

FORMULATION OF GOALS FOR LIFE EXPECTANCY AT BIRTH IN COSTA RICA (REPORT OF ONE EXPERIENCE)¹

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Life expectancy at birth is a summary indicator of the health status of a country. Thus every method of formulating realistic life expectancy goals must take into account the goals already defined for all the programs which in one way or another will affect this health status.

Introduction

Health unquestionably plays a double role in socioeconomic development; as a component of well-being, in one sense it is a goal of the development process; but since health's presence increases the productivity of human resources and its absence decreases this productivity, health is also one of the means for achieving development.

The III Special Meeting of Ministers of Health of the Americas (Santiago, Chile, 2-9 October 1972) set forth new health goals for the present decade in the document entitled *Ten-Year Health Plan for the Americas*.³ During this meeting each of the countries represented committed itself to undertake concerted efforts to achieve these goals.

In Costa Rica, the Ministry of Health sought to match the efforts to be made with the tasks required in each area of work. To accomplish this, it asked its Sectoral Planning Unit to adapt the goals of the Meeting and to formulate recommendations with the aim of updating the health policy that would guide the country's activities in this sector for the rest of the decade.

After nationwide information on each of the program areas defined in the above-

mentioned Ten-Year Health Plan had been compiled and analyzed, a basic working document was prepared. High-level technical personnel from different institutions and sectors, who were responsible for the programs in each of the areas studied, discussed the document at length in a series of meetings held in a period of a little over two months. These discussions gave rise to a set of recommendations on policies, goals, and strategies for the remaining years of the decade 1971-1980, which were then submitted to the participants for final approval.

In turn, these documents and recommendations provided the basis for the *National Health Plan, 1974-1980*, developed within the context of the policy set by the Ministry, within the general guidelines of the Ten-Year Health Plan for the Americas, and within the anticipated guidelines of the National Development Plan as inferred from preliminary published documents. The National Health Plan, in accord with these indicated standards, envisages five major areas of program activity, concerning:

- (a) Life expectancy at birth.
- (b) Coverage of services.
- (c) Service programs.
- (d) Supporting services.
- (e) Infrastructure development.

Projection of Life Expectancy Data

Although life expectancy at birth is a reflection rather than a cause of the country's

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³Pan American Health Organization, Washington, D.C., 1973 (PAHO Official Document 118, 1973).

general level of health, it ranks first among the plan's areas of activity. This is because it is considered a joint product of factors within the health sector (to be dealt with by the rest of the plan) and factors outside the sector, and also because it is a major indicator that reflects the degree of accomplishment of all the other formulated goals—goals whose attainment would lead to specific proposed declines in mortality.

Conversely, although life expectancy at birth ranked first among these areas of program activity, it was the last to be analyzed in formulating recommendations, and this analysis was performed only after recommended goals for all the other areas, as well as the general scope of these goals, had been defined. For purposes of this life expectancy analysis, assistance was requested from the Latin American Center for Demography (CELADE), which has a branch in San José. We consider the Center's participation to have been of great value, since it enabled us to formulate specific goals in this difficult planning area.

In order to arrive at conclusions on this subject, the following measures were carried out:

(a) Analysis of birth rates, death rates, and life expectancy at birth in the countries of the Region, as compared with similar information for Costa Rica.

(b) Analysis of the possibilities for reducing national mortality rates among the different age groups, assuming the persistence of historical trends, if no changes resulting from new programs were introduced.

(c) Comparison of national age-specific mortality rates with those of a developed country (Sweden) in order to clarify the theoretical possibilities for mortality reduction.

(d) Analysis of the leading national causes of death for each age group and the extent to which deaths from these causes would probably be reduced by achieving the goals recommended in the other parts of the National Health Plan.

(e) Preparation of a document setting forth various alternatives for reducing mortality among each group in accord with the goals established in the other program areas of the plan.

TABLE 1—Life expectancy at birth in Middle and South America: rough estimates of average annual rates of death, birth, and natural population growth in 1970-1975, per 1,000 inhabitants.

Area	Estimated annual rates (1970-1975 average)		
	Mortality per 1,000	Birth rates per 1,000	Rates of natural increase per 1,000
Argentina	8.8	22.9	14.1
Bolivia	18.1	43.8	25.7
Brazil	8.5	36.9	28.4
Chile	8.7	31.0	22.3
Colombia	9.0	43.9	34.9
Ecuador	9.9	43.4	33.5
Paraguay	9.3	44.6	35.3
Peru	8.8	39.8	31.0
Uruguay	9.1	20.9	11.8
Venezuela	6.6	40.3	33.7
Costa Rica	6.0	33.3	27.3
El Salvador	11.0	46.5	35.5
Guatemala	13.0	41.7	28.7
Honduras	15.3	48.5	33.2
Nicaragua	14.7	46.8	32.1
Cuba	6.9	26.1	19.2
Dominican Republic	13.0	48.1	35.1
Haiti	17.6	43.6	26.0
Mexico	7.7	42.1	34.4
Panama	7.1	39.2	32.1
Barbados	7.5	24.1	16.6
Guyana	6.6	39.0	32.4
Jamaica	6.2	32.7	26.5
Trinidad and Tobago	6.0	28.1	22.1
Guadeloupe	5.9	31.4	25.5
Martinique	6.3	30.3	24.0
Puerto Rico	6.2	23.1	16.9
Surinam	7.2	42.0	34.8
Windward Islands	7.1	35.3	28.2
Other areas	6.3	28.8	22.5

Source: Latin American Center for Demography (CELADE), *Boletín Demográfico*, Vol. IV, No. 8, 1971.

(f) Preparation of abridged life tables in accord with the alternatives established in item (e).

(g) Preparation of a consolidated table showing what life expectancy at birth could be achieved by realizing the various reductions in mortality set forth in these abridged tables.

(h) Selection of the alternatives most consistent with the goals recommended for each age group.

Results

The findings obtained in this manner were as follows:

For countries of the Hemisphere south of the United States, estimated annual mortality in the period 1970-1975 was found to range from 5.9 to 18.1 per 1,000 inhabitants; Costa Rica appeared near the lower limit of this range, with an estimated rate of 6.0 per 1,000 inhabitants (see Table 1).

Similarly, the estimated annual birth rates were found to range from 20.9 to 48.5 per 1,000, producing natural rates of population growth ranging from 11.8 to 35.5 per 1,000. The birth rate for Costa Rica (33.3 per 1,000) was found to be somewhat lower than the average for the countries studied, which accounts for the fact that the estimated natural rate of population growth (27.3 per 1,000) was also slightly below average.

An essential step in preparing life tables is analysis of mortality rates by age group. Comparison of the rates found for 1950, 1963, and 1972 showed that mortality was reduced to varying degrees among different age groups in the periods 1950-1963 and 1963-1972 (see Table 2). Because of important implications for defining goals, it should be noted that in these periods the percentage reductions in mortality among children under one year and 1-4 years of age were less than the percentage reductions set forth in the goals of the Ten-Year Health Plan for the Americas. (The latter call for reducing mortality among children under one year of age by 40 per cent, within a range of 30-50 per cent, and for reducing mortality in the 1-4 age group by 60 per cent, within a range of 50-70 per cent.) Consequently, unless appropriate measures are taken to change these past trends, the goals of the Ten-Year Health Plan will be difficult to achieve.

Nevertheless, if the mortality rates of Cos-

TABLE 2—Costa Rica: Age-specific mortality in 1950, 1963, and 1972, showing the percentage reduction in the interim periods 1950-1963 and 1963-1972.

Age in years	Annual mortality per 1,000 inhabitants ^a			% mortality reduction in each period	
	1950	1963	1972	1950-1963	1963-1972
<1	102.0	85.1	67.7	16.6	20.6
1-4	15.7	8.0	4.4	49.0	45.0
5-9	2.7	1.5	1.0	44.4	33.3
10-14	1.4	0.8	0.5	42.9	37.5
15-19	1.9	1.2	1.1	36.8	8.3
20-24	3.2	1.6	1.6	50.0	0.0
25-29	3.8	2.0	1.5	47.4	25.0
30-34	4.5	2.6	2.2	42.2	15.4
35-39	5.6	3.1	2.6	44.6	16.1
40-44	6.9	4.2	3.1	39.1	26.2
45-49	9.3	5.7	5.2	38.7	8.8
50-54	12.7	8.0	6.7	37.0	16.3
55-59	19.6	12.6	11.6	35.7	7.9
60-64	28.1	20.0	15.7	28.8	21.5
65-69	41.7	32.2	28.7	22.8	10.9
70-74	65.8	51.2	43.2	22.2	15.6
75-79	100.4	75.3	68.5	25.0	9.0
80-84	144.5	112.7	94.9	22.0	15.8
≥85	232.7	210.3	161.1	9.6	23.4

Source: M. Romero, *et al. Tablas de vida de Costa Rica, 1962-1964*. Universidad de Costa Rica, San José (Publicaciones de la Universidad de Costa Rica, Serie Economía y Estadística, No. 24).

^aRate calculated on the basis of deaths reported.

ta Rica and those of a developed country (Sweden) are compared, the picture changes radically (see Table 3). That is, we can see that the theoretical reductions possible in the Costa Rican rates are very high for the younger age groups, reaching 81 per cent for children under one year of age and 84 per cent for those of 1-4 years. At the same time, the reductions possible among the older age groups are very limited; for example, in terms of the Swedish rates no reduction is possible among those over 75, since from that age onward the mortality rate in Sweden is higher than in Costa Rica.

An analysis of the 10 leading causes of death by age group shows that existing techniques can prevent or reduce the impact of six of them in children under one year of age and of eight in the 1-4 year age group. Gastroenteritis and colitis, preventable with environmental sanitation measures, were the leading cause of death among the 1-4 year group for all of the past decade (1961-1970), being recorded as the second

cause only in 1971, and even then by only a narrow margin. The second and third causes of death in this same period were pneumonia (including bronchial pneumonia) and measles. A similar situation prevailed among those dying under one year of age, enteritis and colitis being the first cause of death in this decade and pneumonia being the third. Enteritis and colitis can be prevented by environmental sanitation measures, measles can be prevented by immunization, and the lethality of all these diseases can be reduced by timely and appropriate treatment.

For those between 5 and 44 years of age, the first cause of death was accidents, the incidence of which can also be reduced by preventive measures.

Analysis of the National Health Plan's other areas of program activity as of 1970 showed that 45 per cent of those dying under one year of age did not receive medical care. In the same year, 36.5 per cent of the infant mortality was due to infectious and parasitic diseases; likewise, 70 per cent

TABLE 3—Potential reduction of Costa Rican mortality, by age group; comparison of mortality in Costa Rica (1972) and in Sweden (1966).

Age in years	Costa Rica (1972)	Sweden (1966)	Mortality in Sweden as a % of mortality in Costa Rica	Reduction potential of Costa Rican rate (%)
< 1	67.7	12.7	19	81
1-4	4.4	0.7	16	84
5-9	1.0	0.4	40	60
10-14	0.5	0.3	60	40
15-19	1.1	0.7	64	36
20-24	1.6	0.8	50	50
25-29	1.5	0.7	47	53
30-34	2.2	1.0	45	55
35-39	2.6	1.5	58	42
40-44	3.1	2.2	71	29
45-50	5.2	3.3	63	37
50-54	6.7	5.3	79	21
55-59	11.6	8.2	71	29
60-64	15.7	14.0	89	11
65-69	28.7	23.5	82	18
70-74	43.2	39.9	92	8
75-79	68.5	69.5	101	0
80-84	94.9	114.8	121	0
≥ 85	161.1	207.5	129	0

Source: United Nations, *Demographic Yearbook, 1967*, and Central Statistics and Census Administration of Costa Rica.

TABLE 4—Costa Rican life expectancy at birth and how it could be changed by alternative reductions in mortality among different age groups.

Alternative No. (see Annex)	% mortality reduction (<1 year)	% mortality reduction (1-4 years)	% mortality reduction (5-14 years)	% mortality reduction (15-44 years)	% mortality reduction (≥45 years)	Life expectancy at birth (years)	Relative increase (years)
1	Costa Rica: both sexes, 1972, based on uncorrected observed deaths					68.15	—
2	20	—	—	—	—	68.93	0.78
3	30	—	—	—	—	69.32	1.17
4	35	—	—	—	—	69.52	1.37
5	40	—	—	—	—	69.71	1.56
6	—	40	—	—	—	68.62	0.47
7	—	50	—	—	—	68.73	0.58
8	—	55	—	—	—	68.78	0.63
9	—	60	—	—	—	68.84	0.69
10	20	40	—	—	—	69.41	1.26
11	30	50	—	—	—	69.91	1.76
12	30	55	—	—	—	69.96	1.81
13	35	35	—	—	—	70.16	2.01
14	40	60	—	—	—	70.42	2.27
15	20	40	5 levels in model U.N. Tables ^a			70.52	2.37
16	30	50				71.02	2.87
17	30	55				71.08	2.93
18	35	55				71.27	3.12
19	40	60				71.54	3.39
20	30	50	5 levels ^a (U. N.)	10 levels ^a (U. N.)	5 levels ^a (U. N.)	71.50	3.35
21	30	55				71.56	3.41

^aSee United Nations, *Age and Sex Patterns of Mortality: Model Life-Tables for Under-Developed Countries*, New York, 1955 (ST/SOA/Series A/22).

of the deaths in the 1-4 year age group were caused by problems that could have been prevented or reduced with existing techniques.

On the basis of the foregoing analysis, 21 alternatives were examined for the purpose of estimating possible changes in life expectancy at birth (see Annex). These take the following circumstances into account: the existing situation, the goals established at the III Special Meeting of Ministers of Health of the Americas, and the goals proposed at a high technical level and set forth in Costa Rica's National Health Plan.

Overall, the alternatives allow for the following: reduction of infant mortality by 20 to 40 per cent; reduction of mortality among the 1-4 year age group by 40 to 60 per cent; and no reduction among older age groups or a rate of reduction considered

“normal” according to a U.N. recommendation for constructing life expectancy tables. The reductions considered “normal” in making life tables and used here in the computations for groups over 5 years of age assume a gain for the period of five “levels” of mortality reduction in conformity with model tables drawn up by the United Nations.⁴

In addition, two other alternatives—which involved twice the “normal” reduction of mortality among the 15-44 year age group—were explored in order to project the favorable effect which achievement of such a reduction would have on life expectancy at birth.

⁴United Nations, *Age and Sex Patterns of Mortality: Model Life-Tables for Under-Developed Countries*, New York, 1955 (U.N. Population Studies Document No. 22, ST/SOA/Series A/22).

Preparation of these life tables, based on the cited alternative age-specific mortality rates, yielded the results summarized in Table 4. This table indicates the impact on life expectancy of the alternative assumptions about percentage reductions in mortality among various age groups. In view of the current situation and proposed national goals, especially those in the areas of "maternal and child health and family welfare" and "rural health," alternatives 16 and 17 appear to be the most realistic for the country. These reductions cannot be attained unless all the other proposed goals are achieved, since the former depend on the latter as well as on existing levels of socioeconomic development. Consequently, efficient execution of all the proposed programs is required.

Alternatives 20 and 21 show that the sub-

stantial effort needed to double the projected reduction of mortality in the 15-44 age group, which would have to be achieved primarily by high-cost action to restore health, would result in a relatively small increase in life expectancy that would not warrant the effort required. This may be seen by comparing alternatives 20 and 21 with 16 and 17.

It is clear that the procedure employed here constitutes nothing more than the application of a rational line of thought. Nevertheless, since the planning of this work was a product of joint efforts by groups in various disciplines working together to analyze a common problem, it was felt that a description of this procedure and its outcome could prove useful to others engaged in health planning work.

SUMMARY

Costa Rican authorities have finished a national adaptation of the goals of the Hemisphere's *Ten-Year Health Plan for the Americas*⁵ and have formulated a National Health Plan for 1974-1980. This work was coordinated by the Health Sector Planning Unit and was assisted by various multidisciplinary and multi-institutional working groups. The methodology set forth in this article was developed by a group responsible for formulating goals with regard to life expectancy—the last of five health-related subjects analyzed, and one regarded as dependent on the rest.

In brief, this methodology was as follows: Birth rates, death rates, and life expectancy at birth in the other countries of the Region and in a developed country (Sweden) were compared with those prevailing now and in the past in Costa Rica. This served as a basis for projecting Costa Rica's future prospects

if no changes were made, or if certain changes were made through implementation of new programs.

This was followed by analysis of leading causes of death in the country—by age group and vulnerability of those dying, and by probable reductions in mortality that would result from achieving the goals established for other programs. On this basis, various alternative reductions in mortality for each age group were considered. Using these alternatives, abridged life tables were devised, and these in turn were used to draw up a table showing the life expectancy at birth that would result from realization of each alternative. This made it possible to derive life expectancy goals that were consistent with the goals for reducing mortality in each age group that were formulated during the sectoral planning process.

It is hoped that this general procedure, illustrated here with data from the Costa Rican case, may prove useful to others engaged in health planning work.

⁵Op. cit.

ANNEX

Assumptions underlying each alternative presented in Table 4
(based on 1972 data for both sexes).

Alternative No.	Assumptions
1	No special assumptions. This is the base to which the modifications indicated on subsequent lines are applied. It was developed from observed mortality data for 1972 (both sexes) and a mid-1972 population estimate based on the sample 1973 Census.
2	20 per cent reduction of infant mortality.
3	30 per cent reduction of infant mortality.
4	40 per cent reduction of infant mortality.
5	50 per cent reduction of infant mortality.
6	40 per cent mortality reduction in the 1-4 year age group.
7	50 per cent mortality reduction in the 1-4 year age group.
8	55 per cent mortality reduction in the 1-4 year age group.
9	60 per cent mortality reduction in the 1-4 year age group.
10	20 per cent reduction of infant mortality and 40 per cent mortality reduction in the 1-4 year group.
11	30 per cent reduction of infant mortality and 50 per cent mortality reduction in the 1-4 year group.
12	30 per cent reduction of infant mortality and 55 per cent mortality reduction in the 1-4 year group.
13	35 per cent reduction of infant mortality and 55 per cent mortality reduction in the 1-4 year group.
14	40 per cent reduction of infant mortality and 60 per cent mortality reduction in the 1-4 year group.
15	Mortality reduction of 20 per cent among infants and 40 per cent in the 1-4 year group, plus "normal" reductions in other age groups.
16	Mortality reductions of 30 per cent among infants and 50 per cent in the 1-4 year group, plus "normal" reduction in other age groups.
17	Mortality reductions of 30 per cent among infants and 55 per cent in the 1-4 year group, plus "normal" reductions in other age groups.
18	Mortality reductions of 35 per cent among infants and 55 per cent in the 1-4 year group, plus "normal" reductions in other age groups.
19	Mortality reductions of 40 per cent among infants and 60 per cent in the 1-4 year group, plus "normal" reductions in other age groups.

- 20 The same reductions as in Alternative 16, except for twice the "normal" reduction in mortality among the 15-44 year group.
- 21 The same reductions as in Alternative 17, except for twice the "normal" reduction in mortality among the 15-44 year group.
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