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**THE IMPACT OF SOCIAL
AND ECONOMIC POLICIES**

Chapter 16

THE CASE OF COSTA RICA

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INTRODUCTION

Costa Rica is composed of two well defined ecosystems: the Inter-mountain valley with a subtropical climate where 60 percent of the total population of 2,4 million live; and the low coastal areas. At the time of the last census (1973), 58 percent of the population were classified as rural dwellers. Of the remainder, 750,000 lived in the metropolitan area of San José.

The national economy is based on agricultural exports although over the last two or three decades an incipient industrialization has taken place. The gross national product in 1980 was approximately US\$ 2000 per capita which is among the highest in Latin America.

There has also been considerable social development in Costa Rica which is reflected, for example, by a literacy rate of more than 90 percent, an infant mortality rate of 20 per 1,000 and a social security system covering 80 percent of the total population. Successive governments have ensured the redistribution of the benefits of economic progress by improving public services (education, health, social security, etc.) at the same time that they have encouraged economic growth based on a protectionist and subsidized model.

The evolution of public health progress in Costa Rica can be described according to three stages of development:

- a) The first stage includes the period up to the 1920's and is characterized by the virtual absence of any public health measures. Activities were limited to medical assistance offered by charity institutions, and some simple measures for the control of some epidemics.
- b) From the 1920's to the 1960's, the health sector expanded, in part due to the social reforms of the 1940's. During this period, the health programme benefited from the import of new highly efficient and low-cost techniques. By the end of the 1960's, the health sector was organized around three basic agencies, but without much coordination among them:
 - The Central Sanitary Office of the Ministry of Health; this Office, which had limited economic resources, was in charge of preventive medicine and the implementation of specific activities (some with considerable success, such as the anti-malaria campaign);
 - The Central Assistance Office of the Ministry of Health; through the Committees for Social Protection, this agency offered medical and hospital assistance of doubtful quality to people with scarce economic resources;
 - The Social Security System, with more economic resources, offered medical and hospital services (some of them highly specialized) to a restricted sector of the population.
- c) The third stage began around 1970 and is characterized by a more rational use of existing resources and a rapid improvement in health conditions, (for example, life expectancy rose from 65.3 to 72.5 years between 1970 and 1980). Health services based on primary care reached populations that had previously lacked them (rural-disperse and urban-marginal) by means of the Rural Health and Community Health programmes, Social Security became universal, medicine was virtually socialized and nutrition programmes were strengthened. Organized community participation was promoted in health programmes. A vigorous latrine and rural sewerage construction campaign was developed and additional resources were granted to the health sector so that by 1980, health expenditure accounted for 8 percent of the gross national product. The political basis for this public health development was the social conscience of the people in government who wished to redistribute, by means of services, some of the benefits of economic progress. Secondly, this expansion of the health sector was economically viable due to the substantial growth of the Costa Rican economy during a prolonged period (from 1964 to 1979); per capita gross domestic product grew, in real terms, at an average rate of 4 percent annually. In addition, these public health developments represent the culmination of a series of activities carried out during approximately 50 years, in which an important amount of experience, knowledge, institutional organization, resources, and infrastructure were accumulated.

A brief summary of the demographic transition in Costa Rica is presented in Table 1¹. Mortality began to decrease around 1850 following a

¹Costa Rica has reasonably reliable vital statistics. It is estimated that about 95 percent of deaths are registered and that birth registration is practically complete. It must be kept in mind, however, that although vital statistics for the country as a whole are reliable, this may not be true for small geographical divisions.

TABLE 1
Rates of natality, mortality, natural increase, infant mortality
and total fertility, Costa Rica, 1910-80

Years	Crude birth rate	Crude death rate	Rate of natural increase	Infant mortality per 1000 live births	Total fertility rate (children per woman)
	(Rates per 1000 population)				
1910-20	46	30	16	195	...
1920-30	46	27	19	187	...
1930-40	45	23	22	154	...
1940-50	44	18	26	112	...
1950-60	48	12	36	89	6.9
1960	48	10	38	76	7.3
1965	42	9	33	75	6.5
1970	33	7	26	63	4.9
1975	30	5	25	38	3.8
1980	31	4	27	19	3.7

Source: Rosero, 1982a, p. 11.

severe cholera epidemic. Natality remained high up to about 1960, and even increased in the 1950's. As a result, the country's rate of population growth increased, reaching a maximum of 3.8 percent in 1960, one of the highest in the world.

By 1980 the population growth rate (2.7 percent per year) and the crude birth rate (31 per 1,000) still remained moderately high, despite the dramatic decline between 1960 and 1975. On the other hand, mortality is now nearly as low as in most of the developed countries with a life expectancy at birth close to 73 years and an infant mortality rate of 19 per 1,000. The crude death rate of 4 per 1,000 is one of the lowest in the world.

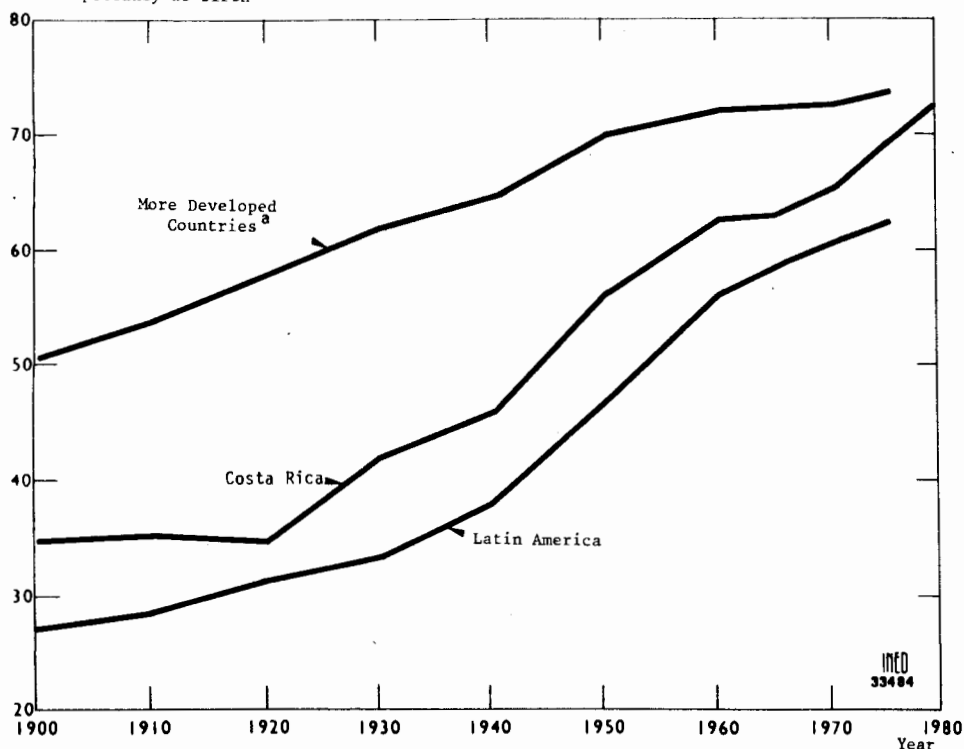
I. THE DECLINE OF MORTALITY

A) General Trend of Mortality

Costa Rica has always exhibited a more favourable mortality situation than the Latin American average (see Figure 1). This is consistent with the relative social homogeneity inherited from the colonial period, as well as the relatively successful economic transition to world capitalism (by means of coffee exports) at a lower social cost than other countries of the region.

Life expectancy in Costa Rica and in Latin America as a whole around the beginning of the century was markedly lower than the more developed countries (35 years compared with 58 years in 1920). Since then, the gap has narrowed. Moreover, during the 1970's when health progress in Latin America

Life expectancy at birth



^a Average of Denmark, France, England and Wales, Norway, Netherlands, Sweden and the United States (before 1940 only the State of Massachusetts).

Figure 1

Life expectancy at birth in Costa Rica, Latin America and more developed countries, 1900-1980

tended to moderate, Costa Rica continued to register impressive gains to reach a similar level as the more advanced countries.

The various phases of mortality transition in Costa Rica can be described as follows:

1) *The second half of the 19th century*

What information is available shows that there were some improvements in life expectancy. Following the cholera epidemic of 1856, there were no more important mortality crises. The advances in these years were probably due to the application of certain isolation measures against epidemics and, perhaps, to a certain improvement in the population's resistance to disease as a consequence of economic growth.

2) The first two decades of the 20th century

During this period, life expectancy remained stable at around 35 years. Two occurrences that may have hindered any further public health progress were: a) migration to malaria infected zones of the Atlantic Coast where the banana plantations were; and b) the economic crisis during the years of World War I (per capita exports at 1970 prices fell from US\$ 114 in 1913 to US\$ 64 in 1918), which led to a deterioration in living standards.

3) The 1920's and 1930's

Life expectancy at birth during this period increased from 35 to 46 years. It was also during this time that the first public health programmes were initiated, which were undoubtedly a major factor responsible for the mortality decline, despite their limited coverage. Even during the economic crisis of the 1930's mortality decline was maintained as the public health programmes more than compensated for the detrimental effects of the economic crisis.

4) The 1940's and 1950's

This was the time of most rapid health improvement. In Costa Rica life expectancy rose by 17 years (from 46 to 63 years). These gains coincided with the advances in medical sanitary technology which occurred especially during World War II (antibiotics, DDT, new vaccines) and which enabled health programmes to become more efficacious. Nevertheless, this was not the only factor. Various government initiatives including the creation of the Social Security system and the reorganization of the Ministry of Health also contributed. During this period the standard of living in Costa Rica increased significantly, (per capita product at 1970 prices increased from US\$ 398 to US\$ 474 between 1945 and 1960). Furthermore, the old oligarchic-liberal system of government was replaced by a benefactor-type one with a much greater sense of social responsibility.

5) During the 1960's

As in the majority of Latin American countries, a deceleration of the rate of mortality decline took place as the impact of health programmes of moderate cost which did not substantially alter the level of living was exhausted (see Arriaga, 1981). In addition, during the first years of the decade, Costa Rica experienced a period of economic stagnation and was affected by a natural disaster (eruptions of the Irazu Volcano in 1963-64).

6) In the 1970's

Mortality decline resumed and life expectancy rose from 65.3 to 72.5 years, bringing Costa Rica to the levels of the more developed countries. Even if the decline observed in this decade was not as fast as that in the 1940's and 1950's, it is more significant in that it was peculiar to Costa Rica which departed from the pattern of relative stagnation prevailing in Latin America; moreover, it occurred at a level of mortality at which gains are much more difficult to achieve. The causes of Costa Rica's success can be ascribed primarily to the efficient health policies that were applied during the decade. There was also a rise in living standards brought about by economic growth and the redistributive policies of the Government. The cumulative effects of past

development - education, communication (roads, electricity, telephones), social and health infrastructure - also created optimum conditions (very particular to Costa Rica) for the implementation of a successful health policy.

In short, the evolution of mortality in Costa Rica can be characterized according to the following four stages:

- a) "Natural" mortality (until 1856): very high and unstable mortality rates reflecting frequent epidemic crises;
- b) Slight decline of mortality without major public health improvements (from 1857 to 1921);
- c) Accelerated mortality decline with low-cost sanitary measures and the incorporation of new technologies (1922-1970);
- d) Transition from mortality level and pattern of a developing country to that of a developed country (decade of the 1970's) with a reorientation and rationalization of health policies.

B) Decline of Mortality by Age and Sex

Table 2 shows the trend in mortality rates by age and sex since 1900. The largest relative decline has taken place among children 1 to 4 years of age and among adolescents, a pattern similar to that observed in other populations. The evolution of infant mortality shows two distinct trends: prior to 1970 infant mortality declined less rapidly than death rates of adults; since 1970 the reverse is true. It would thus appear that significant progress in reducing infant mortality can only be expected after health programmes adopt an integral approach and following a sustained period of economic growth. On the other hand, rapid declines in adult mortality occurred during a period of relative economic stagnation and, fundamentally, as a result of low-cost programmes.

Another factor that may have contributed to the acceleration of the decline of infant mortality is the drastic reduction in birth rates which commenced in 1960. This effect may in part be due to there being a smaller proportion of births at a higher risk of death (i.e. births to women at extreme ages of reproductive life, multiparity women, short birth intervals), and in part to the fact that lower birth rates enable better care for the child, both by parents and by public health and nutrition programmes.

Table 2 also shows the average mortality rates of seven developed countries around 1975. From a comparison with Costa Rica one may note the progress which must still be made to achieve a mortality level that is possible with presently available medical-sanitary technology. Provided the pace of mortality decline over the last decade is sustained, Costa Rica should reach this level before the end of the 1980's.

With respect to sex differences in mortality, Costa Rica has followed the well-known pattern of increasing male over-mortality with declining general mortality. For example, in 1900 life expectancy at birth for females was 1.8 years greater than for males (35.4 years compared with 33.6); by 1980, this difference had widened to 4.7 years (75.0 years and 70.3 respectively).

TABLE 2

Age-specific death rates, Costa Rica, 1900-80 and more developed countries (MDC), 1975

Year	Age group (in years)					
	0 ^a	1-4	5-19	20-39	40-59	60+
Death rates per 1000						
1900	196.3	48.2	6.1	14.8	25.0	82.9
1910	208.5	49.5	5.5	12.3	24.3	80.3
1920	176.6	48.9	7.3	14.5	27.3	85.0
1930	171.7	34.8	4.9	8.6	16.8	72.1
1940	137.5	28.1	3.4	7.3	16.3	75.0
1950	95.5	15.7	2.0	4.3	11.4	65.0
1960	80.4	8.0	1.2	2.3	8.0	59.6
1965	81.1	7.8	1.1	2.3	7.7	59.1
1970	66.8	5.7	.94	2.0	6.9	57.4
1975	41.2	2.4	.73	1.8	5.9	54.8
1980	21.2	.96	.57	1.4	5.2	53.0
MDC ^b (1975)	11.3	.57	.43	1.0	5.7	51.7
Average annual decline (in percent)						
1900-80	2.8	4.9	3.0	2.9	2.0	0.6
1900-40	0.9	1.3	1.5	1.8	1.1	0.3
1940-60	2.7	6.3	5.2	5.8	3.6	1.2
1960-70	1.9	3.4	2.4	1.4	1.5	0.4
1970-80	11.7	17.7	5.0	3.4	2.8	0.8
1980-90 ^c	6.0	5.3	2.9	3.2	-	0.2

^a Probability of infant death.^b MDC figure is an average figure based on rates for Denmark, France, England and Wales, Norway, Netherlands, Sweden and the United States.^c Reduction necessary to reach in 1990 the rates of the MDC group around 1975.Source: Rosero, 1982b; United Nations, *Demographic Yearbook*.

C) Causes of Death

The epidemiological transition in Costa Rica has, as elsewhere, produced a radical change in the structure of mortality by cause. Of particular note is the virtual eradication of malaria and mortality due to intestinal parasites, diseases which in 1930 accounted for 11 and 7 percent of deaths respectively. The decline in mortality from diarrhoeal diseases has also been substantial; in 1930, these diseases were responsible for 18 percent of all deaths but for only about 2 percent in 1980. Currently, Costa Rica has a pathology similar to that of the more developed countries (although the relatively young age structure ensures some differences), with more than half of all deaths occurring from three groups of causes: cardiovascular diseases (25 %), cancer (17 %), and accidents and violence (12 %).

For certain infectious diseases with a high incidence, detailed series of crude death rates are available for Costa Rica since the 1920's or thereabouts. These are shown in Figure 2. The impact of new treatments or preventive techniques on these diseases is clear. Thus the role of residual insecticides, which were introduced in Costa Rica immediately after the second world war, in the control of malaria, the introduction of antibiotics at the end of the 1940's for the treatment of diverse infectious diseases, especially tuberculosis, as well as new vaccines for immunization, including BCG for tuberculosis (beginning in 1952) and diphtheria, pertussis and tetanus (DPT) (at the end of the 1960's), can be easily observed.

Evidently, not all of the decline of mortality from these causes can be ascribed to the import of new technologies. For example, in the case of tuberculosis, it can be seen that in the first half of the century (and especially

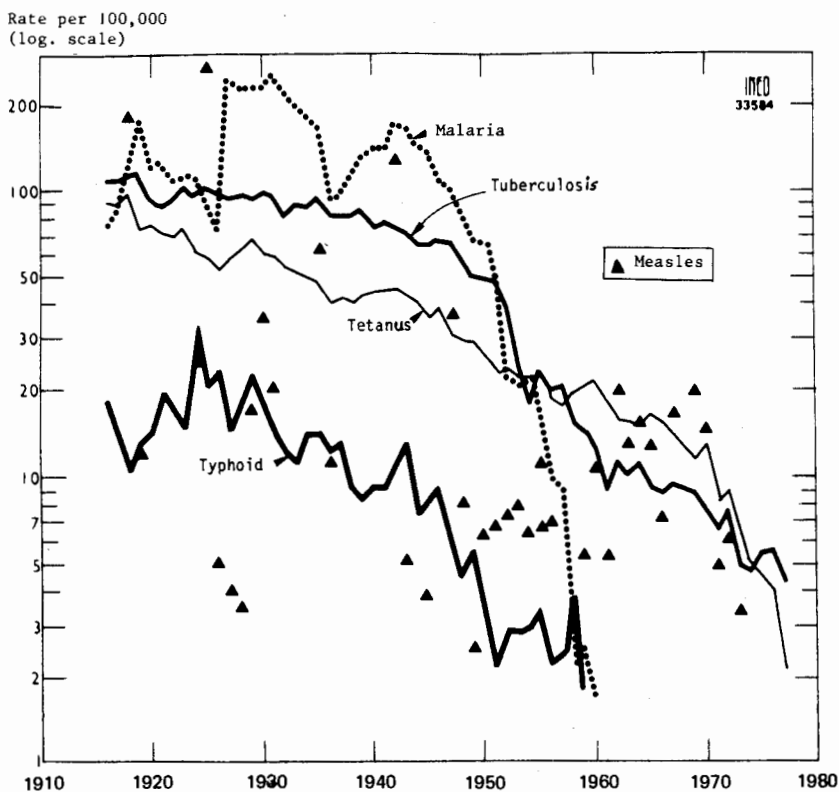


Figure 2

Trends in crude death rates for certain infectious diseases, Costa Rica, 1916-1977

since 1930), a substantial reduction had already taken place. Indeed, in absolute terms, this decline was as large as that which occurred in the 1950's when new treatment, diagnostic and immunization procedures were available. Rather, a complex set of factors have acted to control the different causes of death, including the previous anti-tuberculosis programme, an increase in the population's resistance to disease and less exposure to contamination through higher living standards, environmental hygiene in urban centres, elimination of common breeding grounds for flies and gnats; and improvements in food control. Notwithstanding the effects of these various factors, the impact of new technology is clear and can be well identified.

It is also of interest to briefly review the contribution of the various causes of death to the overall decline of mortality. These contributions, which are shown in Table 3, depend not only on the proportional decline of death rates (first column of Table 3), but also on the initial level of mortality from each cause.

As might be expected, the bulk (at least 75 %) of the declines in mortality in Costa Rica between 1940 and 1980 has arisen from the control of infectious and parasitic diseases. At least 40 percent of the decline of mortality was due to the control of diseases which are closely related to environmental hygiene (diarrhoea, malaria and other parasitic diseases). A further 20 percent of the decline (that due to influenza-pneumonia-bronchitis and respiratory tuberculosis) may be largely attributed to the availability of new and efficient drugs (particularly antibiotics) for their treatment. Improvements in the nutritional condition of the population have also undoubtedly played a significant role in these trends by increasing the resistance of the host and reducing the lethality of the infection.

An important difference can be discerned in the structure of the causes responsible for the decline of mortality up to 1960, from those determining the decline thereafter. Whereas infectious diseases accounted for almost all (roughly 90 percent) of the decline in the first period (1940-1960), in more recent years this contribution was reduced to 55 percent; indicating that factors such as access to specialized medical care (possibly through universal social security) and improvements in the general welfare of the population have recently exerted greater influence.

Nonetheless, even during this latter period (1960-80), the major reasons for mortality decline continued to be the control of infectious diseases, particularly diarrhoeal diseases (23 %) and respiratory diseases (16 %). This was mainly achieved through the reorientation and rationalization of health programmes (effective extension to the rural-disperse and urban-marginal populations via a primary health care strategy) and in a political framework favourable to the development of strong redistributive social programmes.

D) Reduction of Socio-Economic Differentials in Mortality

Table 4 allows a comparison of differential mortality among children aged less than two years according to the mother's level of education for both Costa Rica and Latin America. In relative terms at least, the pattern of differential mortality prevailing in Costa Rica during the period was very similar to that for Latin America as a whole. The reasons for lower overall mortality in Costa Rica are two-fold: firstly, for each socio-economic group as defined by

TABLE 3

Percentage decline in cause-specific standardized death rates and their relative contribution to total mortality decline, Costa Rica, 1940-80

Cause of death group	Percent decline in death rates, 1940-80	Contribution (in percent) to total mortality decline over the period:		
		1940-80	1940-60	1960-80
<i>All causes</i>	75	100	100	100
<i>I. Causes attributable to "micro-organisms"</i>	96	75	87	55
Diarrhoeal diseases	97	22	22	23
Influenza, pneum., bronch.	89	15	14	16
Malaria	100	11	18	0
Other parasitic diseases	99	7	9	4
Respiratory tuberculosis	96	5	7	2
Other infectious diseases	96	15	17	10
<i>II. Causes not attributable to "micro-organisms"</i>	45	25	12	45
Certain diseases of infancy	61	1	-4	8
Maternal mortality	96	2	2	1
Certain chronic diseases	73	4	5	2
Cardiovascular diseases	25	2	1	6
Neoplasms	26	0	-3	5
Violence (excl. motor veh. acc.)	29	1	1	1
Auto accidents	-1700	-1	-1	-2
Other and unknown causes	65	16	11	24

A negative sign indicates an increase in mortality over the period.

Source:

Cause of death categories have been adapted from Preston, Keyfitz and Schoen (1972); data are taken from DGEC, Anuarios Estadísticos and are shown more fully in Appendix Table 1.

TABLE 4

Mortality of children under two years of age, by education of the mother, Latin America and Costa Rica, 1966-1971

Years of education of the mother	Probability of dying (times 1,000)		Ratio LA/CR
	Latin America	Costa Rica	
<i>Total</i>	117	81	1.44
None	150	125	1.20
1-3 years	118	98	1.30
4-6 years	91	70	1.20
7-9 years	61	51	1.20
10 years or more	41	33	1.24
Ratio: none/ 10+	3.7	3.8	

Source: Behm, 1982.

this criterion (mother's education), the probability of dying was uniformly lower in Costa Rica and, secondly, the proportion of children in the more disadvantaged groups was lower than in Latin America as a whole. But the general conclusion still holds; prior to the early 1970's, the health programmes of Costa Rica were not adequate to reduce the inequalities in survival chances.

Although differences in the target population make it difficult to determine whether these differentials have narrowed with mortality decline, the figures presented in Table 5 from two fertility surveys suggest that some progress at least in this regard has been achieved. In particular, the absolute difference in mortality rates according to mother's education has declined dramatically in the 1970's although the relative difference, after narrowing considerably between 1965-69 and 1970-74, has remained unchanged since then. The reverse was true of the urban/rural differential which remained essentially stable until the second half of the 1970's after which a dramatic improvement in the relative infant mortality rate of the rural population occurred.

TABLE 5
Infant mortality rate according to mother's education
and place of residence, Costa Rica, 1965-79

Variable	1965-69	1970-74	1975-79
	Infant mortality rates per 1000		
<i>Total</i>	75	64	22
<i>Years of education of mother</i>			
Less than 4	89	83	33
4-6	73	56	20
7 or more	24	40	16
<i>Less than 4 vs. 7 and over:</i>			
Difference	65	43	17
Ratio	3.7	2.1	2.1
<i>Residence</i>			
San José	51	39	17
Other urban	71	75	18
Rural	86	71	26
<i>Rural vs. San José</i>			
Difference	35	31	9
Ratio	1.7	1.8	1.5

Source:

For 1965-74: World Fertility Survey, 1976.

For 1975-79: Contraceptive Prevalence Survey II, 1981.

Differential trends in infant mortality between the capital city San José and the country as a whole presented in Table 6 also provide some insight into this question. These trends, which are probably representative of other socio-economic differences in mortality, corroborate previous statements regarding the evolution of Costa Rican society during the present century and, consequently, of mortality. A widening of inequalities during the first half of the century can be seen as a consequence of a series of historical factors already mentioned. In effect, as Table 6 clearly shows, the sanitary policies implemented during these years mainly favoured the more privileged groups, in this case primarily the inhabitants of the capital of the Republic. This is not at all exceptional; given an unequal social order, sanitary progress is generally achieved firstly in certain segments of the population (those enjoying better socio-economic conditions), and only afterwards are the effects of some of these improvements felt by the rest of the population. What is exceptional in the Costa Rican case is the reversal of this tendency in the 1970's, following a period of 20 years or so when the difference between the mortality of the two groups had essentially stabilized.

There is, therefore, a close connexion between the beginnings of this homogenization process, and the social reforms of the 1940's and the adoption of a new style of development following a social-democratic model. However, it still required a new approach to health policies to eliminate much of the socio-economic inequality in survival chances.

TABLE 6
Infant mortality rate in Costa Rica and San José City, 1920-80

Period	Rate (per 1000)		Difference ^a	
	Costa Rica	San José	Absolute	Percent
1920-24	194.2	171.4	22.8	13.3
1925-29	179.4	144.2	35.2	24.4
1930-34	160.0	120.2	39.8	33.1
1935-39	148.0	101.5	46.5	45.8
1940-44	131.0	89.4	41.6	46.5
1945-49	99.7	64.0	35.7	55.8
1950-54	87.2	56.0	31.2	55.7
1955-59	73.7	51.3	22.4	43.6
1960-64	76.4	49.6	26.8	54.0
1965-69	66.0	45.8	20.2	44.1
1970-74	51.0	36.4	14.6	40.1
1975-77	33.0	24.7	8.3	33.6
1978-80	21.0	20.0	1.0	5.0

^a Excess mortality of Costa Rica compared with San José.

Data corrected for the period 1920-27. Rates for 1938, 1946, 1947, 1955 and 1957 have not been included because of incomplete or insufficient information. Before 1950, rates for San José city refer to the four districts of the city, and from 1950 onwards they refer to the whole canton.

Source: DGEC, *Annuarios Estadísticos*.

II. IMPACT OF PROGRAMMES ON MORTALITY DEVELOPMENT AND PUBLIC HEALTH

A) *Historical Context*

The economic, social, and sanitary development of Costa Rica during the period 1910-1980 is summarized in Figure 3, which shows the annual change in infant and adult (ages 20 to 49) mortality rates, the evolution of the economy (per capita exports and imports at constant prices and price index) and an indicator of public health (sector's per capita expenditure at constant prices).

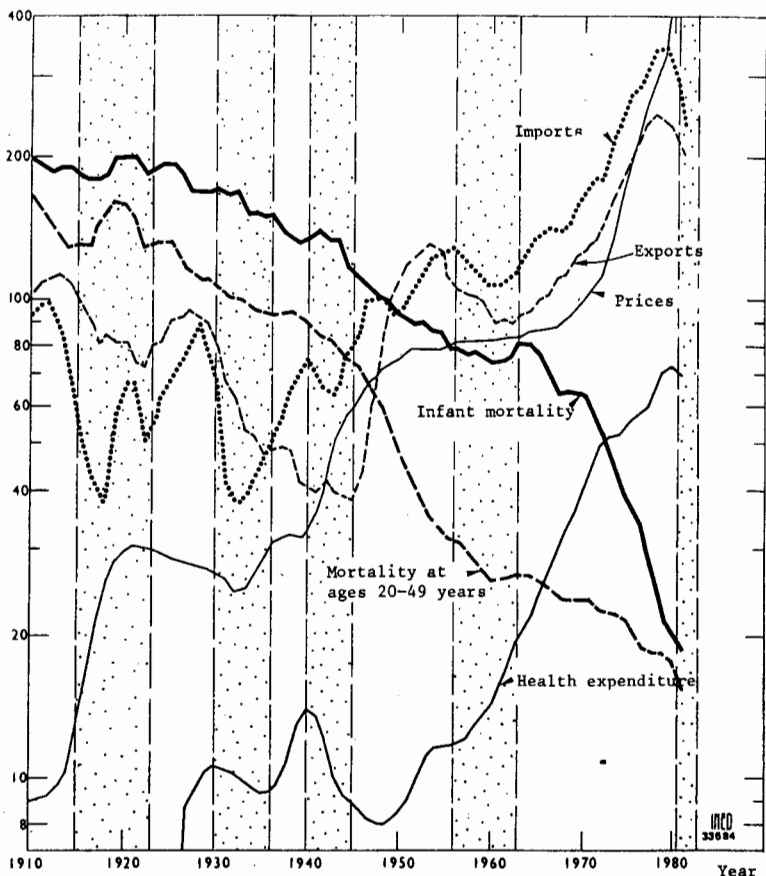
At a glance it can be seen that up to the mid-1940's the slight decline of both mortality rates occurred despite the stagnation, and even deterioration of the economy. It is also clear that in the 1940's and 1950's, the decline of adult mortality accelerated. This trend coincided with a noticeable economic improvement and increments in public health expenditure, but as previously mentioned, seems mainly due to the import of new sanitary technology. The decline of infant mortality, which had lagged behind adult mortality, began to accelerate only in the 1970's, in an environment of sustained economic growth, and only after health expenditure had been substantially increased.

According to the evolution of foreign trade and other economic indicators, the periods that roughly correspond to economic crises in Costa Rica have been shaded in Figure 3. One can see that in these periods, the decline of mortality rates tends to slow. If the annual relative rate of mortality decline is computed separately for normal years and crises periods (see Table 7), it is evident that in periods of economic contraction mortality tends to decline at a slower rhythm than in normal years. This negative effect becomes even more pronounced when a certain time lag for the impact of economic crises is assumed. This is most evident in the case of infant mortality; in normal periods the annual rate of decline was 5.2 percent, whereas in times of crises (more than 1 year lag), the trend is reversed and even annual increases of 0.5 percent in the infant mortality rate can be observed.

As the table shows, sanitary progress is influenced by socio-economic conditions, which in turn are linked to external factors (prices of export products) that are uncontrollable. This is one of the major negative health consequences of the economic dependence of the Third World countries. This is, at present, very pertinent in Costa Rica which is suffering from a new economic recession which could lead to a revision of the redistributive model adopted during the last decade.

B) *Mortality Trends and Economic Development*

Another way to observe the impact of some factors on mortality is to make use of quantitative relations that have been established by transnational studies. Among these is the model developed by the United Nations and used by Mauldin and Berelson (1978) for studying the determinants of fertility. This model establishes, for a wide range of economic, social and demographic indicators, a correspondence with a theoretical index of the level of development that may vary from 0 to 100. The application of this model to data for Costa Rica between 1950 and 1980 is shown in Table 8.



Notes: Infant mortality rate per 1,000 live births
 Adult mortality rate per 10,000 population aged 20-49
 Exports per capita in 1970 US\$
 Imports per capita in 1970 US\$
 Public health expenditure per capita in 1970 US\$
 Price index (1970=100)

Figure 3

Trends of mortality rates for infants and adults, exports, imports, expenditure on public health, and price index, Costa Rica, 1910-81

Source: Computed from data given in Appendix Table 2.

TABLE 7

Annual decline in mortality rates of infants and adults (aged 20-49) during periods of economic crisis and in other periods, Costa Rica, 1911-81

Period	Infant mortality			Mortality at ages 20-49		
	Without lag	1 year lag	2 years lag	Without lag	1 year lag	2 years lag
<i>Average annual decline in death rates (in percent)</i>						
1911-14	1.4	1.9	1.0	5.1	5.9	2.3
1915-23*	-0.2*	-1.9*	-1.6*	-1.2*	-2.8*	-1.5*
1924-29	-0.3	3.7	1.3	1.4	3.7	4.1
1930-36*	1.3*	0.9*	5.1*	2.5*	1.2*	1.4*
1937-39	2.2	1.7	-1.0	-0.4	2.4	2.4
1940-45*	2.6*	2.9*	0.9*	4.1*	4.2*	5.5*
1946-55	2.6	3.1	2.6	8.1	7.5	6.9
1956-63*	0.3*	-2.6*	0.3*	2.0*	1.6*	1.6*
1964-80	6.7	8.5	8.3	2.0	3.0	3.2
1981*	3.7*	...	...	16.7*	...	...
<i>Total (1911-81)</i>	<i>2.8</i>	<i>2.8</i>	<i>2.8</i>	<i>2.9</i>	<i>2.9</i>	<i>2.9</i>
Years of crisis	1.4*	-0.5*	1.0*	2.1*	0.7*	1.4*
No crisis	3.8	5.2	4.5	3.6	4.5	4.0
<i>Difference</i>	<i>2.4</i>	<i>5.7</i>	<i>3.5</i>	<i>1.5</i>	<i>3.8</i>	<i>2.6</i>

* Periods of economic crisis.

A minus sign indicates an increase in mortality.

Source: Appendix Table 2.

A set of 10 indicators, including three social indicators, have been translated into indices of the level of development (middle panel of the table) according to the correspondence relationship of the model. These indices verify that in Costa Rica there has been a pre-eminence of social over economic concerns, illustrating the strategy followed by the country. This has been maintained over the whole period 1950-80. At the same time, all variables reflect the substantial economic and social development of the nation during these years.

The lower panel of the table shows the expected value of life expectancy at birth which corresponds, according to the model, to the simple average of the various indices of level of development. From a comparison with the observed values for the respective years, the following observations may be made:

- a) Life expectancy in Costa Rica is higher than what might be expected given its level of economic development according to the relationships observed in other nations, but is broadly compatible with social developments in the country (basically, education).

- b) This discrepancy between observed and expected life expectancies was particularly noticeable in 1960 and 1980 and reflects the impact of technological imports into Costa Rica in the 1950's while in the 1970's, it was due to the effective health policy.

TABLE 8
Indicators of the social and economic situation, and index of corresponding level of development, Costa Rica, 1950-1980^a

Indicators	1950	1960	1970	1980
<i>Observed values of indicators</i>				
<i>Social</i>				
- Literacy (% literate at ages 15+)	78.8	83.6	87.4	90.5
- Enrollment in grammar and high school (% of persons aged 5-19)	38.9	51.5	60.9	69.5
- Newspapers (per 1,000 persons)	84.9	90.9	102	118
<i>Economic</i>				
- Homes with electricity (%)	40.0	50.9	65.3	79.0
- Automobiles (per 1,000 persons)	9.0	22.2	43.3	63.0
- Telephones (per 100,000 persons)	1114	1243	2283	6989
- Economically active male population in agriculture (%)	62.6	58.9	49.3	34.9
- Gross National Product (GNP) of industrial origin (%)	11.6	12.5	15.1	17.5
- Energy Consumption (Kg. of coal per capita)	193	233	453	573
- Per capita GNP (1970 US\$)	347	474	656	898
<i>Index of level of development</i>				
<i>Social (average)</i>	(53)	(60)	(68)	(75)
- Literacy	65	69	73	77
- Enrollment in grammar and high school	34	51	67	80
- Newspaper circulation	60	61	64	67
<i>Economic (average)</i>	(38)	(45)	(56)	(65)
- Homes with electricity	42	54	63	71
- Automobiles	41	59	69	74
- Telephones	40	41	52	71
- Population in agriculture	32	43	53	66
- Industrial GNP	30	33	42	49
- Energy consumption	29	32	46	51
- Per capita GNP	53	60	67	75
<i>Life expectancy (years) corresponding to average development indices</i>				
- All indicators	54.1	57.8	62.4	66.0
- Social indicators only	59.2	62.4	66.0	68.2
- Economic indicators only	51.7	55.7	60.6	64.6
- Observed life expectancy	56.0	62.6	65.3	72.5

^a Based on the United Nations model used by Mauldin and Berelson (1978).

- c) The substantial gain in life expectancy at birth in Costa Rica between 1950 and 1980 (from 56 to 72.5 years) is largely in accord with the social and economic development of the country over the same period. According to the model, the "predictable" increase in life expectancy (11.9 years) is roughly three-quarters of the observed increase (16.5 years); the remaining one-quarter of the gain can be attributed to the particularities of the country not included in the model such as more effective health programmes, more equitable socio-economic development, and a political system more sensitive to social problems.

C) *Determinants of Infant Mortality During the 1970's*

A prominent feature of the trend of Costa Rican mortality is the extraordinary decline which occurred in the 1970's, especially among younger children. In this section, a more formal analysis of the level and trend of infant mortality in the cantons of the country will be presented as a complement to previous statements about the determinants of this decline².

The trend in the mean and standard deviation of the cantonal rates between 1964 and 1980, calculated on the basis of vital statistics (see Table 9), corroborates two facts already mentioned: the acceleration of the relative decline of infant mortality (5 % annual decrease between 1965-72 compared with 12 % for 1973-80), and the convergence of differentials during the 1970's, both in absolute and relative terms. Thus, the standard deviation of rates fell from 22 to 6, while the relative deviation, or coefficient of variation, declined from 35 % to 28 % between 1968-69 and 1979-80.

Firstly, a cross-sectional analysis of infant mortality around 1969 (estimated indirectly with data from the 1973 census) with a series of socio-economic, sanitary, and geo-ecological indicators for the cantons was undertaken (Appendix Table 3). The coefficients of correlation were, as expected, quite high, reflecting the central role of environmental conditions under which the child is born and brought up in determining survival. Similar findings have been reported in other studies (Porrás, 1976; Haines and Avery, 1982).

More interesting are the correlations with the relative decline of infant mortality³. In this case, all the simple correlation coefficients change sign between the two periods, 1965-72 and 1973-80 (see Appendix Table 3).

² A canton is a small political-administrative unit. Costa Rica comprises 7 provinces which are subdivided into 79 cantons. The level of infant mortality around 1970 was estimated for the cantons by indirect techniques (Brass method) from the information provided by the 1973 census. Trends were estimated from vital statistics, under the assumption that such sources of error as differential under-registration and errors in the declaration of the canton of residence of the mother have not varied much during the period under study. The necessary corrections to allow for changes in the political-administrative division were made previously.

³ The dependent variable (relative annual decline of the infant mortality rate) was estimated for the periods 1965-72 and 1973-80 as the slope of the linear regression of the logarithm of annual rates for each canton.

TABLE 9

Mean, standard deviation and coefficient of variation of infant mortality rates (per 1000) among the 79 cantons of Costa Rica, 1964-1980

Year	Mean	Standard deviation	Coefficient of variation (in percent)
1964-65	73	20	28
1968-69	64	22	35
1972-73	50	17	35
1975-76	37	15	42
1977-78	26	7	29
1979-80	21	6	28
<i>Annual percent decline</i>			
1965-72	5.1	3.7	73
1973-80	12.4	4.6	37

Values weighted by the number of births in the canton.

Source: DGEC, Anuarios Estadísticos.

This demonstrates the dramatic change which occurred in the nature of the decline of Costa Rican mortality in the 1970's. During the period, 1965-72, the sign of the coefficients indicates that the relative decline was higher in those cantons where conditions favoured lower mortality; that is, in cantons where economic development was more advanced (non-agricultural, with a prominence of wage-earners, less poor families, and a higher consumption of electricity), which had better levels of education and environmental hygiene, benefited more from public health programmes and which enjoyed better geo-ecological conditions (located in the Central Valley and near the capital). During the years 1973-80, a radical change occurred and it was precisely those less-privileged cantons according to all these indicators where mortality declined at a faster rate. This clearly indicates that to alter the typical process of development, i.e. the accumulation of greatest achievements in the privileged regions which already had a low mortality, new and revolutionary impulses were necessary.

At a third level of analysis (see Table 10), the relative decline of infant mortality over the period 1973-80 was correlated with 5 variables for which information was available regarding cantonal changes during the 1970's (it was not possible to include more explanatory variables since there are as yet no census results for the 1980's). One of the variables measured, although not perfectly, was the economic growth of the canton (consumption of electrical energy), and the remaining four reflect the improvements in health services, one of which, the coverage of Rural and Community Health programmes, is only relevant since 1972. This factor was quantified by taking into account

TABLE 10

Simple and partial correlation coefficients (R) and beta coefficients of the changes in selected background variables with the mean relative annual decline in the infant mortality rate as dependent variable, cantons of Costa Rica, 1972-80

Independent variables	Simple R	Partial R	BETA
	<i>(Coefficients times 100)</i>		
- Increment in per capita consumption of electric energy	3	3	7
- Reduction in distance to the nearest hospital	25	25	4
- Increase in medical hours contracted by Social Security system, per capita	25	24	11
- Increase in the proportion of deaths attended	34	25	8
- Mean proportion of population covered by the Rural and Community Health programmes, 1972-80	60	45	53
<i>Multiple R</i>	<i>62</i>	<i>62</i>	<i>62</i>

Partial R coefficient computed by controlling for the effect of other variables according to their order of appearance in the table.

BETA measures the association after controlling for the effect of all other variables.

The mean coverage of Rural and Community Health programmes was calculated on the basis of data from the year in which the programmes commenced in the canton (1972 or later) and the coverage reached in 1976 and 1980. This information was obtained from the Ministry of Health and from the Information System on Nutrition.

Sources: Same as Appendix Table 3.

three items: the year in which the programmes commenced in the canton and the coverage that they had attained in 1976 and in 1980⁴.

Economic and industrial growth of the canton (as measured by the increment in per capita consumption of energy), has had practically no impact whatsoever on the relative decline of infant mortality; rather, this decline seems to be associated with improvements in health services, such as the opening of health centres in places far away from the nation's capital, the increment in medical care in general, and in the medical resources of the Social Security system in particular, as well as with the implementation of key Rural and Community Health programmes by the Ministry of Health.

It is this last factor which undoubtedly appears as the most influential in the outstanding progress which Costa Rica has achieved in reducing mortality

⁴For example, in a canton where the programme began in 1973 and had, in 1976 and 1980, reached a coverage of 40 and 90 percent of the population, respectively, the mean proportion of the population covered between 1972 and 1980 was estimated as $(40 \text{ times } 3/2 + (40 + 90) \text{ times } 4/2)/8 = 40 \%$.

during the 1970's. This is evident from the corresponding coefficient of simple correlation which is nearly double that of any other variable analysed. Moreover, this variable alone maintains a high net or independent association with regard to all other variables, as measured by the beta coefficient.

Although the Rural and Community Health programmes were based on existing infrastructure inherited from the old health units and from such programmes as the malaria eradication campaign, they constitute a departure from previous activities of the Ministry of Health. Essentially, these programmes revolved around the Health Centers and, even more so, around smaller units attached to them called Health Posts (presently there are nearly 400 units of this type). The aim of these programmes is to offer primary health care to the rural and urban-marginal populations who would otherwise lack medical services. The Centers and Posts are responsible for a given area in which each household receives periodic visits by a nurse, or more often, by a health assistant. According to official data, in 1980 these programmes had achieved a 60 percent coverage of the national population (98 percent of the rural population), and were functioning with the important support of local community organizations.

To better appreciate the effect of the Rural and Community Health programmes, the trend in the infant mortality rate between 1964 and 1980 is shown in Figure 4 for cantons classified according to the mean coverage of these programmes during the period 1972-80. It can be seen that in those cantons which were not targets for these programmes because of their higher level of development (i. e. those with less than 25 % coverage), the relative rate of decline of infant mortality throughout the period remained stable. On the other hand, in cantons with more than a 25 percent coverage, there was a clear acceleration in the decline of mortality precisely during the period when the programmes were begun (1972 and following years). This is even more evident in those cantons with a coverage of more than 75 percent where the infant mortality rate declined from a level of 80 per thousand at the end of the 1960's to 16 per thousand in 1980, lower than in both groups of cantons ⁵.

An analysis of infant mortality trends since 1965 in cantons classified according to the pre-eminence of agricultural activity in general confirms these observations. Prior to the implementation of the Rural and Community Health programmes, infant mortality in those cantons where more than half of the population depended on agriculture was markedly higher than in the remainder (infant mortality rates of 71 and 58 per thousand respectively in 1968-69); by 1979-80, this differential had disappeared. Nevertheless, and to stress the important role of these programmes, at present the only populations with an infant mortality rate substantially higher (35 per thousand) than the national average (21 per thousand) are those located in small rural hamlets in which primary health care has not yet achieved a significant coverage.

A final note of caution is necessary with regard to the determinants of the substantial decline of Costa Rican mortality in the 1970's. Even though there is persuasive evidence of the important role of the Rural and Community

⁵The infant mortality rates around 1965, as shown in Figure 4 are not very reliable due to the fact that at that time under-registration of infant deaths was quite high (estimated at around 15 %). This undoubtedly was concentrated in the rural zones, the same ones which subsequently enjoyed a wider coverage by the programmes under study.

Infant mortality rate
per 1000 (log. scale)

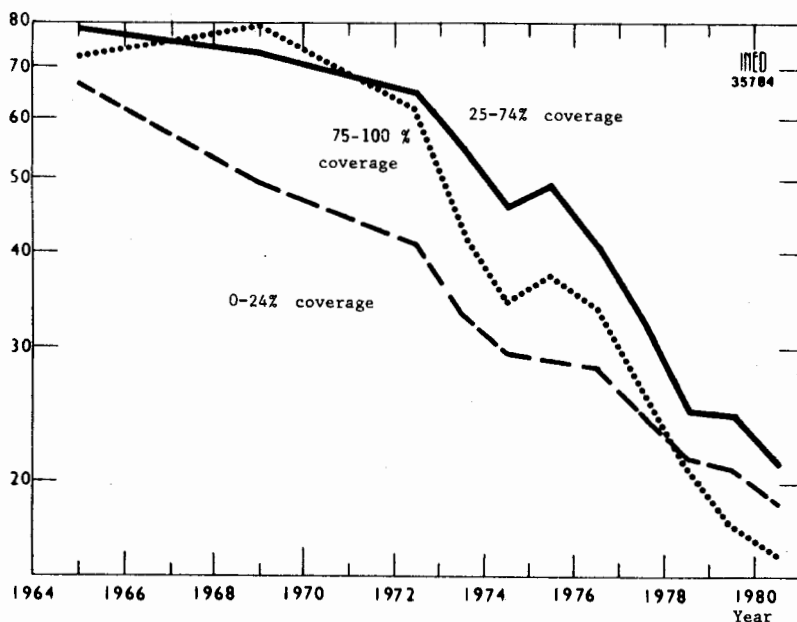


Figure 4

Infant mortality rate for cantons classified according to mean coverage of rural and community health programmes in 1972-80, Costa Rica, 1964-1981

Health programmes In bringing about this improvement, they have been accompanied by other effective actions including the building of rural aqueducts and latrines, nutritional improvement programmes and an improvement in specialized medical care. It would similarly be incorrect to attribute all the success to vertical programmes of the government since it must be acknowledged that the fundamental ingredients of community participation and the predisposition of a relatively well educated population to accept modern medical-sanitary practices were already in place. It is also necessary to bear in mind that these achievements would probably not have been possible if the economic and socio-political context of Costa Rica had been different, that is, without the substantial economic growth which has taken place during the last two or three decades, and without the political will to implement strong social programmes which emanated from the transformations of the 1940's and from the development strategy adopted since then.

SUMMARY

At the beginning of the twentieth century, life expectancy in Costa Rica was only about 35 years, public health was practically non-existent, and the modest reduction of mortality achieved until then was the result of the control of serious epidemics by simple isolation measures. Nevertheless, even at this time, health conditions in Costa Rica were more favourable than the Latin American average due to a relatively homogenous society and a more successful integration into world capitalism (by means of the export of coffee) which was achieved at a lower social cost compared with other nations of the region.

With the beginning of health programmes in the 1920's, life expectancy rose rapidly from 46 years in 1940 to 63 years in 1960. This progress occurred despite the absence of substantial economic growth. Rather, the decline in mortality seems to have been due fundamentally to improved public health and the import of new low-cost and high-efficacy health technology (insecticides, antibiotics). Malaria was virtually eradicated and mortality from tuberculosis fell sharply. Roughly 90 % the decline in mortality between 1940 and 1960 was from causes of death attributable to micro-organisms or parasites, notably diarrhoea (22 %), malaria (18 %) and influenza - pneumonia - bronchitis (14 %).

These advances in health technology allowed Third World countries to reduce the gap in mortality compared with the more advanced nations. However, underdevelopment remains an important factor affecting mortality change. Thus in Costa Rica during periods of foreign trade crises, the decline of mortality has been slower and occasionally mortality has even risen, providing dramatic evidence of the impact of economic dependence.

Up to the decade of the 1960's, the features of Costa Rican mortality, although somewhat better than the Latin American average, evolved in a similar way to the rest of the region. However, in the 1970's Costa Rica departed from the regional pattern of stagnation and managed to move from an underdeveloped country in terms of mortality to a level of health characteristic of a developed nation. Life expectancy increased from 65 to nearly 73 years between 1970 and 1980, due primarily to a marked decline in infant mortality from 67 to 21 per thousand. This was chiefly due to the exceptional decline in mortality among the less privileged segments of the population (peasants and marginal urban populations) who until then had not derived much benefit from the health advances. In this respect also, Costa Rica departed from another regional pattern characterized by severe socio-economic mortality differentials.

These achievements resulted from the extension of services by means of rural health and community medicine programmes with the participation of technical personnel other than medical doctors, auxiliary personnel and the community. This was complemented with programmes for building rural aqueducts, provision of latrines, nutritional improvement, and reforming the social security system.

The favourable socio-political and economic context in which all these actions were executed is an explanatory element that must be taken into account. Since the 1940's, Costa Rica has been a "welfare state" that has strongly favoured social programmes and has attempted to redistribute by means of services some of the benefits of economic progress. This explains the significant development of the country, not only in the health field, but also in other areas such as education and social security. These health advances have

also been strongly dependent on the existence of a population with an acceptable level of education, a good degree of socio-spatial integration, and who are receptive to the practices of modern medicine.

APPENDIX TABLE 1

Distribution of deaths and standardized death rates by cause, Costa Rica, 1930-80

Causes of death	1930	1940	1950	1960	1965	1970	1975	1980
<i>Crude death rate (per 1000)</i>	<i>24.9</i>	<i>20.3</i>	<i>13.0</i>	<i>9.5</i>	<i>9.1</i>	<i>7.0</i>	<i>5.1</i>	<i>4.3</i>
<i>Cause distribution of 1000 deaths</i>								
<i>Total</i>	<i>1000</i>	<i>1000</i>	<i>1000</i>	<i>1000</i>	<i>1000</i>	<i>1000</i>	<i>1000</i>	<i>1000</i>
1. Respiratory tuberculosis	38	42	40	12	11	9	9	7
2a. Malaria	112*	79	50	2	1	0	0	0
2b. Parasitic diseases	70	52	31	22	21	12	5	2
2c. Other infectious dis.	86	106	93	67	59	72	38	18
3. Neoplasms	30	40	61	92	98	104	147	169
4. Cardiovascular dis.	60	87	112	125	136	185	224	251
5. Influenza, pneumonia, bronchitis.	113	132	107	110	103	106	71	54
6. Diarrhoeal diseases	177	166	134	139	141	101	48	18
7. Certain chronic dis. (nephritis, cirrhosis, ulcers, diabetes)	35	43	28	28	29	31	54	49
8. Maternal mortality	13	14	10	8	7	6	4	3
9. Certain diseases of infancy	9	26	43	97	122	85	74	65
10. Auto accidents	0	0	1	8	13	21	37	43
11. Other violence	23	27	33	41	44	48	72	79
12. Other and unknown	234	186	256	250	215	220	218	243
<i>Standardized rates (per 100,000 population)</i>								
<i>Total</i>	<i>2049</i>	<i>1857</i>	<i>1297</i>	<i>977</i>	<i>948</i>	<i>788</i>	<i>568</i>	<i>461</i>
1. Respiratory tuberculosis	74	77	52	12	11	7	5	3
2a. Malaria	260	157	64	2	1	0	0	0
2b. Parasitic diseases	162	103	40	21	18	11	3	1
2c. Other infectious dis.	202	210	122	62	55	54	22	9
3. Neoplasms	51	68	79	94	94	78	77	70
4. Cardiovascular dis.	88	138	146	133	134	141	117	104
5. Influenza, pneu., bronch.	203	233	139	108	99	85	42	26
6. Diarrhoeal diseases	401	322	174	128	130	83	31	10
7. Certain chronic dis.	59	74	36	29	29	24	29	20
8. Maternal mortality	34	25	13	8	6	4	2	1
9. Certain dis. of infancy	24	56	56	88	114	77	56	44
10. Auto accidents	0	1	1	7	12	15	18	17
11. Other violence	50	52	43	41	41	36	39	37
12. Other and unknown	441	341	332	244	204	173	127	119

* Includes "Fever".

Source:

- Crude death rates as corrected in Rosero, 1982b.
- Distribution by causes from DGEC, *Anuarios Estadísticos* (averages of 3 years).
- Classification of causes adapted from Preston, *et al.*, 1972.

APPENDIX TABLE 2

Chronological series of mortality rates and socioeconomic indicators for Costa Rica, 1910-1981

Year	Infant mortality rate per 1,000	Mortality rate at ages 20-49 years per 10,000	Price index	GNP per capita	Exports per capita	Imports per capita	Public expenditure per inhabitant			Illiteracy rate per 1,000	Proportion of deaths medically certified per 1,000	Mortality in developed countries	
							general	education	health			Infant deaths per 1,000	Deaths at ages 20-49 years per 10,000
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	
1910	197	165	89	...	104	94	64	7.6	0.6	548	...	98	68
1911	188	158	90	...	108	101	83	7.3	0.6	536	...	96	66
1912	186	142	91	...	113	97	64	8.0	0.7	524	...	93	65
1913	200	123	96	...	114	96	62	7.6	0.7	512	...	91	64
1914	185	132	103	...	112	71	67	7.1	0.9	501	...	89	62
1915	178	120	127	...	97	43	43	5.8	0.6	489	...	87	61
1916	184	139	163	...	90	53	31	4.3	0.4	477	...	85	60
1917	171	126	213	...	85	42	30	3.5	0.4	465	...	83	58
1918	186	176	252	...	64	25	25	1.9	0.3	453	...	82	57
1919	196	160	287	...	106	46	38	1.9	0.3	441	...	80	56
1920	219	183	300	...	77	105	29	3.3	0.3	429	...	78	55
1921	182	126	308	...	64	49	29	4.0	0.4	418	...	76	54
1922	188	128	304	...	82	47	26	4.1	0.5	406	...	75	53
1923	179	126	300	...	71	53	27	3.8	0.5	395	...	73	52
1924	203	132	292	...	89	64	30	4.2	0.8	383	...	72	51
1925	205	138	286	...	87	72	37	4.5	0.5	372	...	70	50
1926	181	121	282	...	98	71	34	5.1	0.6	361	...	69	49
1927	167	103	279	...	90	83	34	5.0	0.6	350	402	68	48
1928	166	117	277	...	98	89	34	4.9	9.3	343	420	66	47
1929	178	112	272	...	89	98	52	6.6	10.8	336	446	65	46
1930	160	102	266	...	80	52	47	6.9	10.8	330	459	64	45
1931	184	104	254	...	74	44	40	6.2	10.1	323	415	62	44
1932	156	98	241	...	48	31	38	5.6	10.3	317	369	61	43
1933	164	101	244	...	63	37	38	6.0	9.9	310	391	60	43
1934	136	94	264	...	48	48	35	5.9	9.2	304	497	59	42
1935	157	94	291	...	44	42	36	5.2	9.3	297	471	57	41
1936	153	93	311	...	45	48	35	5.0	9.0	291	466	56	40
1937	142	93	324	...	54	56	35	5.4	9.4	285	556	55	39
1938	122	94	315	...	48	59	36	5.7	10.8	279	531	53	39
1939	140	95	322	...	42	78	39	6.0	13.4	273	543	52	38
1940	132	86	309	...	34	76	43	7.1	14.6	267	561	50	37
1941	124	87	328	...	44	76	47	6.6	14.1	269	559	49	36
1942	157	80	426	...	40	46	41	6.1	10.9	255	547	48	35
1943	117	78	535	...	43	71	42	6.5	9.6	250	571	46	35
1944	125	76	560	...	35	71	33	5.6	8.9	244	612	45	34
1945	110	73	614	...	36	84	34	5.3	8.8	238	602	43	33
1946	102	66	614	294	40	92	32	5.3	8.7	233	584	41	31
1947	108	62	714	338	55	115	34	6.2	7.7	228	590	38	29
1948	92	60	725	344	98	90	38	6.1	7.6	222	607	35	27
1949	97	51	719	346	101	91	68	6.4	8.2	217	612	32	25
1950	90	47	762	347	112	92	41	6.3	7.7	212	594	29	23
1951	87	42	790	340	115	101	40	6.7	8.8	206	593	28	22
1952	88	37	788	368	127	117	52	8.1	9.6	200	563	26	21
1953	92	35	754	409	130	121	61	9.5	11.1	194	584	25	21
1954	79	32	789	398	134	125	62	10.4	11.7	188	594	24	20
1955	82	31	804	428	118	128	73	11.3	11.5	182	601	23	19
1956	72	30	813	401	88	123	67	12.7	11.1	177	638	23	19
1957	80	30	809	419	105	120	71	13.9	11.6	171	629	22	19
1958	75	28	814	453	112	110	72	17.4	12.4	166	631	22	19
1959	74	26	807	453	86	106	72	17.5	13.4	161	646	22	18

APPENDIX TABLE 2 (continued)

Chronological series of mortality rates and socioeconomic indicators for Costa Rica, 1910-1981

Year	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
1960	74	25	804	474	94	108	74	19.3	14.2	156	649	22	18
1961	69	24	827	475	85	105	76	18.9	14.8	151	670	22	18
1962	74	27	821	486	91	111	85	19.9	18.1	146	671	21	18
1963	78	26	830	509	88	115	82	19.7	18.6	142	678	21	18
1964	87	26	847	516	100	121	86	21.5	21.2	137	717	21	18
1965	76	26	865	544	93	148	87	23.8	23.3	133	682	21	17
1966	65	24	854	568	105	138	101	27.3	25.8	129	679	20	17
1967	62	24	874	585	105	136	106	30.8	28.0	124	682	20	17
1968	60	23	891	611	116	137	106	34.2	32.2	120	692	20	17
1969	67	22	932	633	119	150	101	32.6	35.9	116	706	20	17
1970	62	24	1000	656	133	183	111	35.1	36.7	112	693	19	16
1971	56	23	1024	680	121	180	134	41.5	45.1	109	724	19	16
1972	54	22	1090	719	139	168	140	42.0	50.9	105	750	18	16
1973	45	21	1252	754	159	183	156	43.2	49.6	102	749	18	15
1974	38	22	1542	775	181	283	151	45.7	51.3	98	765	17	15
1975	38	21	1921	779	181	256	149	47.9	53.9	95	768	17	14
1976	33	19	2239	795	201	263	172	53.4	56.9	92	808	16	14
1977	28	18	2610	842	259	319	166	53.1	57.4	89	816	16	14
1978	22	17	2799	870	244	329	190	65.1	62.5	86	835	16	14
1979	22	18	3102	911	234	349	203	69.0	72.6	83	827	15	13
1980	19	18	3655	898	218	335	216	73.4	75.6	80	851	15	13
1981	18	15	6034	866	196	231	190	64.6	66.5	78	856	15	13

Notes and sources:

- (1), (2) DGEC, *Anuarios Estadísticos*. Unadjusted rates except for the years 1918 to 1926, when it seems that deaths of children aged 1 year were tabulated as less than 1 year of age.
- (3) Internal prices (per 1000) based on 1970. Until 1935 this was estimated on the basis of the exchange rate of the US\$ (average of 3 years) and the price index of the United States. From 1936 to 1949 the wholesale price index calculated by the National Bank of Costa Rica was used. From 1950 onwards the deflationary index of the national accounts of the Central Bank of Costa Rica was utilized.
- (4) Per capita Gross National Product in 1970 US\$. CEPAL, 1978, and Central Bank of Costa Rica (For the conversion to dollars, IUS\$ = 5.09 colones was utilized, estimated by CEPAL for 1970).
- (5), (6) In 1970 US\$. Data from Albarracín and Pérez (1977), DGEC and Central Bank of Costa Rica, converted to prices of 1970 with the United States index.
- (7), (8) In 1970 US\$. Several reports from the Ministry (Secretariat) of the Treasury. Data deflated with the internal price index and the rate of exchange 1 US\$ = 5.09 colones.
- (9) In US\$. Prior to 1927 this represented the operation expenditures of the Ministry (Secretariat) of Health and of hospital assistance; from 1943 the expenditure of the sickness and pregnancy insurance of the Caja Costarricense de Seguro Social (CCSS) was added, and, from 1961, that of the Instituto Costarricense de Acueductos y Alcantarillados (A y A).
Sources: As for (7) and reports from the Ministry of Health, CCSS and A y A.
- (10) Aged 10 years or more.-
- (11) Sources: DGEC, *Anuarios Estadísticos*; from 1933 to 1940, Lueros, 1941.
- (12), (13) Estimates based on the average life expectancy of Denmark, France, England and Wales, Norway, Netherlands, Sweden, and the United States. The rates are those corresponding to that life expectancy in the Coale and Demeny (1966) "West" model life tables.

APPENDIX TABLE 3

Simple and partial correlations (R) of selected variables for cantons with the infant mortality rate (IMR) around 1970 and with mean relative annual decline in IMR between 1965-72 and 1973-80

Independent variables (value around 1970)	Simple correlation coefficient (times 100)			Partial correlation coefficient (times 100)*		
	Infant mortality			Infant mortality		
	Rate 1970	Decline		Rate 1970	Decline	
		1965-72	1973-80		1965-72	1973-80
<i>Multiple R</i>	(91)	(65)	(60)	(91)	(65)	(60)
<i>Economic variables: (multiple R)</i>	(78)	(45)	(50)	(78)	(45)	(50)
- % of active population in agriculture ^a	77	-38	49	77	38	49
- % of active population without wages ^a	59	-32	37	3	4	3
- % of poor families ^b	57	-13	31	3	24	9
- Per capita consumption of electrical energy ^c	-69	24	-37	10	5	3
<i>Social variable: % with high school educ.^a</i>	-79	25	-42	22	8	4
<i>Sanitation variables: (multiple R)</i>	(78)	(43)	(46)	(34)	(21)	(18)
- % with water supply ^a	-78	43	-45	32	21	16
- % sewerage disposal ^a	-71	39	-44	10	4	9
<i>Public health variables: (multiple R)</i>	(74)	(39)	(42)	(13)	(20)	(19)
- Distance to the nearest hospital ^c	44	-13	18	8	20	16
- Per capita medical hours contracted by CCSS ^c	-61	29	-37	9	2	4
- % of deaths with medical assistance ^d	-69	34	-37	5	1	10
<i>Geo-ecological variables: (multiple R)</i>	(78)	(56)	(56)	(18)	(35)	(21)
- Distance to San José ^e	69	-54	43	7	35	12
- Average temperature ^e	65	-45	49	8	1	12
- Average rainfall ^e	41	-32	29	9	1	1
- Area of the canton ^e	67	-41	47	12	2	8

*Partial correlation coefficient after controlling for the effect of the previous variables according to their order of appearance in the Table.

Sources:

^a Population and household censuses of 1973.

^b Estimates from Carvajal, *et al.* (1977) with information from population and agricultural and livestock censuses of 1973.

^c Several reports from the respective institutions.

^d Vital statistics.

^e IFAM (1981) and Atlas Estadístico de Costa Rica (1981).

For infant mortality rate around 1970: ADC, 1979 (calculated from Brass method applied to 1973 census). For annual decline of infant mortality, the average percentage reduction was calculated using vital statistics data.

APPENDIX TABLE 4

Some public health indicators for Costa Rica, 1930-1980

Indicator	1930	1940	1950	1960	1970	1980
- Per capita health expenditure (1970 US\$) ^a	11	14	8	14	39	76
- Expenditure as percentage of GNP	...	...	2	3	6	8
- Hospital beds per 1,000 inhabitants	...	...	5.1	4.6	4.0	3.4
- Population covered by illness and pregnancy insurance (%)	—	—	8	15	39	78
- Medical doctors per 10,000 inhabitants	2.7	...	3.1	2.8	5.6	7.8
- Deaths medically certified (%)	44	55	60	65	71	84
- Population with piped water (%) ^b	...	...	...	68	78	...
- Population with some system for elimination of waste (%) ^b	...	...	...	49	72	...
- Infants with 2nd or 3rd degree malnutrition (%) ^c	...	...	...	...	14	9

... No information.

^a Includes operational expenditures of the Ministry of Health, the Central Medical-Social Assistance Office, Social Security Bureau (from 1942), and the total expenditure of the Costa Rican Aqueduct and Drainage Institute (from 1962). Excluding the latter, the per capita expenditure on health amounts to US\$34 and US\$68 in 1970 and 1980, respectively.

^b Corresponds to population census years (1963 and 1973).

^c Gómez definition based on the relation of age to weight. Data are taken from surveys carried out in 1966 and 1978.

Source: Appendix Table 2 and reports from the Ministries of Health and Social Security.

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