles: "Smallpox," "Typhoid," "What is a Disease" and "Defense Against Invasion" by Walt Disney (Chavarría Valero, 1949, p.5). Finally, and this is of particular importance, the health authorities sought the collaboration of local indigenous intermediaries before and during application of the smallpox vaccine.

One example of this took place in 1948 when a brigade sent to the Uruapan and Carapan regions in the state of Michoacán sought the help of local indigenous community representatives so that the *cancioneros* could disseminate the virtues and blessings of the vaccine through songs composed in the local indigenous language – Purépecha (Chavarría Valero, 1949, p.1-2). The songs contained messages like: "When a health brigade arrives, rejoice for it brings you (all) health;" "if a pair of vaccinators comes to your door, welcome them, trust them; they are here for your welfare;" and "remember that health workers are human beings, and we are all brothers because we are human beings, and we have the duty to look out for your health; do not close the door to your house, do not run, treat them as the brothers we are" (Pámpiri, 1949, p.1-4). They also distributed bilingual pamphlets, fliers and brochures to the general public, rural teachers and local authorities in order to encourage voluntary acceptance of the vaccine (Chavarría Valero, 1949, p.1-3).

The importance granted to the health-education programs as part of the vaccination campaigns in the 1940s led the Office of Epidemiology to review and approve the publication of a small booklet to be used exclusively by rural teachers since they were expected to assume active and responsible participation in the fight against smallpox. Church support was also sought and priests were asked to mention smallpox and the vaccine during their sermons, and the notion that priests should require vaccination certificates before celebrating baptisms and confirmation sacraments was also considered. At the same time, the brigades held regular meetings with women's religious associations, such as the Catholic Ladies and the Daughters of Mary, in order to gain their support and enhance the health-education efforts necessary to effectively implement vaccination programs (Problemas..., 1948).

One subject that came up time and again in the health-education messages during vaccination programs was that under no circumstances was the vaccine to be administered

by anyone other than experts. This makes it clear than many people outside the world of state medicine and the federal health services engaged in vaccination. Precisely because of such widespread involvement, the government repeated the message that it would not provide the vaccine lymph to municipal mayors or teachers unless they had received prior instruction on how to handle the vaccine (Instrucciones..., sep. 1935-oct. 1945). The National Campaign to Combat Smallpox also stressed that the vaccine would only be applied to vulnerable populations, and on those that "do not bear the typical vaccination scar from the last five years, or who suffered from smallpox more than ten years prior" (Instrucciones..., sep. 1935-oct. 1945). This approach was intended to establish a clear distinction between the new vaccination strategy and non-selective and, thus, mass vaccination programs.

It is important to point out that the health-education programs were not designed only for the general public; they were considered fundamental for guiding the work of the large staff that daily participated in vaccination work. Through health education, the campaign sought to strengthen the ties and activities among vaccinators, rural teachers, local authorities and representatives of the indigenous and peasant communities. This collaboration, among many different players and stakeholders, was of utmost importance, especially in light of the fact that the country was still predominantly rural, culturally diverse and lacking in roads, leaving many rural communities completely isolated. It was precisely the lack of communication infrastructure to so many rural areas, made worse during the rainy season (June-September), a factor that complicated vaccine transport and frustrated the work of the vaccination brigades. As we will explore further in the following section, ensuring vaccine-lymph safety and effectiveness was one of the most recurrent technical problems and one that brought to light the limitations to the coordination, training and consistency that the National Campaign to Combat Smallpox so desperately sought.

Problems, debates and long-term setbacks

Throughout the 1940s, the smallpox vaccine manufactured in Mexico City's Hygiene Institute (Instituto de Higiene) and used in the vaccination campaigns was prepared with glycerinated lymph. This meant the vaccine needed to be stored under controlled temperatures using ice or refrigeration so that it would not become ineffective. However, improper conservation of the vaccine was one of the primary problems reported by the heads of the National Campaign to Combat Smallpox. There is evidence that in 1942, in the states of Hidalgo and Veracruz, the brigades vaccinated different patients up to six times in a row without getting any reaction. The same was reported in the city of Coahuila, in the state of Torreón (Linfa..., 1948). According to the Health and Assistance Secretariat, numerous brigades used wet sawdust and sand to conserve the vaccine. Nevertheless, these were rather inefficient methods and partially explain the succession of outbreaks in Silao, Guanajuato in 1945 and 1946 and in the state of Mexico in 1947 and 1948. Thus, the program was critically concerned with how to conserve the vaccine and "to thus save ourselves from the enormous tragedy of implementing campaigns using ineffective vaccine lymph, tragedies that are more frequent than what is presumed in our country's public-health history" (Aguirre Beltrán, 1995, p.157). This was particularly important especially if we take into consideration that,

in 1948, the Health and Assistance Secretariat acknowledged that only 700 or 800 of the 20,000 villages with fewer than 2,500 inhabitants had health centers or clinics with enough staff to properly store and distribute the vaccine. This meant that more than 19,000 villages with fewer than 2,500 inhabitants completely lacked these services, and that many towns and smaller communities had no health services or refrigeration at all, causing the inevitable loss of the vaccine (Problemas..., 1948).

While every vaccination brigade was required to carry the refrigerated lymph vaccine in thermoses with enough ice to keep it active, in most cases, the vaccine was transported from one town to another without thermoses and without ice. Vaccinators went from one area to another on horseback, donkey or foot, and when they had thermoses, it was practically impossible to keep them cooled, which meant the vaccine was "subject to contingencies from ambient temperature" (Aguirre Beltrán, 1995, p.157). In this sense, according to the physician J. Pilar Hernández Lira, who became General Director of Hygiene at the Health and Assistance Secretariat in 1950 and who had been an active participant in the vaccination campaigns in the 1940s, when he headed the Coordinated Health Services of Nuevo León in 1943, it was very common to see smallpox lymph sent back because of expired batches and because of loss of vaccination potential due to improper transport and/or storage. Hernández Lira also stated that, in 1943, one worker from the Health Bureau (Delegación Sanitaria) of Agua Prieta, Sonora, stored boxes containing 1,800 doses of smallpox lymph (equivalent to 180 tubes) inside the lab oven. When Hernández Lira checked on the vaccine, he asked the worker why he had stored the lymph inside the oven. The workers answered that "microbes proliferate with the heat of an incubator, so I put them there to generate more virus and to make the vaccines more potent so that no one can get away without being vaccinated" (Hernández Lira, 1962, p.15-16). This shows that conservation and transport of the vaccine was one of the most critical problems that the National Campaign to Combat Smallpox faced. In addition, the deterioration of the vaccine on account of improper refrigeration or transport led people or groups of people being vaccinated multiple times without any of the vaccinations having any effect whatsoever (Vacunación..., 1948).

It is important to stress the use of inactive lymph in the vaccination programs, and not the overstated "proverbial ignorance" of rural Mexicans that is too often presented in historical accounts, is an issue that can explain why so many men, women and children rejected being vaccinated. When the brigades reached a given area and were told that the inhabitants had been stricken by smallpox, the first thing they needed to do was to see if smallpox was indeed the disease that had befallen community members. If it was smallpox, they had to vaccinate all healthy people that did not show a previous vaccination scar. However, the fact that they often encountered "up to three large vaccination scars on each arm" (Hernández Lira, 1962, p.8-9) is proof of the use of inactive smallpox lymph. Therefore, in some cases, individuals' or groups' negative to receive the vaccine claiming that the vaccine brought no protection whatsoever, was entirely grounded and understandable.

In addition, in very small, isolated, remote rural communities, the brigades were met with rejection for other reasons. In 1945, in the state of Nayarit, the epidemiologist Leocadio Morales Guerrero, who headed the vaccination campaign in the state, reported that in two small houses in the mountainous municipality of Yesca that housed members stricken with

smallpox, a woman over 80 years old had refused to let her family be vaccinated. She argued that her children and herself had already been vaccinated and that she had been responsible for their vaccination. She reported that many years prior she had read a small brochure stating that an English physician had discovered and vaccinated people using the secretion from the small pustules that had formed on cow udders or farmer's hands and that those little pustules contained the vaccine ... [and that], by using a thorn to remove the liquid from the vesicles of a patient, she had vaccinated her children and herself" (Morales Guerrero, 1945, p.5). Her unwillingness to have herself or her family vaccinated is just one example of the entrenched practices and methods to contain smallpox (hand-to-hand vaccine) that prevailed in various rural communities, methods and practices that no longer played a role in the vaccination campaigns organized by the health authorities.

Other long-term difficulties concerned the safety and health of the vaccinators when sent to isolated communities, cut off from general communication routes and located in mountainous regions. As a result, vaccinators were told to carry a first-aid kit with medications appropriate "for the region" they were to traverse; to carry their bedding, clothes and drinking water and, wherever possible, to use a jeep with extra fuel and spare parts (Proyecto..., 1949). However, the travel and labors of vaccinators working in extremely hard-to-reach communities was carried out on horseback and, in some cases, vaccinators' health and safety was seriously affected. In February 1946, Dr. Magdalena Padilla, an epidemiologist heading the Smallpox Campaign in the state of Sinaloa (Campaña Antivariolosa), formed a brigade that was to traverse regions calling for a background campaign. Brigade members included the visiting nurse from the Cosalá (Sinaloa) Clinic, Lucía Salcido Valdés, the health official Francisco Reyna Camberos and volunteer nurse María del Carmen Otañez. The brigade headed out at dawn on February 13 from Cosalá to the municipality in the northern part of the town, which was the gateway to the Sierra Madre Occidental mountains. The brigade's objective was to strengthen the background campaign since the region had earlier been the site of an emergency campaign. Therefore, the brigade had orders to carry out house-by-house vaccinations, concentrating first on those inhabitants who did not have proof or certification of prior vaccination (Vidales Tamayo, 1962).

One account of what transpired states that the brigade reached the town of Aguascalientes at dawn on February 14 and proceeded to visit the outlying ranches located along the border between the states of Durango and Sinaloa. After vaccinating people of all ages house by house (31 in total) and short just two houses to complete the day's work, the brigade reached the house of Ms. Aurelia, the widow of Mr. Meza and mother to young children. Three neighbors were at the house. The nurses and health official introduced themselves and explained they were there to vaccinate. When she asked them if the vaccine was meant for adults, they explained it was for all individuals because smallpox did not discriminate between children, youth and adults. One neighbor, Antonio Valdés, an outlaw "known for being brash" and armed with a .38 caliber handgun, refused to be vaccinated. He threatened the members of the brigade, took the nurses hostage and fled with them, believing that the brigade was a part of a trap to detain him. Lucía's companions managed to escape, but Lucía did not. At dawn the following day, state authorities found her body "half naked, stripped of her undergarments, her white uniform ripped and stained with her own blood" (Biografía..., 1983-1989). She

bore five gunshot wounds; they carried her by stretcher to Napala, where a doctor said she had to be taken immediately to Culiacán. She died a few hours later.

The country's cultural and linguistic diversity was yet another problem vaccinators faced since, on many occasions, they were completely ignorant of the places in which they were to work. Indeed, Dr. Alberto Castellanos, who headed the smallpox vaccination campaign in Oaxaca, stated that as the brigade travelled through the state's Mixe region and more than 40 Mixe communities, the Council of Mixe Elders requested that the brigade explain the nature of its work. With the help of the municipal secretary, the only person who spoke Spanish, the doctor explained that he would do no harm to the Mixe, that he would not charge them any money or fees, and that he wouldn't request food of them nor pasture for the animals transporting the brigade. Castellanos added that he was not seeking election, that the brigade did not include any tax collectors and that, in addition to the smallpox vaccine, the team also carried quinine injections and quinine sulphate pills for malaria because the doctor had noticed a number of malaria cases as he visited the Mixe communities. He even added that he could extract molars, all in the name of trying to convince the elders to accept the smallpox vaccine. The Council of Elders responded by saying that, if he had omitted or falsified any information, "it would be best if [he] leave, since they lived in peace and tranquility without the help of my government" (Castellanos, 1962, p.17).

In addition to the aforementioned problems, and despite the fact that more than 28 million vaccines were administered between 1944 and 1949 (Erosa-Barbachano, 1977, p.561), there was an additional incident involving an entirely new element of concern, one that raised the eyebrows of the national health authorities and led to redoubled smallpox vaccination efforts throughout Mexico. In February 1947, US salesman Eugene Le Bar decided to return to the city of New York after having lived in Mexico City for six years. Mr. Le Bar boarded a bus on February 24 and got off in New York City on March 1. He checked into a hotel in Manhattan and soon complained of a headache, low-grade fever and general malaise. Four days later, he was admitted to the Bellevue Hospital, where he remained until March 8. He was then transferred to the Williard Parker Hospital on account of emerging vesicles on his body that were attributed to either an allergy, erythema multiforme or smallpox. On March 10, Eugene Le Bar died from smallpox. Twelve more people in New York were infected, and three ultimately died.

The US Department of Health opened a detailed investigation into the bus route from Mexico to the United States in order to identify any additional contagion foci and eliminate them. In addition, hospitals, clinics and health services in the city of New York quickly became vaccination centers. Industries, business, offices and union centers also set up makeshift vaccination clinics. In less than one month, more than 6,350,000 people were vaccinated against smallpox in the city of New York. The city had never before organized a vaccination campaign of this size in such a short period (Weinstein, 1947; Colcrove, 2006). Although three people had fallen victim to smallpox, the health authorities showed that the benefits of the vaccine outweighed the risks, which was why there was no room for alternative: vaccinate. This incident, which had started in Mexico, alerted the US and Mexican authorities to the porous nature of the shared border and led both countries to recognize the need to step up efforts to combat the disease. Consequently, in 1947,

the Inter-American Public Health Cooperation Bureau (Dirección de Cooperación Inter-Americana de Salubridad Pública) embarked on projects to increase smallpox-vaccination efforts in Michoacán and Jalisco, to safeguard the Mexico-US border and, three years later, to use lanoline lymph, making it easier to transport and conserve the vaccine. In 1950, the Health and Assistance Secretariat created the Smallpox Vaccination Campaign Bureau (Dirección General de la Campaña contra la Viruela), naming Carlos Calderón head of the institution and calling on the Pan-American Health Organization for financial cooperation (Creación..., 1947-1978).

Final considerations

The implementation of programs to contain, control and eradicate smallpox in Mexico and the Americas, undeniable priorities for the government of the region throughout the preceding century, required careful planning and strategy, the participation of a broad and diverse staff and the implementation of a widespread health-education program. Nevertheless, these topics have not been carefully analyzed in Mexican historical research. It is important to mention that most analyses focusing on how the strategy to contain the spread of smallpox in Mexico in the 1940s developed were written by the primary staff members at the time and that many of the reports have perpetuated the image of a smallpox campaign free from conflicts, problems and inertia. While the enormous significance and transcendence of smallpox eradication is undeniable, this article focuses on the idea that smallpox-vaccination efforts were not homogenous and consistent, and that they were not pursued equally in all geographic and cultural regions of the country. Likewise, this article highlights some of the changes that the vaccination programs underwent in the 1940s, especially selective and persuasive campaigns. The program staff was broad and very diverse, and there were a number of limitations and technical problems regarding transport and storage of the vaccine throughout the vaccination years. In addition, this article stresses the importance of organizing health-education programs. Health education was considered a key element to garner public acceptance of the vaccine, but it was also important so that staff, entrusted with the task of vaccination, could carry out their work responsibly and effectively. The extent, expansion and changes that the smallpox-vaccination efforts underwent, as well as the central role of health education, contributed positively to the gradual consolidation of a culture of prevention in Mexico, a culture of prevention that paved the way for later vaccination campaigns.

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NOTE

[1] In this and other citations of texts from non-English languages, a free translation has been provided.

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