

Review

Does Polio Eradication Succeed Meeting the Target Year of 2000?

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SUMMARY: The global polio eradication program is under way with the target year of 2000. We reviewed the program progress, in perspective, from the experience of the global smallpox eradication, which is at present a sole disease ever eradicated by orchestrated global efforts. We concluded that despite substantial efforts being made by the World Health Organization and member states with the current progress, it would require additional some three years, namely 2002. This would safe-guard the success. As of January 2000, there are still at least 22 endemic states in Indian Subcontinent and sub-Saharan Africa. Experiences in smallpox eradication, although the disease is different, indicated that to stop transmission in such a large number of endemic states took more than three years, assuming that further support would come toward the final goal.

Introduction

The development of medical technology has been remarkable during the last millenium, especially in the last 400 years. The circulation of the blood discovered by William Harvey in the 17th century, opened the way to scientific management of curative medicine in developed region and smallpox eradication declared by the World Health Organization (WHO) in 1980, opened the way to definitive and real equity for distribution of benefit from medical science to all the humanity, namely both in developed and under-developed regions (1).

This means, the technology development in curative medicine has been enjoyed chiefly by Western civilization and its followers including Japan, not by other civilizations such as African, Chinese, Hinduism, Islamic and Latin. Perhaps, smallpox eradication is the first human attempt in the sense that all the civilizations worked together regardless of their culture and religions, by mobilizing all the resources available in their own domains.

Polio eradication follows smallpox eradication aiming at the achievement of zero world incidence by 2000. It will certainly occur in foreseeable future, the end is beginning, but how far the end? In this note, its progress, problem and future was analyzed and forecast based on the experience gained from smallpox eradication, so that the beginning of the end should be assured.

Success of Smallpox Eradication

Smallpox eradication, even though its remarkable success, proceeded with difficulty. The first attempt (1958-1966) failed owing to the fact that industrialized states, namely Western civilization did not understand and meet with the need of

developing world of the other civilizations.

The second, namely the Intensified Program, was successful (1967-1980). WHO co-ordination effectively motivated all the civilizations, making the resources available globally. Many national heads of major smallpox endemic states placed the high priority on the programs. The strategies were innovative, including effective vaccine quality control and vaccine production promotion in selected states, surveillance and containment measures and establishment of international diagnostic laboratories.

The salient picture of progress of smallpox eradication is specifically described below (Table 1).

The program started with U.S. bilateral assistance in 19 states of West and Central Africa in 1967. It successfully stopped the transmission with the last case in Nigeria in 1970. Massive investment of international personnel (average yearly 54 U.S. personnel) as well as necessary transport (more than 100) assured the success.

In entire Asian Continent, Indian Subcontinent was major reservoir of smallpox. The commencement of the program was delayed, but, in September 1973, late Indira Gandhi, then prime minister, India, instructed all the health centers staff took one week every month only for search for smallpox,

Table 1. Smallpox eradication Disease in the number of endemic states

Table with 3 columns: Block Area, Year of Last Cases (State), No. of Endemic States Worldwide. Rows include South America, Africa West, Africa Central, America South, Africa East, Africa South, Asia South East, Horn of Africa, etc.

In polio eradication, as of January 2000, there are 30 polio endemic states (including suspected 8 states).

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being followed by containment vaccinations. After implementation of this "Autumn Campaign", India recorded the last case in May 1975. Estimated investments included assignment of average 27 international and 31 national epidemiologists. Similar program took place in Bangladesh which recorded the Asian Continent's last case in October 1975, with average 27 international and later date 28 national epidemiologists in 1974 and 1975.

Having secured the Asian Continent to be in good odor, the WHO's global program was able to concentrate on the last battle taking place in the Horn of Africa. In fact in 1976, most of international personnel engaged in Asian Continent Autumn Campaign joined national and international program personnel in Ethiopia and Somalia, the two last reservoir states of smallpox. Ethiopia recorded last case in August 1976 and Somalia in October 1977. The case detected in Somalia is, in fact, the end point of natural smallpox transmission over the last 6000 years. Since October 1977, continuing surveillance in the Horn of Africa and elsewhere in the world has not discovered smallpox until to-date. Exception was the laboratory associated smallpox cases in Birmingham, U.K. in 1978. This was quickly contained, but gave a lesson that laboratory stocks of smallpox virus did pose real risk of reintroduction of smallpox. WHO recommended, therefore, to destroy the variola virus stocks in all research laboratories, having proposed several times the dates of destruction.

As of to-date, this important post eradication action, regrettably, has not yet been implemented; U.S. and Russia have been against this policy. They fear the probable presence of smallpox bioweapon and maintain the virus stocks with dubious understanding that their retention of the virus stocks would prevent the use of such weapon.

Commencement of Polio Eradication

With recognition of this unprecedented achievement of smallpox eradication, WHO and international community thought of the next step, and agreed to strengthen immunization programs of vaccine preventable diseases. Thus, Expanded Program of Immunization (EPI) commenced early

1980.

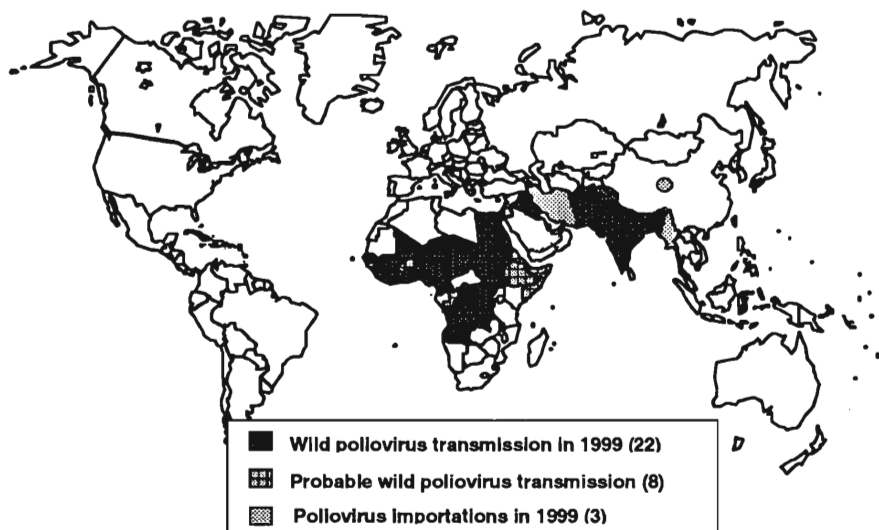
In the course of time, Pan American Health Organization (PAHO) recognized the immunization programs in a few states effectively stopping the indigenous transmission of wild polio. In 1985, PAHO decided to launch regional polio eradication in North and South America. Notably, PAHO traditionally was interested in disease eradication as seen in their failed efforts for yellow fever as well as malaria eradication. This time, encouraged by success of smallpox eradication, they, including ex-smallpox eradication staff, initiated this new venture. Being impressed by PAHO's successful execution, in 1988 WHO resolved to commence the global eradication of polio by the year of 2000.

Progress of Polio Eradication as Compared with That of Smallpox Eradication

In both diseases, there are no animal reservoir, no long-term virus shedding and effective vaccines with affordable price, and lastly, world community is concerned about the disease burden, which resulted or will result in greater possibility of global resource mobilization.

The strategy for polio eradication is similar to smallpox eradication. The main strategies consist of National Immunization Days (NIDs) and acute flaccid paralysis (AFP) surveillance. Surveillance containment measures are also aggressively undertaken in the risk areas. PAHO recorded the last endemic case of polio in 1991, WHO Western Pacific Regional Office (WPRO) in 1997 and European Regional Office (EURO) in 1998. Technical advantage of polio eradication over smallpox eradication is that polio vaccine virus can be naturally transmitted to the contacts, thus assuring wider vaccination coverage, and that fecal-oral route of polio infection may be less frequent than respiratory route of smallpox infection. Presence of subclinical infection in polio does not appear hampering the operation, as proved by successful surveillance in PAHO and WPRO.

As of January 2000, there are all together 22 endemic states reporting polio wild virus and 8 states where the virus transmission is strongly suspected due to lack of adequate



Source: Polio Eradication: WHO
Jan. 2000

Fig. 1. Status of polio eradication.

surveillance and its proximity to endemic states. They are in Africa, the Middle East and Southeast Asia (Fig. 1). The situation is compared with that of smallpox eradication. In smallpox eradication program in 1970, 7 years before the last case, there were 17 states where smallpox virus transmission was continuing (Table 1). In other words, the current situation of polio eradication, the number of endemic or suspected polio states is larger than that of smallpox eradication in the year of 1970. If the target year of 2000 were to be met, these a total of 30 states should finish the transmission from now until December 2000 (Fig. 1), namely, from now on, only 12 months.

Further, if we make the observation one year before the last case in smallpox eradication, the number of states reporting the virus was only two, Kenya and Somalia. Kenya had only importation; Somalia had an extensive outbreaks newly developed being imported from Ethiopia. The extent of resources investment was compared in both situations. In smallpox eradication, in about 40 million population areas, 45 WHO personnel were assigned for the special containment campaign in addition to the nationwide mobilization of national staff (Table 2). In polio eradication, there appears to be about 200 international staff worldwide, roughly for 1500 million population in 30 states in Africa and Asian Continent.

In the last stage of smallpox eradication, notably the number of laboratories was strictly limited to efficient and reliable ones, Centers for Disease Control and Prevention (CDC), Atlanta and Research Institute of Viral Preparation (RIVP), Moscow, both were WHO International Collaboration Center for diagnosis of smallpox. The measures were particularly critical since there was no room to make mistake in that very last stage of the global program. This was in a sense an extreme action, but there was the understanding that in the emergency situation, WHO could not afford to let limited number of program staff work for improvement of laboratory capability at that time. In polio eradication, there are at present

148 polio laboratories being engaged in surveillance activities (Table 3). Of these, 110 laboratories were accredited by WHO. Such global efforts are commendable, but polio program may wish to limit the number when the end is near.

Discussion

Why we are, first of all, specifically interested in the length of an eradication program.

As discussed in the Eradication Conference, held in Berlin in 1997, the cost-benefit of eradication program depends upon its length of eradication program, namely "the longer the global program, the greater the expenditure and the lesser the benefit"(2). For example, North and South America became free of polio in 1991 and Western Pacific in 1997. Though this is commendable achievement, they must continue surveillance as well as immunization program as long as polio remains endemic in Indian Subcontinent and African Continent.

We would note, there is a striking similarity between smallpox eradication and polio eradication program in terms of the endemic states making "fast" progress and those making "slow" progress. As mentioned previously, smallpox eradication was first launched in 1958. All the 59 states of smallpox endemic were recommended to conduct vaccination programs. In about 12 years' time, states in Latin America as well as in Western Pacific became endemic smallpox free. Thus, the Intensified Program dealt with the 31 endemic states of sub-Saharan Africa, Indian Subcontinent, and Indonesia (Fig. 2).

In polio eradication, it had been started from 1985 in South and North America, and globally from 1988. Similarly in about 12 years' time, "fast" states in Latin America as well as Western Pacific became endemic free. And since 1995, the global program was dealing with endemic states, so to speak "slow" states, in sub-Saharan Africa and with those in Indian Subcontinent. Parenthetically, Egypt and Iraq made fast progress in smallpox eradication, but only slow progress in polio eradication, reason for which may need some studies.

Now the question is "Can polio eradication program stop polio transmission in 2000?", or how near the end?

Since 1998, substantial efforts have been made to strengthen the national programs in sub-Saharan Africa as well as Indian Subcontinent. Here, we should review the situation in smallpox eradication as previously mentioned. There were 1) the U.S. bilateral CDC program with Headquarter (HQ) in Lagos, Nigeria in 19 states of West and Central Africa (1967-1970) with the last case in Nigeria in 1970, 2) Autumn Campaign (1973-1975) in Indian Subcontinent with the last case in Bangladesh in 1975, and 3) Horn of Africa Campaign (termed "Crocodile" in Ethiopia) with the world last endemic case in 1977. The number of personnel international as well as national were certainly far greater than those for current polio eradication (when the number of personnel international as well as national are available, it would be desirable to make correct comparison).

As of January 2000, polio eradication is positioned where? It would not be certainly the position comparable to the smallpox eradication's 1976-one year before the world last case.

Those "slow" states in polio eradication have some advantages over some endemic states during smallpox eradication, first, they have had experience in EPI programs during last 15 years. Secondly, they should have a confidence they can do, if they want, having achieved the great success in smallpox eradication in the past. Further vaccination apparently

Table 2. Estimated number of WHO personnel and of laboratories for smallpox eradication as of 1976-1977

	No. of personnel	Population (Estimated in 1970)
Regional Office	3	-
Ethiopia	16	26 million
Somalia	25	3 million
Kenya (importation)	1	11 million
Total	45	40 million

Laboratories to support surveillance are only 2 - one in CDC, Atlanta and the other in RIVP, Moscow.

Table 3. Type of laboratories for polio in January 2000

WHO Regional Office	Global	Regional	National
AFRO	-	3	12
AMRO	1	1	8
EMRO	-	4	8
EURO	4	1	44
SEARO	-	4	13
WPRO	1	2	42
TOTAL	6	15	127
		148	

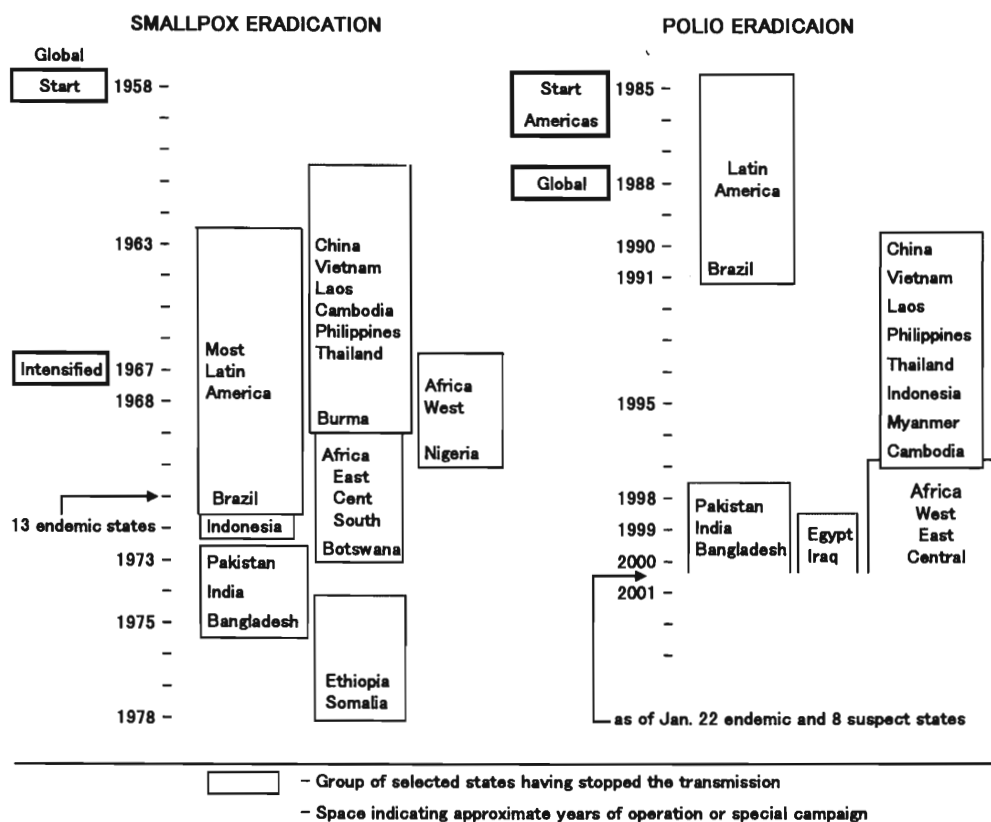


Fig. 2. Comparison: how states making progress in smallpox and polio eradications.

is relatively effective to stop transmission in low densely populated areas like sub-Saharan Africa (3). How much these things could accelerate the progress meeting 2000 year target? In smallpox eradication, massive investment of international and national personnel in “slow” states was cause of success as described before. It should be noted that although the diseases are different, managerial aspect of eradication global should be the same.

Parenthetically, in smallpox eradication, the last epidemic in the Horn of Africa was, in fact, “set-back”. We were complacent on incomplete surveillance capability in these areas. In polio eradication, political instability appears to be worse than that 20 years ago. Epidemics in Angola was a good lesson. Therefore, strengthening surveillance capability would be also top priority in catching up. We are not saying, the Horn of Africa would be the last polio endemic area. It could be any states where surveillance is poor and resulting containment is ineffective.

These reviews may lead to concern that the target 2000 (December 2000) may not be reached. As mentioned before, technically both programs should be feasible, but different modus operandi makes one wonder how the polio program meets the target. It should be noted that even with such greater investment the smallpox program had enormous difficulties such as war, shortage of funding and extremely difficult geographical terrain which required helicopters. In all aspects, it would be sensible to give additional three years as to meet the target, based on the experience that the above mentioned special eradication campaigns could eliminate the foci roughly in three years’ time. We should stress that if the current program met the target in 2002 (three years from now), it would be still the second greatest achievement by WHO and by member states following smallpox eradication. It would

be fair and sensible for polio program to indicate new target year of 2002, at time of World Health Assembly (WHA) 2000 or of October 2000 when WPRO declares the freedom of polio in part of Asian Continent. In this occasion, it is of vital importance to request additional resources to finish the job up.

This revision of target date needs courage. Though, nothing wrong, and politically solid. Once WHO said “Health for all by 2000”. Without special notion, the phrase disappeared. We should assure public that once we say, it will be so. Also, pressing too much endemic states toward zero incidence may lead to false surveillance results as happened in Iran and Somalia during the last stage of smallpox eradication program.

What is the plan, then? The last acceleration period requires to conduct 1) cautious and dispassionate analysis of programs in individual polio endemic states, and 2) estimate of requirements for additional resources to be made available in terms of personnel as well as contingency funds for field and laboratory work. Whether or not the magnitude of investment done by smallpox eradication campaigns should be applied would be critical decision, but it is absolutely certain that substantial increase in international and national personnel will be needed to meet a new target year. As done in smallpox eradication, a special information officer already recruited would be important to deal with the world major presses. When the incidence goes down to some level, reward announcement also can be of help. This would prevent suppression of case reports. Provision of transport may need special attention. As done by U.S. bilateral in West Africa in 1967-1970, Japan International Cooperation Agency (JICA) provided 257 vehicles to polio eradication in China in 1990’s. Any query by international community should be responded promptly. Perhaps, priority will also have to be re-examined

and determined with clear understanding that the operational program to “stop endemic transmission” should come first. Smallpox program staff sometimes broke the WHO rule. This may be a lesson polio program should “not” take.

Lastly, we should add, in this discussion, we did not use the number of reported cases. Instead, we used the number of endemic states. Because the varied surveillance capability often leads to the confusing assessment of actual status of disease transmission. Also, certification program was not mentioned, of which virtual purpose is for all WHO member states to rest assured that they can safely disestablish the polio immunization, and this was not objective of this report.

Measles Program

Discussion on measles eradication program has started. However, unless polio eradication is over, measles program should be of a low priority. It is noted that in WPRO, former Regional Director advised not to talk on measles elimination before achieving zero polio in the Region. In fact, this was a wisdom for the success. Sometime in future, there will be a global measles eradication program, lessons from smallpox eradication as well as this on-going polio eradication will be useful.

Conclusion

Polio eradication is now in progress to interrupt the wild polio transmission globally. It aims to be by December 2000, namely only one year left for the completion of the program, when this report is being prepared.

Experience in special eradication campaigns conducted by the past smallpox eradication was used to assess and safe-guard the current progress of the global eradication. Such assessment led to cautious thinking that additional three years would be required to reach the global interruption of transmission.

Considerable efforts so far made by WHO as well as member

states are commendable. The momentum, if intensified by additional mobilization of world resources, would make the global program reach the end in 2002. For global resource mobilization, it would be rational strategy, namely Japan together with other partners focus on Asian Continent and U.S. and E.U. on Africa.

Although the delay thus occurred, if succeeded, it would be a tremendous success by humanity after smallpox eradication, in the history of preventive medicine. All the people under different civilizations will be benefited.

Acknowledgment

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