

ESTIMATE OF THE COST OF A MALARIA ERADICATION PROGRAM¹

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The potential benefits of an eight-year program to wipe out malaria in Paraguay are measured in terms of the actual value of agricultural productivity now lost as a result of the disease.

Of all the production factors, it is the human element—the labor force—that merits particular consideration. The validity of this statement rests on the following facts:

a. The individual is always the intended beneficiary of production, since in the last analysis every production effort is aimed at meeting a human need, whether for food, health, housing, or another requirement.

b. The individual is the active element of production, and his work capacity is one of the chief determinants of production efficiency.

But the capacity of men to produce and, by so doing, to improve their economic and social conditions is, in turn, largely dependent on environmental factors, which in Latin America are generally unfavorable.

In Paraguay, malaria is high on the list of factors adversely affecting the potential productivity of man. This is a matter of grave concern, particularly since the means are now available for eradicating the disease and Paraguay is making a serious effort to speed up development of its economy.

The present report attempts to arrive at an estimate of the social cost of the loss in man-hours caused by malaria in Paraguay. The resultant loss is then compared with the total cost of carrying out an eight-year

eradication program through the National Malaria Eradication Service (NMES).

By evaluating the effects of malaria on productivity—using estimates for the agricultural sector, the one most seriously affected by the disease—it was possible to establish the economic feasibility of the program in cost-benefit terms.

Loss Caused by Malaria

According to data supplied by NMES, based on a three-year period of continuous observation and methodical tabulation, the number of malaria cases in Paraguay is 90,000 a year in the agricultural sector alone, and the average number of working days lost is 44 per case per year (Table 1). In 1965, the productivity loss attributable to the disease was equivalent to US\$6,478,599, not counting the related losses in other economic sectors or the medical care expenses of the victims.

It is noted, by way of example, that the loss of potential productivity in the agricultural sector, although conservatively estimated, is equivalent to 5 per cent of the sector's total product and to more than 10 per cent of the value of Paraguay's exports for the year. Moreover, the estimate does not include the value of volunteer community services, offered free of charge, which on a paid basis would cost the equivalent of US\$87,000 a year.

Rate of Return of the Eradication Program

Table 2 shows the cost of the malaria eradication program in each of its eight years

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TABLE 1—Estimate of potential output lost as a result of malaria in the agricultural sector of Paraguay, 1965.

Subsector	No. of persons affected	Assumed output per man-day (US\$)*	No. of days lost	Production lost (US\$)*
Farming	72,810	1.18	44	3,780,295
Cattle raising	8,280	5.62	44	2,047,478
Lumbering	8,910	1.66	44	650,786
Total	90,000			6,478,559

* Paraguayan currency converted to dollars at the rate of exchange in effect in 1962.

and the sources of financing. According to estimates by NMES, the campaign will begin to produce favorable effects from the second year and will reach its peak of activity in the fourth year. By the end of the sixth year, malaria should be virtually eradicated, so that the two remaining years would be devoted to consolidation work.

Cumulative progress toward eradication would be 10 per cent after the second year, 20 per cent after the third, 50 per cent after the fourth, 80 per cent after the fifth and 100 per cent by the end of the sixth year.

By comparing the cost of the program with the productivity losses the program is intended to eliminate, we arrive at the figures shown in Table 3.

In social programs, such as many of those

carried out by governments, the economic benefits cannot be measured in the same way, or as readily, as those of private enterprises. In private activities the prime motivation is turning a profit and every effort is bent toward that goal. In government services the criteria are based on a different scale of values, though in the last analysis a proper selection of programs will result in higher productivity throughout the country and, perhaps, a better distribution of national income.

In private enterprise it is technically possible to measure the return per unit of investment by determining the cost-benefit ratio, but the situation is rather different in the case of programs and projects in such fields as health, education, and housing, where there are indirect as well as direct effects.

TABLE 2—Cost of the malaria eradication program in Paraguay, by years and by sources of funds.

(In thousands of US\$)

Year	Total cost	Paraguayan Government	AID ^a	UNICEF ^b	PAHO/WHO ^c	Balance to be funded ^d
1st	904	320	235	347	2	—
2nd	1,140	427	435	275	3	—
3rd	1,152	427	458	264	3	—
4th	1,200	427	500	270	3	—
5th	821	427	278	113	3	—
6th	620	427	—	33	3	157
7th	582	427	—	24	3	128
8th	529	427	—	18	2	82
Totals	6,948	3,309	1,906	1,344	22	367

^a Loan. ^b Grant. ^c Grant, not including salaries of consultants. ^d The National Government of Paraguay will finance this balance by increasing the contribution of GNP in the next few years.
Source: NMES.

TABLE 3—Rate of return of the malaria eradication program in Paraguay.

(In thousands of US\$)

Year	Cost		Benefits				Adjustment factor *
	Disbursements in year	Adjusted value	Productivity losses to be eliminated		Adjusted value		
			Annual	Cumulative	Annual	Cumulative	
1st	904	837	—	—	—	—	0.92592593
2nd	1,140	977	648	648	555	555	0.85733882
3rd	1,152	914	1,296	1,944	1,029	1,584	0.79383224
4th	1,200	882	3,239	5,183	2,381	3,965	0.73502985
5th	821	559	5,183	10,366	3,527	7,492	0.68058320
6th	620	391	6,479	16,845	4,083	11,575	0.63016963
7th	582	340	6,479	23,324	3,780	14,355	0.58349040
8th	529	286	6,479	29,803	3,500	18,855	0.54026888
Totals	6,948	5,186	29,803		18,855		—

* Source: Standard Mathematical Tables— $i = 0.08$.

While programs of this kind will obviously help to increase the production capacity of certain social groups, it is difficult to estimate with any degree of accuracy the additional amount these groups will be enabled to produce, and even more difficult to determine the linkage effects of the added production on other sectors of the economy.

Despite these difficulties it is now imperative, in view of the many services provided by governments, the scarcity of resources and the growing needs of society, to establish some method of resource allocation that will ensure the greatest possible economic and social returns for each monetary unit spent by the government. A number of methods are available for estimating the benefits arising from the use of government funds. The essence of the matter is to determine which are the factors influencing the benefits and how they can be evaluated.

Adjustment Factor

In this report a simple methodology has been applied to this problem. An attempt has been made to determine how much the agricultural sector's share in the gross national product (GNP) would be if a single factor (malaria) did not exist and all the others remained as they are. It is logical to

assume that production would rise, since the present victims of malaria would not have the disease and would be able to work during the time now lost on account of malaria, which would add an extra volume of goods to those now produced. The difference between what would have been produced and what is in fact produced is the gap to be closed, that is to say, the volume of production to be recovered through a malaria eradication program. This difference represents the amount of benefits that would accrue to the economy as a whole if the program were carried out.

Table 3 makes abundantly clear that the investment would yield tremendous returns: the benefits would be 328.9 per cent of the costs, taking gross values as a basis, or 263.6 per cent if adjusted values are used. No account has been taken of benefits in the post-program years, after malaria is eradicated.

It was thought advisable to use an adjustment factor in the computations, in order to arrive at a closer approximation of the return on investment. The reason for this is that there are always alternative uses to which resources can be put, or, expressed in other terms, assigning resources to one use means denying them to another. The potential yield of this other use, technically

known as the "opportunity cost," is what we have tried to consider in this case. If the malaria program is decided upon, it will be allotted resources that could be used for another program or programs. If another alternative were chosen the "opportunity cost," or return on the other investment, would have to be at least 8 per cent, including the time factor, since that is the minimum interest rate paid for the use of money in Paraguay.³

Table 3 also shows that by the fifth year the favorable effects of the campaign would be equivalent to the sum invested and the program would then be financially self-sustaining. From then on, production would show a constant and steady rise and the settlement areas, currently beset by malaria, would be brought into the economic and social mainstream.

In other words, if there were no malaria in Paraguay the agricultural sector alone would be able to produce, in four years, an added volume of goods with a value equal to the total cost of the Acaray dam.⁴ In a single year the added production would be sufficient to cover the cost of a modern 350-bed hospital, and over the eight years of the campaign the value of the increased output would be equal to the cost of 300 rural schools.

These facts are sufficient proof of the benefits offered to the country's economy by a program of this kind. Moreover, since Paraguay's economic and social development efforts are directed to achieving a sub-

stantial improvement in living conditions, malaria eradication is more than just an important measure that can be taken; it is a national commitment to which high priority is attached.

Summary

This article presents an estimate of the social cost of the reduction in productivity caused by malaria in Paraguay as well as of the total cost of an eight-year eradication program.

The number of malaria cases is estimated at 90,000 a year, each losing an average of 44 working days in the agricultural sector alone. In 1965 the cost of reduced productivity in agriculture was estimated at US\$6,478,589, not counting the effects on other sectors of the economy.

The campaign, as envisaged by the National Malaria Eradication Service, will begin to produce favorable effects in the second year and will achieve its target in the sixth; the two remaining years will be used for consolidation purposes.

The evaluation criteria used in government activities are different from those used in profit-making enterprises, because of the variety of services and the paucity of resources. It is therefore essential to allot the available resources to programs providing maximum returns. According to the method used in this report, the potential returns of the program are equal to the difference between what would have been produced if malaria had not existed and what has in fact been produced. The data offered show a rate of return of more than 300 per cent, taking gross values as a basis, and of more than 250 per cent if adjusted values are used.

The adjustment factor in Paraguay is at least 8 per cent. There are indications that by the fifth year the favorable effects of the campaign would be equal to the sum invested and the program would be financially self-sustaining.

³ The interest paid on savings accounts in any bank in the country is 8 per cent.

⁴ On the Acaray River in eastern Paraguay.