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wealthy countries of the world. Hence international assistance was available on an adequate scale. Global eradication could probably not have been achieved this century if the national responses had not been thus supported. Indeed, the national response in these two countries was really reverse aid; the developed countries (and the world as a whole) profited more than did Somalia and Ethiopia. It is important, therefore, always to consider the geographic scale of any proposed eradication campaign.

Successful eradication in countries and continents is a useful indicator of the likelihood that global eradication might succeed; for example, smallpox had already been eradicated from Europe and North America when WHO first proposed global eradication in 1958. Countrywide efforts at eradication of measles and poliomyelitis are worthwhile not only in relation to the country involved but also as a possible prelude to attempts at global eradication once the socioeconomic preconditions for the latter goal have been established.

Yekutieli's comparative analysis of the four eradication campaigns achieves a balanced view of the relative merits of eradication and control, assessing the strengths, weaknesses and problems of each programme. The prime requirements for eradication, on any sizable geographic scale, are the technical and epidemiological factors. Eradication is impossible to contemplate without a good tool, like an effective vaccine. Given this, national and international socioeconomic factors become of major importance. The four eradication campaigns reviewed were "basically social phenomena", but

I can see no reason why any other virus should ever occupy the smallpox "niche" now that it has been vacated.

none of them could have been contemplated without a particularly good tool (insecticide, vaccine, or drug). It is the lack of such tools, as well as the nature of some diseases, that has inhibited initiatives with other important infections; it is the ambition of WHO's Special Programme for Research and Training in Tropical Diseases to provide the technical tools for the control of some of these diseases. If promising tools are discovered, Yekutieli's other preconditions should be examined, to see whether eradication rather than control is a reasonable goal, and on what geographic scale it should first be attempted.

Finally, if a novel and effective tool is discovered that makes it reasonable to contemplate eradication

on at least a countrywide scale, it may be valuable to introduce, at the appropriate time, a strong and specific "vertical" component into the development of general health services, which is now the top priority health-related activity in most developing countries.

D. A. Henderson

— I foresee no candidate diseases for a decade

In the course of time, many have employed the term "eradication" with mounting enthusiasm and diminishing precision. I have listened incredulously to respected authorities evaluating the prospects for the "eradication" of urban rabies, unnecessary traffic accidents, and even hunger and poverty. Professor Yekutieli performs an invaluable service to public health by recalling the definition and in weighing the practicalities of disease eradication on the scientific balance and in terms of administrative realities.

It seems to me that abuse of the term "eradication" and its application essentially as a slogan have been the result of well-meaning but ultimately destructive political motives. Misuse of the word can serve only to reduce the scientific credibility of public health. It is of critical importance that we return to a clear definition of the word and its implications and that these be identified in terms of reality.

The reason for increasing imprecision in use of the word "eradication" is not difficult to discern. Primarily, it relates to the practical difficulties experienced by health officials in obtaining even the most modest funds for demonstrably effective public health measures. Politicians and administrators have traditionally been far more amenable to allocating large sums of money for buildings and curative services, which predictably produce grateful patients and constituents. Although successful programs in prevention may be more cost-effective, they are usually less visible and recognizably beneficial than is, for example, the pediatrician administering an intravenous infusion to a dehydrated infant or a surgeon applying a cast to a fracture. Disease control through improvement of water supply, the fluoridation of water, or the application of a vaccine does not have the same personal-emotional connotations of a physician "laying on

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DISCUSSION

hands" to bring the patient back to health. In arguing the case for prevention, the beleaguered health administrator is at a distinct disadvantage compared to his clinical colleague.

The case for "eradication," however, can be compelling. One can argue for a larger capital budget expended over a finite period and eventually permitting all expenditure for control of the disease to be stopped. Implicit is the ultimate vision of a national pride of achievement and public officials receiving accolades before grateful constituents. The siren song of eradication can be even more appealing to donor agencies, which all but universally insist that their contributions to projects be limited strictly to a finite period — preferably 3-5 years.

Regrettably, the public health profession has too often succumbed to the temptation to advocate eradication in an effort to persuade the reluctant. In so doing, scientific objectivity has been abandoned, the concept bastardized, and the credibility of public health expertise called into question.

The first eradication campaign—against yellow fever—seemed scientifically plausible when it began. Moreover, Gorgas had demonstrated its practical feasibility in difficult although geographically limited tropical areas. The campaign finally ran aground on the reef of an unsuspected jungle reservoir of the virus. However, the resources were quickly redirected to a campaign to eradicate the urban vector of the disease, *Aedes aegypti*. The scientific basis and practicability of this campaign were less secure.

By the time the vision of global malaria eradication was displayed, dispassionate scientific assessment had been replaced by the stated imperative that eradication had to be achieved rapidly before DDT resistance of the vector became widespread. But was it ever feasible? Should this ever have been the stated goal? Professor Yekutieli aptly quotes from the 1968-69 reexamination of the global strategy: "unless the present methodology is further simplified, global eradication, though theoretically possible, will continue to be beyond reach for many years to come." He neglects to point out that, from the inception of the program, the eradication of malaria in sub-Saharan Africa was considered by most to be a highly doubtful proposition, at best. There is no question but that the transmission of malaria was interrupted over large geographic areas, and with better epidemiology, more effective administration and larger expenditures it might have been interrupted over even larger areas. Unhappily, however, the public health profession enthusiastically and uncritically proclaimed global eradication to be the objective and persuaded their political confreres that this was possible as a time-

limited objective. That the program failed is unfortunate; that the public health profession was substantially discredited in the process is tragic.

There is no question but that the campaign to eradicate smallpox was the subject of justifiable political skepticism despite the fact that it required an entirely different strategy for an entirely different epidemiological entity. On the scientific level it made sense. Operationally, the use of a vaccine to immunize people is a far cry from the use of an insecticide to kill mosquitos. Feasibility had been demonstrated. By 1966 transmission had been inter-

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rupted by less than optimal programs in a number of the poorer developing countries under widely different conditions. This implied that others could do likewise. The political climate, however, was far less salubrious than that which Professor Yekutieli sketches. True, the World Health Assembly unanimously concurred that a global eradication campaign should be undertaken. However, if even one-tenth of the resolutions unanimously approved by the Assembly were taken seriously by Member governments, the world would be a far healthier place than it is today. Many governments were persuaded to undertake the smallpox eradication program only with the greatest difficulty. Most frequently cited in argument was the observation that eradication demonstrably could not be achieved. The malaria program provided ample evidence. It was a view shared by many senior officials of WHO and by donor agencies alike. UNICEF, which had so generously supported malaria eradication, refused to provide support except to assist some laboratories in vaccine production. The US Agency for International Development, which initially offered generous assistance to the countries of western and central Africa, refused to provide further support until 1976, when the program had been ill but concluded; Ethiopia was then the only infected country. Few potential donor countries were more enthusiastic. As Professor Yekutieli correctly notes, international assistance to the campaign over the entire 12-year period 1967-1979 was only \$112 million. Why so little for a program that would clearly benefit all countries? Quite simply, our credibility as public health professionals was rightly viewed with skepticism.

I fully support Professor Yekutiel in his statement: "There are no suitable candidates [for eradication] in the immediate future." Smallpox, for many reasons, was by far the most likely candidate. By the narrowest of margins and through the utmost dedication and imagination of highly motivated field staff, materially aided by good fortune, the campaign succeeded.

I would hope that the term "eradication" might now cease to be used and advocated unless indeed we intend and expect to achieve this goal within a specific limit of time. Given available technology and today's practical and political realities, there are no candidate diseases, and I foresee none for at least a decade.

Measurable objectives, reasonably defined and ultimately achievable have less "sex appeal" than vaguely defined nirvanas. However, in the longer term, I believe the profession will be better served by proclaiming more modest aspirations, which can be realized. Even now our credibility is being put to the test in the unfortunate proclamation: "Health for All by the Year 2000." Too many today regard this as a program objective rather than as a political slogan to encourage a shift in emphasis in health policy. That it is a hopelessly unrealistic goal is patently obvious. However, the more it continues to be proclaimed as a program objective the more will public health be discredited, as it has been so frequently in the past by emotional slogans of this nature. □

W. Koinange

— *There must be room for flexibility*

Professor Yekutiel's penetrating analysis should make policy-makers review their approach on this important field of public health. The preconditions he proposes for eradication programmes are reasonable but, as the article clearly states, only compliance in principle should be required and there must be room for flexibility. Yekutiel discusses the philosophy of eradication in terms of exogenous and endogenous microbiological agents. In practical terms I agree that the exogenous infections are first priority, but to assert that the eradication of diseases caused by endogenous agents is "illusory and has never been contemplated by any serious epidemiologist or health administrator" is admitting defeat and does not serve to encourage devel-

opments in immunopathology, which may one day enable us to solve the very problem of why some such organisms cause "harm only under special conditions of stress in the host".

One derives much encouragement from the observation that when eradication has been achieved for a disease arising from some exogenous agent, its replacement by a similar disease has not so far been of any consequence. This should make

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policy-makers appreciate that it is worth while putting a great effort into eradication programmes. The key to eradication is the permanent interruption of transmission.

Infectious diseases are still a very big public health problem in many developing countries and are likely to remain so for several decades to come. Their control and eventual eradication are therefore issues that people in a large part of the world will have to face. The administrative arrangements are of great importance, considering all the constraints that exist. I do not agree that for success "a semi-autonomous organization within the health administration [is] a precondition that can only rarely be waived".

The problems of a semi-autonomous organization in a weak health structure are so many that if one were to accept this precondition one would not find sufficient personnel or resources available and there would be no coordinating machinery to manage such a system. Each country has to have the mix of basic techniques, financing, and imaginativeness that is appropriate to it. In my view the establishment of such organizations would not only cloud the issues but compromise the health delivery system. Control or eradication has to be done with the cooperation of neighbouring countries because diseases do not respect boundaries. The benefits are not only to nationals but to mankind. It is only through active international participation that we can hope for future control or eradication of diseases.

This excellent article ended on a disappointing note by implying that there are no diseases that can be eradicated in the near future. Poliomyelitis, louseborne typhus, and schistosomiasis are given as examples of diseases that could be considered, but in the end they are excluded. In science, what is impossible today sometimes turns out to be possi-

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