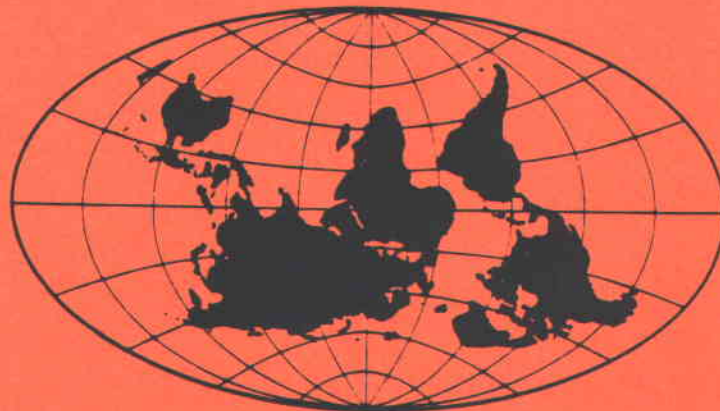EXCESS MORTALITY IN GUATEMALA: A COMPARISON OF

CAUSES OF DEATH IN GUATEMALA AND COSTA RICA

by

Arjun Adlakha

and

Eduardo Arriaga

Information on the number of deaths due to various causes is not sufficient in itself to determine policy agendas for health planners. It is helpful to compare patterns of mortality (rates and causes) in two analogous countries to expose areas of dissimilarity and possible intervention. Costa Rica, a Central American country with a similar per capita gross national product and urban/rural residence pattern, has a life expectancy 14 years higher than that of Guatemala. The fact that Costa Rica--and other developing countries such as China and Sri Lanka-- has had improvements in life expectancy that are not directly related to substantial economic development can serve as a model for realistic mortality changes in Guatemala.

When compared to its neighbor Costa Rica, Guatemala shows a mortality excess. That is to say, if Costa Rica's death rates by age and sex had applied to Guatemala's population in 1984, an estimated 29,000 deaths would have occurred. But, total deaths in Guatemala for 1984 surpassed 77,000, indicating approximately 48,000 excess deaths (Figure 1). Excess deaths in Guatemala show the following gender and age pattern: slightly more of the excess deaths are male than female and many more occur to children than adults.

Figure 1. Expected and Excess Deaths by Age in Guatemala: 1984
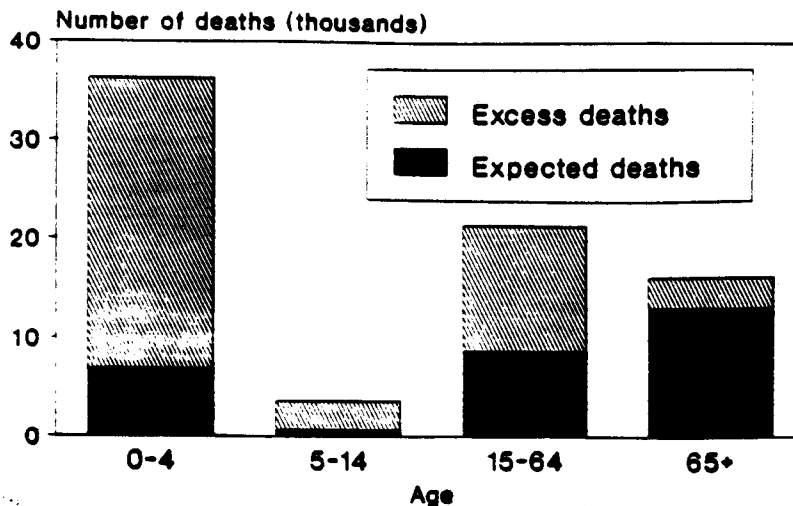
Source: Table 5.

Although males have a higher rate of excess deaths than females in Guatemala, they die from similar causes with one notable exception: excess deaths are nine times higher for Guatemalan males from violence. The substantial number of excess deaths among prime-age adult males is alarming. The male prime-age population, considered of vital importance

PREFACE

The Center for International Research conducts economic and demographic studies, some of which are issued as Staff Papers. A complete list of these papers is included at the end of this report. The use of data not generated by the U.S. Bureau of the Census precludes performing the same statistical reviews the Bureau does on its own data.

We are grateful to our analyst Vera Harris-Bourne and statistical assistants Vicki Hart-Spriggs and Maureen Buhler for verifying the calculations and assisting in the preparation of the tables. We also are grateful to John Gibson for assisting in the preparation of the charts. Any errors and shortcomings in the report are the responsibility of the author.

Comments and questions regarding this study should be addressed to Arjun Adlakha, Center for International Research, U.S. Bureau of the Census, Washington, D.C. 20233; telephone (301) 763-4811.

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INTRODUCTION

This paper identifies those causes of death which, when realistically reduced, would produce the largest gains in life expectancy at birth in Guatemala. Such an identification would aid the Guatemalan health planners and donor agencies in targeting their scarce health funds to those kinds of mortality that will produce maximum increases in longevity of the people in Guatemala. The premise is that in the development of health policy, information on number of deaths due to various causes of death alone is not sufficient for allocating resources. A health planner needs to know, among the various causes of death, where the resources should be allocated so that maximum benefits in terms of life expectancy at birth will be achieved.

This is achieved by comparing current patterns of mortality in Guatemala with Costa Rica's patterns. Costa Rica's current level of mortality is comparable with some developed countries and is much lower than Guatemala's level. On the average, people in Costa Rica live about 14 years longer than their neighbors in Guatemala (see Table 1), even though it has a similar per capita gross national product, in 1985, of U.S. $1,250, as in Guatemala of U.S. $1,200 (World Bank, 1987). The experiences of Costa Rica and some other developing countries, such as Sri Lanka and China, which have achieved low levels of mortality, indicate that Guatemala does not have to wait for substantial economic development to significantly reduce its mortality. The present patterns of mortality rates of Costa Rica can serve as goals for Guatemala to expand life expectancy of its people. Both countries provide sufficient data on causes of death to identify causes that produce excessive mortality in Guatemala.

The historical perspective of differences in mortality between the two countries, in terms of life expectancy at birth, is presented in Table 1 and Figure 1. As early as the beginning of this century, Costa Rican people enjoyed an advantage of about 8 years in their life expectancy over Guatemalans. Between 1900 and 1940, the gap in life expectancy widened substantially to about 18 years in 1940 as Costa Rica made greater improvements in increasing the longevity of its people. Perhaps these differential improvements in mortality were reflections of differences in social and economic improvements of people in Costa Rica and Guatemala. In the following two decades of 1940-1950 and 1950-1960, when low cost massive health programs were introduced, both countries made substantial gains in life expectancy. However, improvements in Guatemala were substantially large and unprecedented in its history, a gain of about 19 years in life expectancy over a period of 20 years. The life expectancy gap between the countries substantially narrowed to 12 years in 1960 from 18 years in 1940. During the 1960's and 1970's there was a slower decline in mortality in both countries. Guatemala could not maintain the advantage over Costa Rica in the previous two decades. The gap widened to 15 years in 1980 and decreased slightly to 14 years by 1984. In terms of life expectancy at birth, Guatemala is where Costa Rica was 25 years ago.

Table 1: Expectation of Life at Birth for and Difference Between Guatemala and Costa Rica by Sex: 1900 to 1984

Year	Guatemala			Costa Rica			Difference		
	Total	Male	Female	Total	Male	Female	Total	Male	Female
1900	24.0	23.8	24.2	31.6	31.1	32.0	7.6	7.3	7.8
1910	24.6	24.4	24.9	32.6	32.0	33.2	8.0	7.6	8.3
1920	25.3	25.2	25.8	36.8	35.7	37.9	11.5	10.5	12.1
1930	26.6	26.3	26.9	41.9	40.9	43.0	15.3	14.6	16.1
1940	30.4	29.9	30.9	48.7	47.4	49.9	18.3	17.5	19.0
1950	40.7	39.9	41.5	55.5	54.0	57.0	14.8	14.1	15.5
1960	49.5	47.6	51.4	61.8	60.2	63.5	12.3	12.6	12.1
1970	52.6	51.4	53.8	66.3	64.2	68.6	13.7	12.7	14.8
1980	57.3	55.1	59.6	72.6	70.3	75.0	15.3	15.2	15.4
1984	60.1	57.8	62.5	74.3	72.1	76.7	14.3	14.3	14.2

Source: Arriaga, Eduardo E. 1968. New Life Tables for Latin American
Population in the Nineteenth and Twentieth Centuries.
Population Monograph Series, No. 3. University of California, Berkeley; and
U.S. Bureau of the Census, Center for International Research, International Data Base.

Figure 1. Expectation of Life at Birth for and Difference
Between Guatemala and Costa Rica, 1900 to 1984

Source: Table 1.

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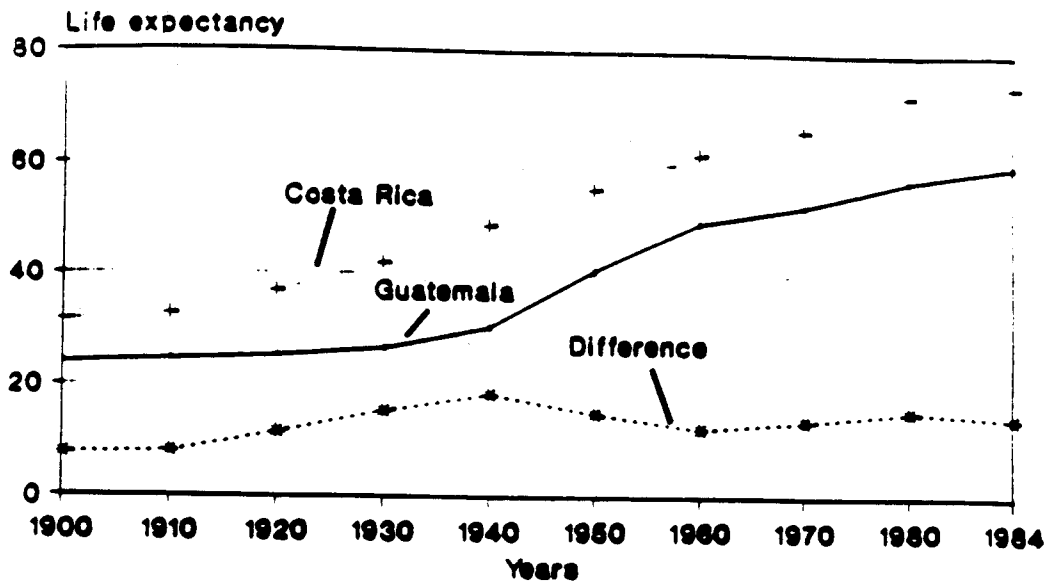
PURPOSE

The purpose of this paper is to analyze the 1984 data on causes of death for Costa Rica and Guatemala to quantify numerically each country's contribution to this large differential in expectation of life at birth between the two countries. The paper is organized as follows:

1. The mortality differentials between the two countries at each age are analyzed by causes of death for each sex.

2. Contributions of differences in mortality at each age to the overall differential in the life expectancy at birth are analyzed.

3. Results are presented on the contributions of the major groupings of causes of death and of the most important cause of deaths.

4. Contributions to causes of death are presented for those groups where the mortality differential is the largest.

5. A presentation on the number of deaths that will be prevented if mortality by cause in Guatemala was similar to the 1984 mortality in Costa Rica.

DATA

The 1984 data on causes of death for Costa Rica and Guatemala used in this analysis are the official data published in the Annual Statistics of the World Health Organization (1987 Table 6). The analysis required life tables for both countries by sex for the same year. For Costa Rica, official life tables were available and accepted for the study (Costa Rica DGEC, no date, Table 11). For Guatemala, life tables were derived from the U.S. Bureau of the Census (1989) from reported data for 1984, a life table constructed for 1979-80, and the use of indirect demographic techniques.

When interpreting results, it is important to note that the data used contain certain deficiencies. Besides underreporting deaths, the major problem with causes of death data is error in establishing cause of death itself because a large proportion of deaths is not medically certified. Also, in many cases final cause is not known, resulting in a large number of deaths being classified in the category "symptoms and ill-defined causes." Impact of these errors on a comparative study is difficult to assess, but some caution is necessary when interpreting results.

RESULTS

Mortality Differential by Age

The life expectancy at birth is a derived measure from the incidence of mortality at different ages. Therefore it is important to analyze the differentials in age specific death rates between Guatemala and Costa Rica to obtain a better understanding of the large differences in the expectation of life at birth between the two countries. An analysis of absolute and relative differentials between the mortality rates is shown in Figure 2 (see Table 2).

From an absolute point of view, mortality differential is large in infancy and reaches to minimum at ages 5-14 for females and ages 15-24 for males. Thereafter, the difference increases up to ages 65-74 and falls slightly at age category 75 and over.

In relative terms, infant mortality in Guatemala is about 3 times higher than that of Costa Rica. Child mortality at ages 1-4 is substantially higher, about 14 times for males and 17 times for females than Costa Rica. At ages 5-14, the difference is substantial but significantly lower than the previous age group. From ages 15-24, the differential decreases uniformly as age increases (the only exception to this pattern is the age group 25-34 for males) and reaches to almost unity at age 75 and over. This indicates that mortality differentials, in relative terms, between Guatemala and Costa Rica decrease with age and converge at the older ages.

Contribution of Cause of Death to the Differential in Mortality by Age

Table 2 also presents differences in mortality rates for each cause by age. Overall, four major groupings of causes of death, the infectious and parasitic diseases, diseases of the respiratory systems, nutritional deficiencies and anemia, and ill-
defined causes, are responsible for the largest mortality differentials between Guatemala and Costs Rica (referred to hereafter as the mortality differential) for all age groups except the groups on both extremes of the age range. With regard to the sexes, the only important difference is that accidents and violence are the leading contributors to the mortality differential for males in the age range 15 to 34 and an important contributor in the age range 33 to 54. A brief description of the cause of death pattern separately for each group is described below.

Infant Mortality

In absolute terms, infant mortality, as reported before, shows the largest differential between Guatemala and Costa Rica. About half of the infant mortality differential between Guatemala and Costa Rica is due to conditions originating in the perinatal period. About one-fourth of the differential is due to infectious and parasitic diseases and one-fifth is due to diseases of the respiratory system (see Figures 3-A, 3-B, and Table 2).

Figure 2. Absolute and Relative Differential in Mortality by Age and Sex Between Guatemala and Costa Rica: 1984
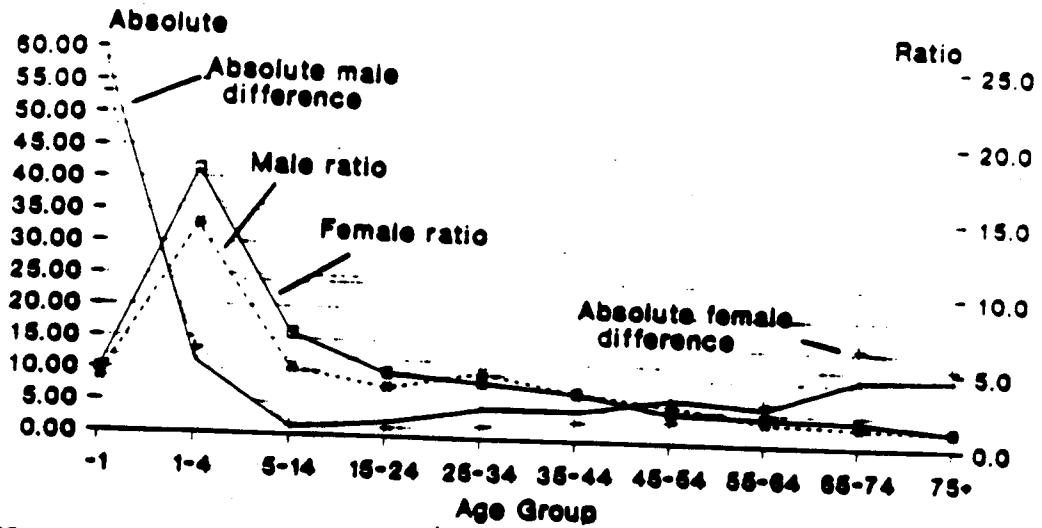
NOTE: Absolute differential refers to the difference of Guatemala and Costa Rica central death rates in each age group. Relative differential is the ratio of Guatemala to Costa Rica central death rates in each age group.

Source: Table 2.

Table 2. Mortality Rates and Intercountry Differences by Sex, Age Groups, and Cause of Death,
          Guatemala and Costa Rica: 1984
          (Rates per 100 thousand)

Item, country, sex, and cause	Under 1	1-4	5-14	15-24	25-34	35-44	45-54	55-64	65-74	75+
MORTALITY RATES										
Guatemala										
Males										
All causes	8079.20	1217.78	163.69	330.77	607.13	689.05	1161.05	1845.58	4548.65	12341.30
A	1311.88	240.75	30.48	38.06	59.21	62.50	120.94	242.04	603.97	2014.39
B	105.42	22.26	2.80	2.08	.00	3.12	10.99	15.13	106.95	195.30
C	2.93	1.65	2.65	8.30	11.84	32.81	90.16	127.07	371.19	797.60
D	35.14	18.14	13.66	147.39	254.05	184.37	189.11	151.28	213.91	335.83
E	.00	.00	.70	15.22	30.14	37.50	131.94	284.40	824.17	2980.50
F	1452.44	594.46	63.76	47.05	111.95	143.75	224.29	402.40	761.25	1259.37
G	210.84	89.87	14.36	9.69	15.07	35.94	74.76	130.10	503.31	1161.42
H	.00	.00	.00	.00	.00	.00	.00	18.15	232.78	1483.26
I	465.60	145.94	19.62	26.99	39.83	57.81	114.35	139.18	408.94	937.53
J	4011.70	.00	.00	.00	.00	.00	.00	.00	.00	.00
K	2.93	1.65	.35	1.38	20.45	42.19	57.17	75.64	100.66	111.34
L	480.24	103.06	17.52	34.60	64.59	89.06	147.33	280.20	421.52	1063.47
Females										
All causes	7046.40	1403.04	169.00	171.23	267.58	446.19	699.90	1514.27	3762.65	10821.29
A	1174.40	318.07	36.81	22.87	36.07	50.29	70.58	207.78	467.99	1442.02
B	83.69	23.18	3.17	2.23	3.36	3.87	7.84	25.19	37.44	160.22
C	5.99	3.71	1.98	5.02	20.97	50.29	105.87	217.22	524.15	862.74
D	26.96	9.27	5.94	19.52	20.97	27.08	33.33	18.89	62.40	147.90
E	.00	.00	1.58	13.39	19.29	42.56	86.26	226.67	761.27	2563.58
F	1506.96	683.43	62.53	42.39	62.07	91.56	135.28	264.46	655.19	1257.14
G	188.75	188.71	15.04	16.17	13.42	30.95	76.46	154.36	343.19	1072.27
H	.00	.00	.00	.00	.00	.00	.00	37.78	162.24	1663.87
I	488.30	147.46	21.77	17.85	32.71	58.03	56.85	147.96	274.56	690.20
J	3088.79	.00	.00	.00	.00	.00	.00	.00	.00	.00
K	.00	1.88	.79	.56	4.19	7.74	13.72	40.93	68.64	36.97
L	515.30	110.38	19.39	31.23	54.52	83.82	113.71	173.15	405.59	924.37

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Table 2. Mortality Rates and Intercountry Differences by Sex, Age Groups, and Cause of Death,
Guatemala and Costa Rica: 1984--Continued
(Rates per 100 thousand)

Item, country, sex, and cause	Age Groups									
	Under 1	1-4	5-14	15-24	25-34	35-44	45-54	55-64	65-74	75+
MORTALITY RATES										
Costa Rica										
Males										
All Causes	2275.88	89.44	38.15	103.50	141.00	225.77	479.49	1269.26	3492.76	11265.39
A	262.07	8.13	1.51	2.20	1.43	3.53	5.91	108.63	318.80	1441.70
B	8.28	.00	.00	.37	.00	.00	.00	.00	.00	20.50
C	11.03	4.88	10.60	14.68	15.72	36.16	122.82	396.41	1086.01	2409.71
D	33.10	26.02	12.72	62.76	85.74	87.31	113.38	154.37	171.66	370.72
E	27.59	.00	.91	8.07	17.63	35.28	113.38	396.41	1355.77	4846.87
F	168.28	16.26	1.51	1.10	4.29	7.06	20.08	24.78	80.58	302.07
G	30.35	.81	.61	1.47	2.38	.88	1.18	.00	17.52	109.84
H	.00	.00	.00	.00	.00	.00	.00	3.81	38.54	446.24
I	55.17	8.13	1.51	.73	.95	1.76	9.45	24.78	21.02	144.17
J	1084.15	.81	.00	.00	.00	.00	.00	.00	.00	.00
K	.00	.81	.30	1.84	2.86	13.23	37.79	26.68	56.05	123.57
L	595.87	23.58	8.48	10.28	10.00	40.57	55.51	133.41	346.82	1050.38
Females										
All Causes	1734.00	81.56	25.55	41.53	73.51	144.84	361.37	861.82	2210.46	9562.31
A	181.21	8.07	1.40	2.06	1.58	9.29	21.57	59.56	179.96	1366.04
B	5.58	.00	.00	.00	.00	.00	.00	.00	3.00	5.39
C	8.36	5.38	4.90	7.21	18.38	43.37	160.46	290.37	638.84	1448.48
D	13.94	17.93	6.65	14.76	15.75	18.59	14.83	26.06	26.99	282.63
E	13.94	.00	1.05	1.72	11.55	30.21	72.81	271.76	932.77	4457.31
F	122.66	13.44	2.80	1.72	2.63	5.42	17.53	40.95	35.99	206.08
G	33.45	.90	.35	.34	.53	.77	1.35	5.58	15.00	38.12
H	.00	.00	.00	.00	.00	.00	.00	1.86	29.99	559.37
I	61.33	5.38	.70	.34	2.63	2.32	2.70	26.06	26.99	129.54
J	775.01	.00	.00	.00	.00	.00	.00	.00	.00	.00
K	.00	.90	.00	.34	1.05	5.42	2.70	24.20	35.99	38.12
L	518.53	29.58	7.70	13.04	19.43	29.43	67.42	115.41	284.93	930.32

Table 2. Mortality Rates and Intercountry Differences by Sex, Age Groups, and Cause of Death, Guatemala and Costa Rica: 1984--Continued (Rates per 100 thousand)

Country, sex, and cause	Age Groups									
	Under 1	1-4	5-14	15-24	25-34	35-44	45-54	55-64	65-74	75-
DIFFERENCE										
All causes	5803.32	1128.33	127.54	227.26	466.13	463.28	681.56	576.32	1055.89	1075.92
A	1049.81	232.62	28.96	35.86	57.78	58.97	115.04	133.41	285.17	573.28
B	97.14	22.26	2.80	1.71	.00	3.12	10.99	15.13	106.95	175.31
C	-8.11	-3.23	-8.15	-6.38	-3.88	-3.35	-32.67	-269.33	-714.82	-1612.11
D	2.04	-7.88	.94	84.63	168.30	97.06	75.73	-3.09	42.25	-34.89
E	-27.59	.00	-.21	7.15	12.52	2.22	18.56	-112.00	-531.60	-1866.37
F	1284.16	578.20	62.24	45.95	107.67	136.69	204.22	377.62	680.68	957.30
G	180.49	89.06	13.76	8.22	12.69	35.05	73.58	130.10	485.79	1051.57
H	.00	.00	.00	.00	.00	.00	.00	14.34	194.24	1037.01
I	410.43	137.80	18.10	26.25	38.88	56.05	104.90	114.40	387.92	793.16
J	2927.64	-.81	.00	.00	.00	.00	.00	.00	.00	.00
K	2.93	.84	.05	-.45	17.59	28.96	19.38	48.96	44.61	-11.63
L	-115.62	79.48	9.04	24.32	54.58	48.49	91.82	126.79	74.70	13.08
Other										
All Causes	5312.40	1321.48	143.45	129.70	194.08	301.35	338.54	652.46	1552.19	1258.98
A	993.19	310.00	35.41	20.81	34.49	41.00	49.00	148.22	288.04	75.97
B	78.31	23.18	3.17	2.23	3.36	3.87	7.84	25.19	34.44	154.34
C	-2.37	-1.67	-2.92	-2.19	2.59	6.92	-54.59	-73.15	-114.69	-585.73
D	13.02	-8.65	-.71	4.76	5.22	8.49	18.50	-7.17	35.41	-134.73
E	-13.94	.00	.53	11.67	7.74	12.35	13.45	-45.09	-171.51	-1893.72
F	1384.28	669.99	59.73	40.67	59.45	86.14	117.75	223.50	619.20	1051.06
G	152.29	104.82	14.69	15.83	12.90	30.18	75.11	148.68	328.20	983.95
H	.00	.00	.00	.00	.00	.00	.00	35.92	132.24	1104.49
I	397.04	142.07	21.07	17.50	30.09	55.71	54.16	121.91	247.56	560.66
J	2313.79	.08	.00	.00	.00	.00	.00	.00	.00	.00
K	.08	.96	.79	.21	3.14	2.32	11.03	16.73	32.65	-51.35
L	-3.23	80.77	11.69	18.19	35.10	54.39	46.29	57.74	120.66	-5.95

Note: Negative differences indicate higher mortality in Costa Rica than in Guatemala.

Groups of causes of deaths

Group A: Respiratory Diseases
Group B: Influenza
Group C: Neoplasm
Group D: Accidents and Violence
Group E: Diseases of Circulatory System
Group F: Infectious & Parasitic Diseases

Group G: Anemias & Nutritional Deficiencies
Group H: Senility without mention of Psychosis
Group I: Other Ill-defined Conditions
Group J: Conditions in the Perinatal Period
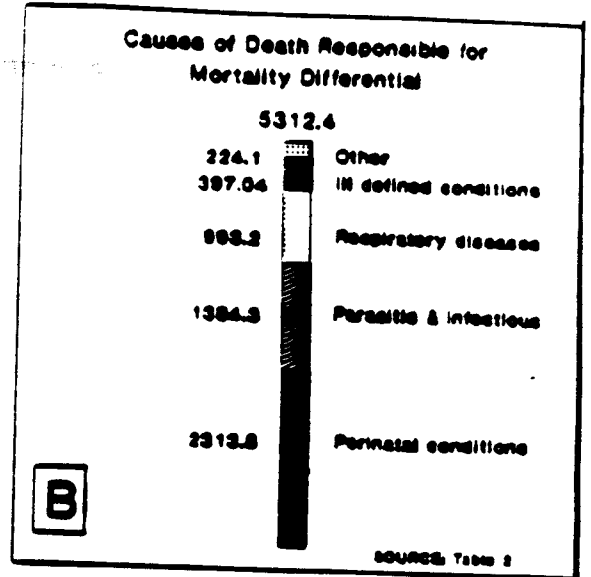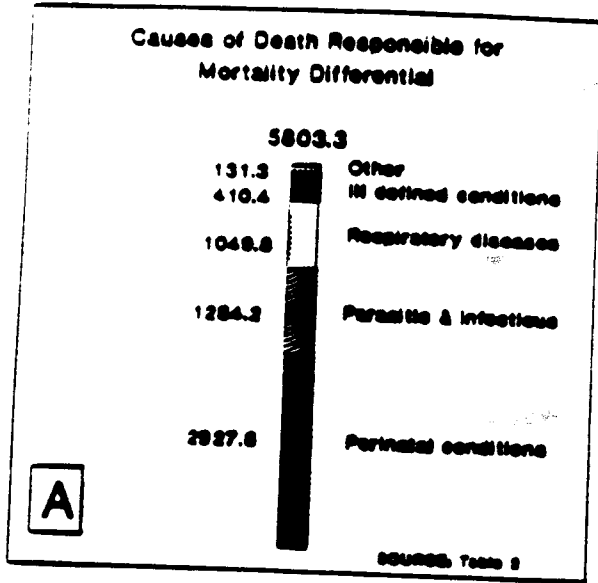Group K: Cirrhosis of the Liver
Group L: Other Causes

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Figure 3. Differentials in Mortality Between Guatemala and Costa Rica by Selected Age Groups and Main Causes of Deaths for Males and Females: 1984
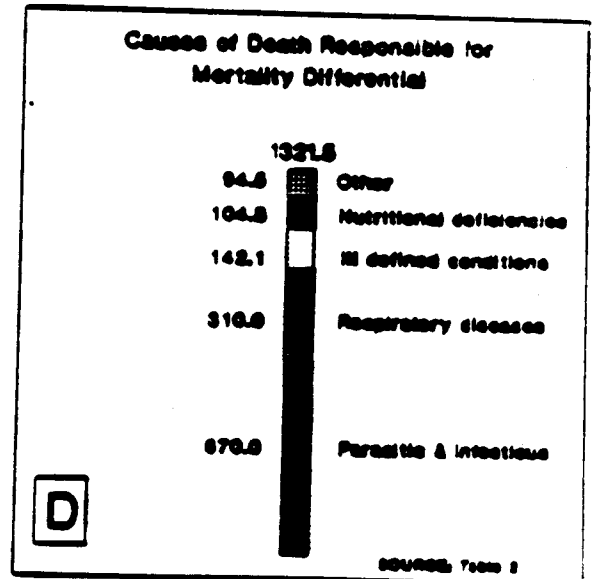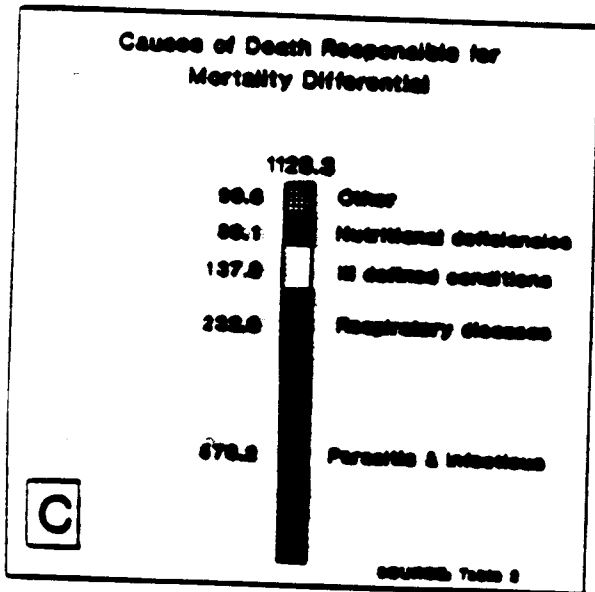
(Figures per hundred thousand)

Males

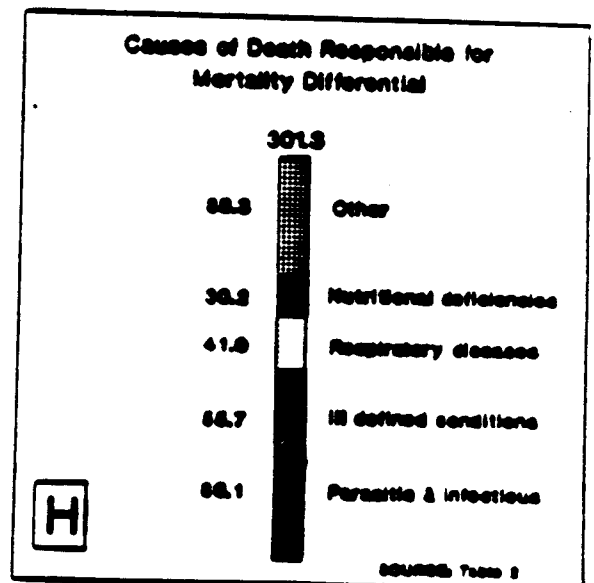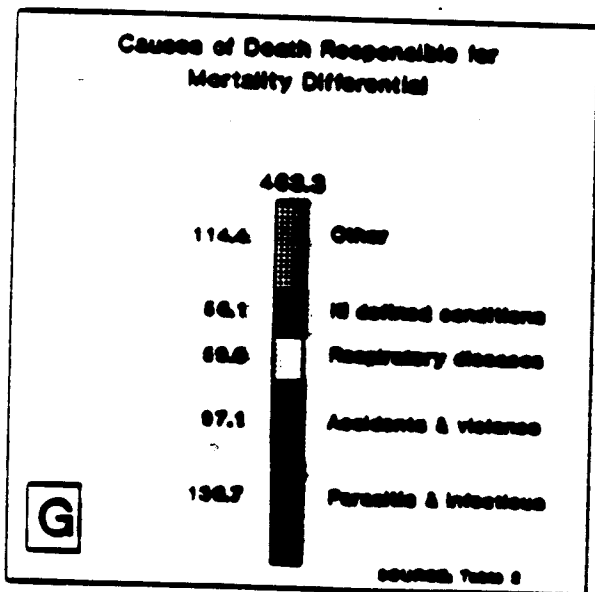### Females

Infant Mortality

Causes of Death Responsible for Mortality Differential

5803.3

131.3	Other
410.4	Ill defined conditions
1049.8	Respiratory diseases
1284.2	Parasitic & Infectious
2927.6	Perinatal conditions

A

SOURCE: Table 8

Causes of Death Responsible for Mortality Differential

5312.4

224.1	Other
397.04	Ill defined conditions
983.2	Respiratory diseases
1384.5	Parasitic & Infectious
2313.6	Perinatal conditions

B

SOURCE: Table 8

Age group 1-4

Causes of Death Responsible for Mortality Differential

1128.8

93.8	Other
86.1	Nutritional deficiencies
137.9	Ill defined conditions
232.8	Respiratory diseases
678.2	Parasitic & Infectious

C

SOURCE: Table 8

Causes of Death Responsible for Mortality Differential

1321.5

94.5	Other
104.8	Nutritional deficiencies
142.1	Ill defined conditions
310.0	Respiratory diseases
670.0	Parasitic & Infectious

D

SOURCE: Table 8

NOTE: Each bar represents th

Mortality at Ages 1-4

This age group shows the second largest mortality differential in absolute terms. The infectious and parasitic diseases are the primary contributors to the mortality differential at this age. These diseases account for one-half of the differential. The respiratory diseases are responsible for about one-fifth of the difference. Nutritional deficiencies and anemia, ill-defined conditions, and other causes each account for about one-tenth of the differential (see Figures 3-C, 3-D, and Table 2).

Mortality at Ages 5-14

This age group almost always has the lowest death rate of all ages of the population. This is true for both Guatemala and Costa Rica. As a result, the mortality differential for this age group is the smallest of all ages. The pattern of causes of death, accounting for the mortality differential of this age group, resembles the previous age group. The infectious and parasitic diseases and the diseases of the respiratory system are the major contributors. About 70 percent of this age mortality differential is due to these two causes of death groups. The nutritional deficiencies and anemia, ill-defined conditions, and other causes also contribute to the mortality differential for females. For males, accidents and violence contribute the largest to the differential, about four-tenths. Also, infectious and parasitic diseases, and the diseases of the respiratory system are important contributors to the mortality differentials, together they account for about three-tenths of the differential (see Figures 3-E, 3-F, and Table 2).

Mortality at Ages 25-34

For both males and females, the mortality pattern resembles the previous age. For females, the infectious and parasitic diseases and the diseases of the respiratory system are major contributors to the mortality differential, accounting for one-third of the difference. Infectious and parasitic disease and the diseases of the respiratory system are the second and third largest contributors. Combined they account for one-third of the differential (see Table 2).

Mortality at Ages 35-44

For females, the pattern of mortality resembles the previous age. For males, the infectious and parasitic diseases again become the leading contributor, contributing three-tenths to the differential. Accidents and violence are the second largest contributor for age groups 35-44 and the third largest for age groups 45-54, accounting for one-fifth of the differential. Ill-defined causes and other causes explain a large proportion of the mortality differentials of both sexes (see Figures 3-G, 3-H, and Table 2).

Figure 3. Differentials in Mortality Between Guatemala and Costa Rica by Selected Age Groups and Main Causes of Deaths for Males and Females: 1984 (continued)
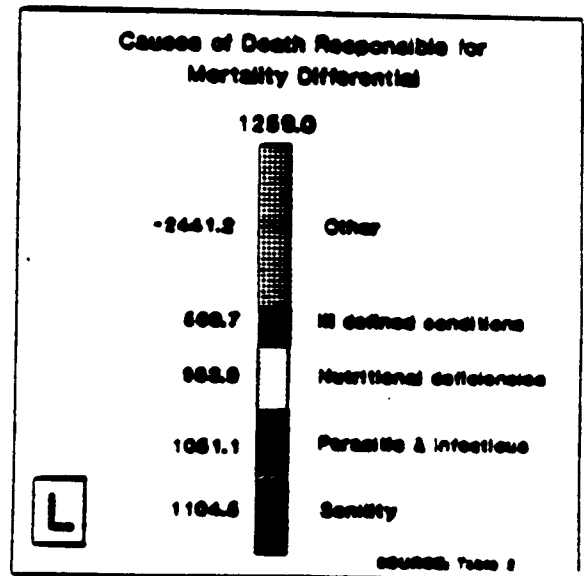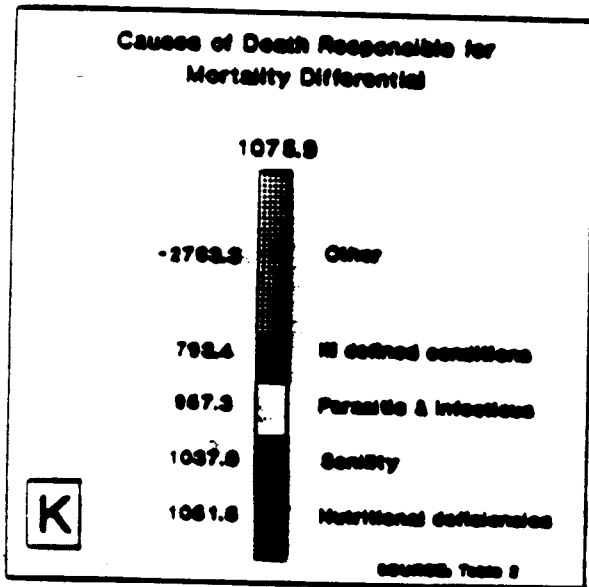
(Figures per hundred thousand)

Males

Females

Age group 15-24

E

Causes of Death Responsible for Mortality Differential

227.3

34.6 Other

26.3 Ill defined conditions

36.9 Respiratory conditions

48.0 Parasitic & infectious

84.8 Accidents & violence

SOURCE: Table 2

F

Causes of Death Responsible for Mortality Differential

128.7

34.8 Other

16.8 Nutritional deficiencies

17.5 Ill defined conditions

20.8 Respiratory diseases

48.7 Parasitic & infectious

SOURCE: Table 2

Age group 35-44

G

Causes of Death Responsible for Mortality Differential

462.3

114.4 Other

66.1 Ill defined conditions

60.0 Respiratory diseases

87.1 Accidents & violence

136.7 Parasitic & infectious

SOURCE: Table 2

H

Causes of Death Responsible for Mortality Differential

301.3

66.8 Other

30.2 Nutritional deficiencies

41.0 Respiratory diseases

66.7 Ill defined conditions

66.1 Parasitic & infectious

SOURCE: Table 2

NOTE: Each bar represents the DIFFERENCE of mortality

Figure 3. Differentials in Mortality Between Guatemala and Costa Rica by Selected Age Groups and Main Causes of Deaths for Males and Females: 1984 (continued)

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Mortality at Ages 55-64 and 65-74

Again, the four main groupings of causes--the infectious and parasitic diseases, the diseases of the respiratory system, nutritional deficiencies and anemia, and ill-defined causes--account for the mortality differentials for these groups. It should be noted that the diseases of the circulatory systems and all other causes act to reduce the differentials. At this stage of mortality reduction, Guatemala has lower rates of mortality due to the groupings of the diseases of the circulatory system and all other causes (see Figures 3-I, 3-J, and Table 2).

Mortality at Ages 75+

Senility without mention of the psychosis, the infectious and parasitic diseases, and nutritional deficiencies and anemia are the major contributors to the mortality differentials at this age group. Again, for this age group, diseases of the circulatory system, as well as all other causes combined, reduce the mortality differentials (see Figures 3-K, 3-L, and Table 2).

CONTRIBUTION TO THE LIFE EXPECTANCY AT BIRTH DIFFERENTIALS

The previous section identified the role of age mortality in determining the large gap in the life expectancy at birth between Guatemala and Costa Rica, as well as the major causes of death responsible for this differential. We did further analysis of the data to estimate contribution of age and cause of death differentials in mortality to the life expectancy at birth differential between Costa Rica and Guatemala. The technique provides contributions of age or cause mortality to the gap in life expectancy in terms of number of years. These contributions also can be interpreted as the increases (or decreases) in the life expectancy at birth of Guatemala if the mortality rates in Guatemala are equalized to those of Costa Rica.

Contribution to the Differential in Life Expectancy at Birth by Differential in Mortality at Each Age Group

For both males and females, differentials in mortality of children under age 5 between Guatemala and Costa Rica account for nearly half of the gap in life expectancy at birth between the two countries (6.9 years for males and 7.5 years for females (see Figure 4 and Table 3). For males, productive ages 15-54 account for another 5.3 years of the gap in life expectancy, with the maximum contribution by age group 25-34 (1.7 years). In the case of females, each age group in the age range 15 to 54 produces a similar contribution. However, the combined contribution of 3.2 years to the life expectancy gap for females is smaller than the combined contribution of males. At older ages, the pattern is reversed in the sense that differentials in female mortality between the two countries contribute more to the difference in the female expectancy of 2.7 years compared to only 1.5 years in the difference in the male expectancy.

Figure 4. Contribution to the Differential in Life Expectancy at Birth by the Differential in Mortality at Each Age Group. Guatemala and Costa Rica, 1984.

Source: Table 3.

Contribution to the Differential in Life Expectancy at Birth by the Differential in Mortality in Each Cause of Death

As expected for a developing country, the differential in mortality over all ages from infectious and parasitic diseases produces the largest contribution, about 5 years for each sex, to the differential in life expectancy at birth between Guatemala and Costa Rica (see Figure 5). The second largest contributor to the gap in the life expectancy between the two countries is made by the group of diseases of the respiratory system. These diseases contribute nearly 3 years to the difference in life expectancy between Guatemala and Costa Rica. Infectious and parasitic and respiratory diseases will produce a large increment of about 8 years in the life expectancy of each sex in Guatemala if mortality rates from these diseases are reduced to the mortality levels in Costa Rica. Other important contributors to the gap in life expectancy between Guatemala and Costa Rica for both sexes are the categories pertaining to conditions originating in the perinatal period, groups of diseases arising from nutritional diseases and anemia, and the ill-defined conditions which are difficult to interpret.

A noteworthy feature for males is that the cause that includes deaths from accidents, homicides, suicides, and violence is an important contributor to the life expectancy gap between Guatemala and Costa Rica. This cause contributes about 1.5 years to the difference in life expectancy of males between the two countries. It also is important to point out that circulatory diseases and neoplasms, as groups, produce negative contributions to the life expectancy differential between the two countries. Relatively more people in Costa Rica die from neoplasms and diseases of the circulatory system because Costa Rica has a lower mortality rate from airborne and water diseases.

So far, we have identified major cause groupings which contribute to the differential in life expectancy at birth. For some of these groups, at least those which contribute substantially to the differential in life expectancy, it is useful to disaggregate into subgroups or into a single cause. Unfortunately, classification of causes of death data puts limits on the disaggregation which is not necessarily satisfactory. However, some disaggregation was possible and these are discussed briefly below.

Infectious and Parasitic Diseases

As described above, infectious and parasitic diseases, as a category, contribute the largest differential in life expectancy at birth, about 5 years; intestinal infections contribute about 3.5 years to the differentials in life expectancy of each sex between Guatemala and Costa Rica. Unfortunately, data to further disaggregate this subcategory are not readily available. No other single cause makes a major contribution to the differential in the life expectancy at birth. Tuberculosis,

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Figure 5. Contribution to the Differential in Life Expectancy
at Birth by the Differential in Mortality in Each Cause
of Death. Guatemala and Costa Rica, 1984.

Causes of death
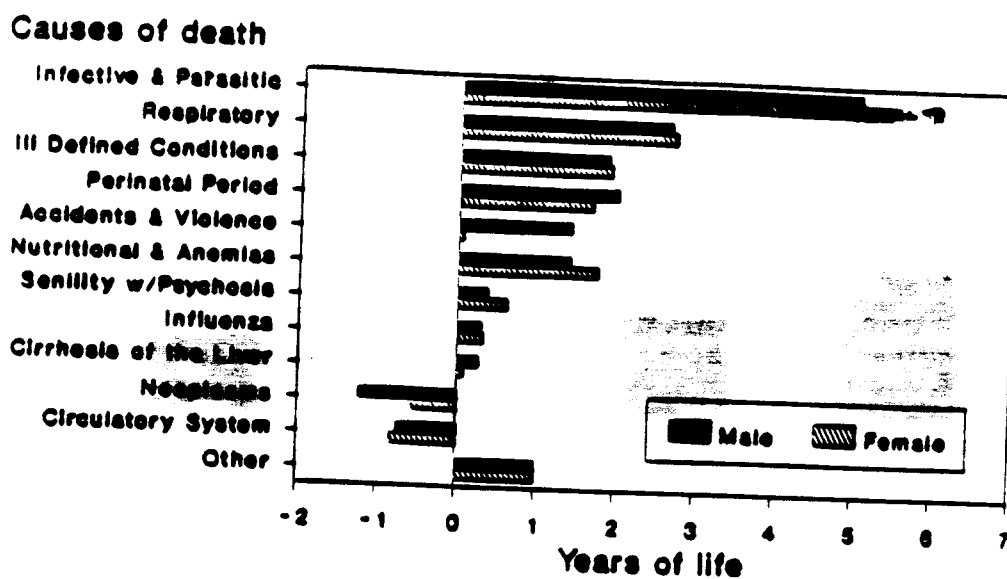
Source: Table 3.

measles, **and** whooping cough together produce a contribution of 1 year to the life expectancy differentials between the two countries (see Figure 6 and Table 4).

Respiratory Diseases

This group of diseases contributes about 2.7 years to the life expectancy at birth differential between the two countries. Pneumonia is the major cause contributing 2.5 years (equal to the entire group contribution) to the differentials in the life expectancy at birth between the two countries (see Figure 7 and Table 4).

Accidents and Violence

As stated before, in the case of Guatemala-Costa Rica mortality differential, this category has more relevance for males and contributes about 1.5 years to the difference in the life expectancy at birth between the two countries. Suicide, homicide, and violence, a subgroup within this category, are responsible for this contribution. In fact, the contribution of this subgroup of 1.5 years to the differential in life expectancy at birth is greater than the contribution of the whole group. The subcategory, motor vehicles and other transportation accidents, makes a negative contribution to the life expectancy differentials, indicating that the mortality rate for this subcategory is lower in Guatemala than in Costa Rica (see Figure 8 and Table 4).

Diseases of the Circulatory System

Differential in mortality from the schematic diseases between the two countries reduces the gap in life expectancy of each sex between Guatemala and Costa Rica by about 1 year. Cerebrovascular diseases also appear to reduce the gap in the life expectancy by a small amount. By contrast, diseases of the circulation of the respiratory system contribute to the gap in the life expectancy at birth between the two countries (see Figure 9).

Nutritional Deficiencies of Anemia

Within this grouping of causes of death, the nutritional deficiencies category is the major contributor adding 1 year to the gap in the life expectancy between Guatemala and Costa Rica. Anemia as a single cause makes a very small contribution to the gap in the life expectancy (see Figure 10 and Table 4).

Other single causes analyzed are influenza, cirrhosis of the liver, and diseases of the digestive systems. Each of these makes a very small contribution and is not an important contributor in determining the differential in the life expectancy between the two countries.
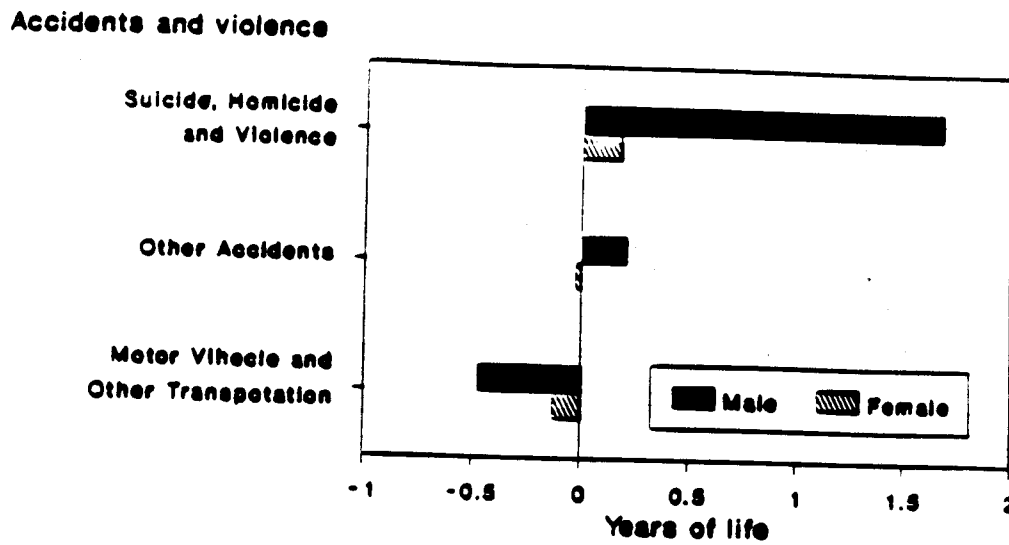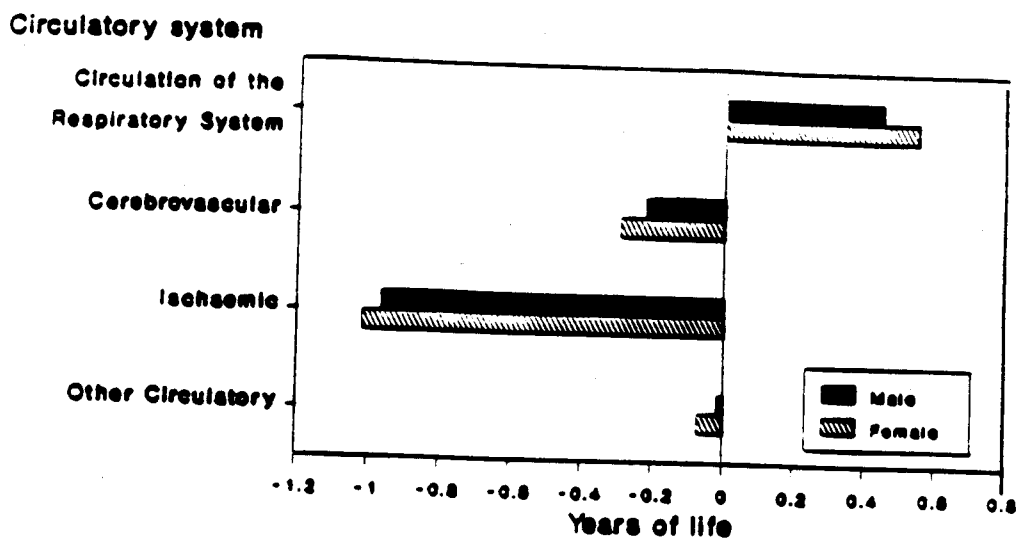
20

Figure 6. Contribution to the Differential in Life Expectancy
at Birth by the Differential in Mortality from Infectious
and Parasitic Diseases. Guatemala and
Costa Rica, 1984.
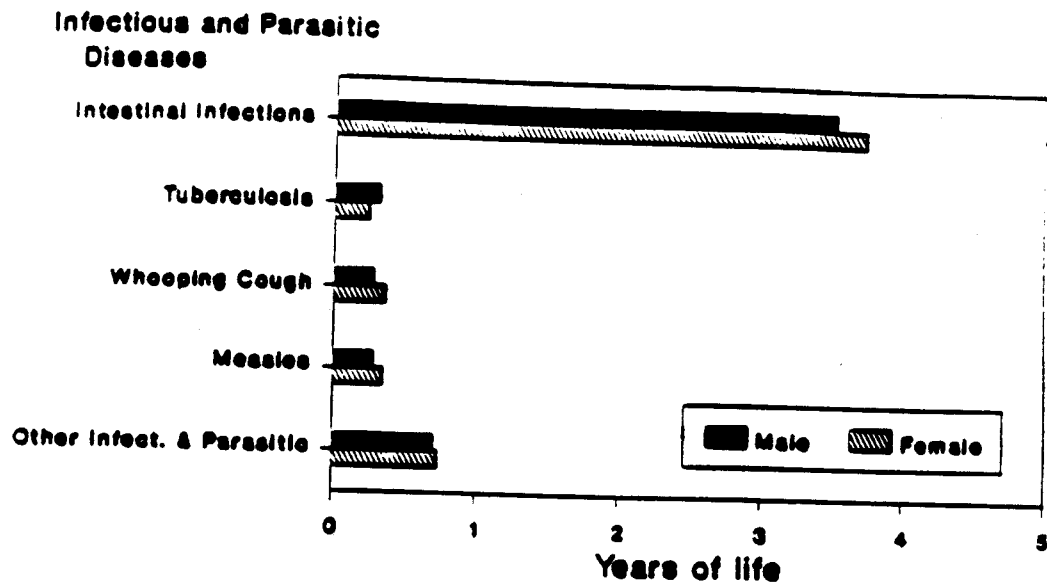
Source: Table 4.

Table 4. Contributions of Years of Life to the Sex Differential in Life Expectancy
at Birth Between Guatemala & Costa Rica, by Selected Causes of Death and
and Age Group: 1984

Age Groups	All causes	Causes of Death											
		1	2	3	4	5	6	7	8	9	10	11	12
Male													
-1	3.96	.06	.64	.02	.07	-.01	.00	-.01	.01	.00	-.01	.00	-.01
1-4	2.89	.03	.53	.04	.06	-.01	-.01	-.03	.01	.00	.00	.00	.00
5-14	.73	.01	.14	.01	.02	-.05	-.02	.00	.02	.00	.00	.00	.00
15-24	1.07	.01	.14	.02	.01	-.03	-.08	.06	.41	.02	.01	.02	.01
25-34	1.73	.01	.18	.03	.00	-.01	-.08	.14	.56	.01	.02	.01	.02
35-44	1.28	.00	.12	.04	.01	-.01	-.09	.04	.32	.00	.01	.00	.01
45-54	1.25	.00	.17	.04	.02	-.06	-.08	.01	.21	-.06	.06	-.06	.06
55-64	.56	-.03	.19	-.01	.02	-.30	-.06	.00	.06	-.21	.10	-.21	.10
65-74	.47	-.01	.22	-.07	.06	-.38	-.03	.01	.04	-.28	.10	-.28	.10
75+	.13	-.02	.28	-.12	.04	-.39	-.03	-.02	.04	-.45	.16	-.45	.16
	.00												
Total	14.06	.06	2.60	.01	.29	-1.25	-.48	.21	1.68	-.97	.45	-.97	.45

Age Groups	Causes of Death												
	13	14	15	16	17	18	19	20	21	22	23	24	25
-1	.55	.00	.14	.08	.10	.01	.11	.00	.28	2.00	.00	.01	-.09
1-4	1.00	.01	.12	.14	.21	.03	.20	.00	.35	.00	.00	.02	.18
5-14	.23	.02	.01	.05	.05	.01	.07	.00	.10	.00	.00	.01	.04
15-24	.16	.01	.00	.00	.04	.00	.04	.00	.12	.00	.00	.02	.09
25-34	.21	.10	.00	.00	.09	.01	.04	.00	.14	.00	.06	.03	.17
35-44	.26	.05	.00	.00	.07	.01	.09	.00	.15	.00	.08	.02	.12
45-54	.31	.03	.00	.00	.04	.02	.12	.00	.20	.00	.04	.04	.13
55-64	.31	.06	.00	.00	.05	.03	.12	.02	.13	.00	.06	.03	.11
65-74	.27	.03	.00	.00	.05	.05	.20	.10	.20	.00	.02	.04	.00
75+	.23	.00	.00	.00	.00	.02	.24	.25	.19	.00	.00	.02	-.01
Total	3.52	.31	.28	.28	.70	.19	1.22	.37	1.87	2.00	.26	.22	.75

Table 4. Contributions of Years of Life to the Sex Differential in Life Expectancy
at Birth Between Guatemala & Costa Rica, by Selected Causes of Death
and Age Group: 1984 -- Continued

Age Groups	All causes	Causes of Death											
		1	2	3	4	5	6	7	8	9	10	11	12
Female													
-1	3.89	.08	.61	.04	.06	.00	.00	.01	.01	.00	-.01	.00	.00
1-4	3.60	.05	.74	.05	.06	.00	-.01	-.01	.01	.00	-.01	.00	.00
5-14	.91	.01	.20	.01	.02	-.02	-.01	.00	.04	.00	.00	.00	.00
15-24	.66	.00	.08	.03	.01	-.01	-.02	.01	.02	.00	.00	.00	.00
25-34	.76	.00	.12	.02	.01	.01	-.02	.00	.01	.01	.05	.00	.00
35-44	.98	.00	.13	.00	.01	.02	-.02	.03	.01	.01	.02	.01	.00
45-54	.76	.00	.11	.00	.02	-.13	.00	.02	.03	.01	.03	.02	-.02
55-64	.99	.00	.20	.01	.04	-.11	-.02	-.01	.00	.00	.05	.00	-.02
65-74	1.18	-.01	.25	-.02	.03	-.09	.00	-.01	.03	-.16	.13	-.02	-.01
75+	.38	-.05	.30	-.22	.06	-.24	-.01	-.06	.01	-.21	.10	-.01	-.01
										-.67	.19	-.29	-.02
Total	14.11	.08	2.	-.08	.32	-.57	-.13	-.03	.18	-1.02	.55	-.29	-.07

Age Groups	Causes of Death												
	13	14	15	16	17	18	19	20	21	22	23	24	25
-1	.62	.00	.17	.08	.14	.01	.10	.00	.29	1.69	.00	.01	-.01
1-4	1.21	.00	.15	.23	.23	.02	.27	.00	.39	.00	.00	.01	-.01
5-14	.21	.02	.01	.03	.08	.01	.07	.00	.13	.00	.00	.00	.21
15-24	.12	.03	.01	.01	.03	.02	.06	.00	.09	.00	.00	.01	.07
25-34	.15	.05	.00	.00	.03	.00	.05	.00	.12	.00	.00	.02	.08
35-44	.18	.03	.00	.00	.06	.02	.07	.00	.18	.00	.01	.02	.12
45-54	.21	.03	.00	.00	.03	.04	.14	.00	.12	.00	.01	.04	.15
55-64	.28	.01	.00	.00	.04	.03	.19	.05	.18	.00	.03	.02	.09
65-74	.38	.03	.00	.00	.06	.04	.21	.10	.19	.00	.02	.05	.06
75+	.36	.04	.00	.00	.03	.06	.35	.46	.23	.00	-.02	-.14	.01
Total	3.74	.24	.35	.36	.73	.26	1.51	.61	1.92	1.69	.08	.09	.35

Causes of death:

Cause 1: Bronchitis
Cause 2: Pneumonia
cause 3: Other respiratory
Cause 4: Influenza
Cause 5: Neoplasms
Cause 6: Motor Vehicle and Trans. Accidents
Cause 7: Other accidents
Cause 8: Suicide, Homicide, Violence
Cause 9: Ischaemic diseases
Cause 10: Circulation of the Respiratory System
Cause 11: Cerebrovascular
Cause 12: Other circulatory
Cause 13: Intestinal Infections

Cause 14: Tuberculosis
Cause 15: Whooping cough
Cause 16: Measles
Cause 17: Other infection and parasitic
Cause 18: Anemias
Cause 19: Nutritional deficiences
Cause 20: Senility without ment./psychosis
Cause 21: Ill defined conditions
Cause 22: Conditions Orig. in perinatal period
Cause 23: Cirrhosis of liver
Cause 24: Digestive system
Cause 25: Other causes of death

Figure 7. Contribution to the Differential in Life Expectancy
at Birth by the Differential in Mortality from Disease
of the Respiratory System. Guatemala and
Costa Rica, 1984.

Respiratory diseases
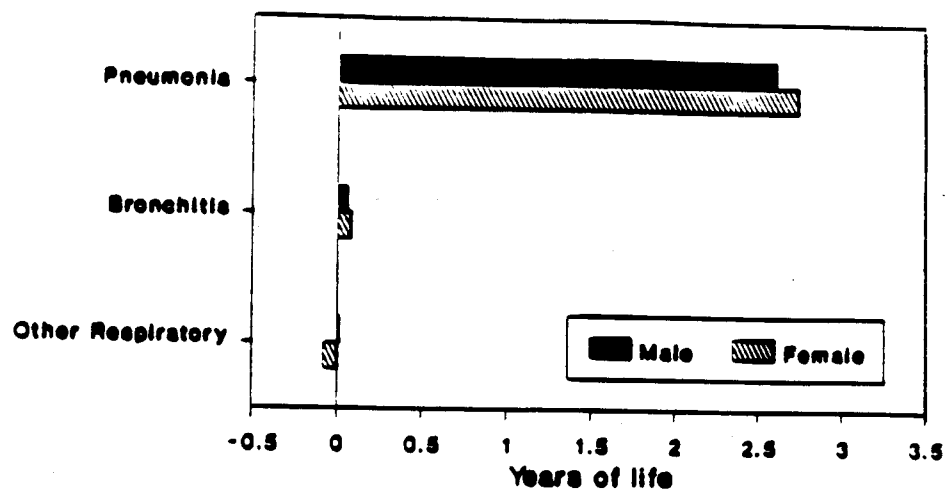
Source: Table 4.

24

Figure 8. Contribution to the Differential in Life Expectancy
at Birth by the Differential in Mortality from Accidents
and Violence. Guatemala and Costa Rica, 1984.

Source: Table 4.

25

Figure 9. Contribution to the Differential in Life Expectancy at Birth by the Differential in Mortality from Diseases of the Circulatory System. Guatemala and Costa Rica, 1984.

Circulatory system

Source: Table 4.

26

Figure 10. Contribution to the Differential in Life Expectancy at Birth by the Differential in Mortality from Selected Causes of Death. Guatemala and Costa Rica, 1984.
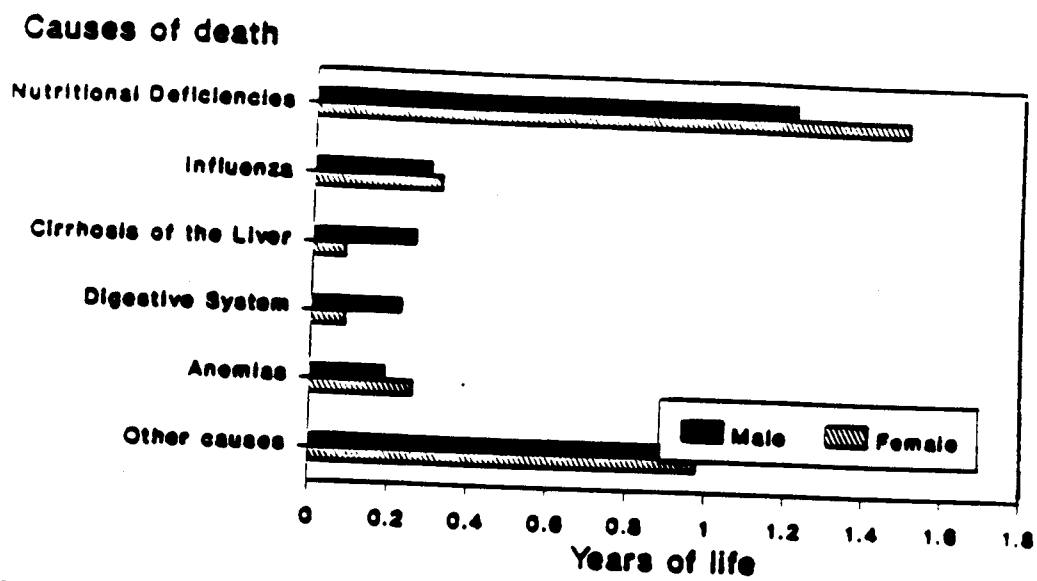
Source: Table 4.

EXCESS DEATHS

In addition to improvements in life expectancy, it is of interest to estimate the number of deaths that would not have occurred in Guatemala if Costa Rica's 1984 death rates by age, sex, and cause apply to Guatemala. In 1984, approximately 29,000 deaths would have been expected in Guatemala if its population had experienced the death rates by age and sex that prevailed in Costa Rica. However, total deaths in Guatemala in 1984 were over 77,000. This indicates that about 48,000 deaths would not have occurred (referred to hereafter as excess deaths) in Guatemala. Figure 11 shows expected and excess deaths by age and Table 5 shows excess deaths by age and sex for each cause of death. Some important findings are as follows:

1. Improvements in infant and child mortality in Guatemala to the levels in Costa Rica would reduce the excess deaths by about 61 percent. An additional 28 percent reduction in excess deaths would result if prime age adult (15 to 54 years old) mortality is reduced in Guatemala to the levels in Costa Rica.

2. Slightly more of the excess deaths are of males (about 25,700) than females (about 22,600). Excess deaths for both males and females are a result of similar causes of death with one notable exception, excess deaths from violence are 9 times higher for males.

3. The largest contributors to these excess deaths are the causes identified in the previous section on the basis of increases in life expectancy that would result when mortality rates are equalized in two countries--intestinal infections, pneumonia, conditions originating to the perinatal period, and nutritional deficiencies. Intestinal infections account for 25 percent (about 12,000) of the excess deaths and pneumonia for another 19 percent of the excess deaths. Nutritional deficiencies (about 4,000) and conditions originating in the perinatal period (about 7,700) together are responsible for 24 percent of the excess deaths in Guatemala. Violence, including homicides and suicides (2,600), accounts for 5 percent of the excess deaths.

SUMMARY

The analysis of causes of death data from Guatemala and Costa Rica provides useful insights for health planners in terms of where to effectively target limited resources. First, it finds that very few causes of death are responsible for the large mortality differentials between the two countries. Of the 25 causes analyzed, death rates from the 4 causes of death--intestinal infections, pneumonia, conditions originating in the perinatal period, and nutritional deficiencies--when reduced to the levels in Costa Rica, would substantially improve the life expectancy of both males and females in Guatemala. In addition, violence, including homicides and suicides, is an important cause of lower expectation of life of males in Guatemala. When reduced to the level of Costa Rica, these 5 causes would add 10 to 11 years to the life

Figure 11. Expected and Excess Deaths by Age in Guatemala: 1984
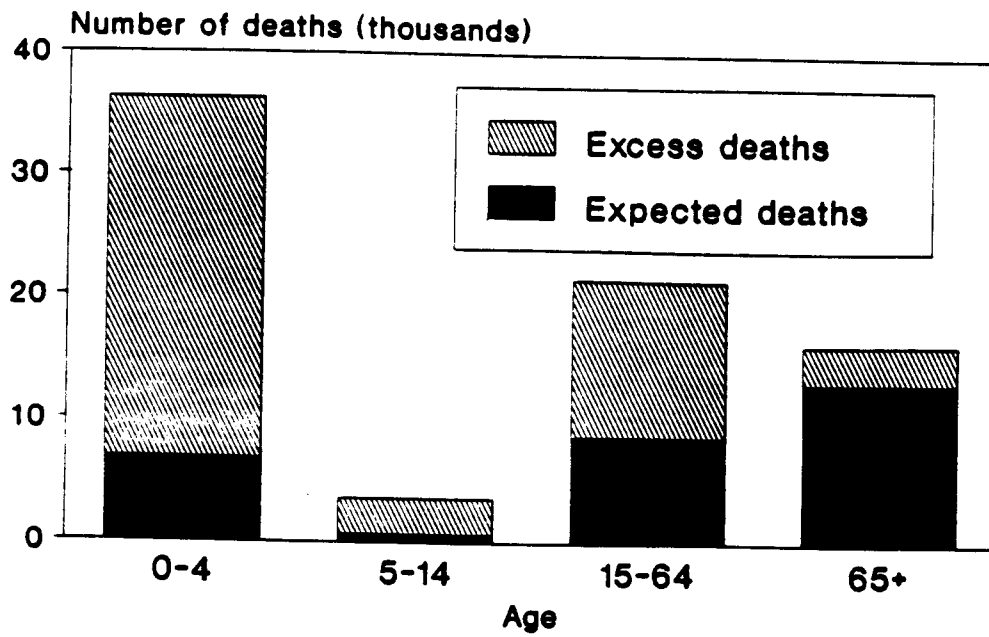
Source: Table 5.

Table 5. Excess Deaths by Cause of Death, Sex and Age Groups: Guatemala 1984 -- Continued

Sex, and cause	Total	1	1-4	5-14	15-24	25-34	35-44	45-54	55-64	65-74	75+
Female Total	22570	7662	6874	1502	958	1007	1015	786	993	1260	515
1	207	156	92	9	4	2	5	-2	3	-11	-50
2	4254	1202	1419	349	112	148	133	114	210	272	295
3	30	74	101	13	38	29	0	2	12	-27	-214
4	461	113	121	33	16	17	13	18	38	28	63
5	-593	-3	-9	-31	-16	13	23	-127	-111	-93	-240
6	-167	-8	-23	-21	-28	-22	-22	-5	-24	-5	-10
7	-25	18	-27	-8	21	-3	27	21	-8	-7	-58
8	255	9	5	22	43	52	23	27	21	41	13
9	-1019	0	0	4	8	7	15	-3	-165	-225	-661
10	584	-12	0	5	69	20	29	48	130	109	187
11	-286	-8	0	0	7	17	17	2	-24	-15	-282
12	-77	0	0	-4	2	-3	-19	-16	-9	-9	-19
13	5748	1234	2312	371	179	196	188	212	290	411	355
14	291	-4	5	33	47	64	32	30	12	30	41
15	669	342	289	25	12	0	0	0	0	0	0
16	678	156	444	58	12	4	4	0	0	0	0
17	1166	269	435	139	50	44	65	31	38	61	34
18	309	23	34	25	30	2	23	38	30	43	61
19	1965	197	511	128	86	65	78	137	196	223	341
20	614	0	0	0	0	0	0	0	55	107	452
21	2747	573	739	221	129	156	188	126	186	201	229
22	3337	3337	0	0	0	0	0	0	0	0	0
23	96	0	5	8	2	16	8	26	25	27	-21
24	161	9	25	5	10	26	22	20	25	28	-9
25	1167	-14	396	118	124	157	161	87	62	70	6

Causes of death:

Cause 1: Bronchitis
Cause 2: Pneumonia
Cause 3: Other respiratory
Cause 4: Influenza
Cause 5: Neoplasms
Cause 6: Motor vehicle and trans. accidents
Cause 7: Other accidents
Cause 8: Suicide, homicide, violence
Cause 9: Ischaemic diseases
Cause 10: Circulation of the respiratory system
Cause 11: Cerebrovascular
Cause 12: Other circulatory
Cause 13: Intestinal infections

Cause 14: Tuberculosis
Cause 15: Whooping cough
Cause 16: Measles
Cause 17: Other infection and parasitic
Cause 18: Anemias
Cause 19: Nutritional deficiences
Cause 20: Senility without ment./psychosis
Cause 21: Ill defined conditions
Cause 22: Conditions Orig. in perinatal period
Cause 23: Cirrhosis of liver
Cause 24: Digestive system
Cause 25: Other causes of death

Both sexes

Table 5. Excess Deaths by Cause of Death, Sex and Age Groups: Guatemala 1984 -- Continued

Sex, and cause	Total	1	1-4	5-14	15-24	25-34	35-44	45-54	55-64	65-74	75+
Female Total	22570	7662	6874	1502	958	1007	1015	786	993	1260	515
1	207	156	92	9	4	2	5	-2	3	-11	-50
2	4254	1202	1419	349	112	148	133	114	210	272	295
3	30	74	101	13	38	29	0	2	12	-27	-214
4	461	113	121	33	16	17	13	18	38	28	63
5	-593	-3	-9	-31	-16	13	23	-127	-111	-93	-240
6	-167	-8	-23	-21	-28	-22	-22	-5	-24	-5	-10
7	-25	18	-27	-8	21	-3	27	21	-8	-7	-58
8	255	9	5	22	43	52	23	27	21	41	13
9	-1019	0	0	4	8	7	15	-3	-165	-225	-661
10	584	-12	0	5	69	20	29	48	130	109	187
11	-286	-8	0	0	7	17	17	2	-24	-15	-282
12	-77	0	0	-4	2	-3	-19	-16	-9	-9	-19
13	5748	1234	2312	371	179	196	188	212	290	411	355
14	291	-4	5	33	47	64	32	30	12	30	41
15	669	342	289	25	12	0	0	0	0	0	0
16	678	156	444	58	12	4	4	0	0	0	0
17	1166	269	435	139	50	44	65	31	38	61	34
18	309	23	34	25	30	2	23	38	30	43	61
19	1965	197	511	128	86	65	78	137	196	223	341
20	614	0	0	0	0	0	0	0	55	107	452
21	2747	573	739	221	129	156	188	126	186	201	229
22	3337	3337	0	0	0	0	0	0	0	0	0
23	96	0	5	8	2	16	8	26	25	27	-21
24	161	9	25	5	10	26	22	20	25	28	-9
25	1167	-14	396	118	124	157	161	87	62	70	6

Causes of death:

Cause 1: Bronchitis
Cause 2: Pneumonia
Cause 3: Other respiratory
Cause 4: Influenza
Cause 5: Neoplasms
Cause 6: Motor vehicle and trans. accidents
Cause 7: Other accidents
Cause 8: Suicide, homicide, violence
Cause 9: Ischaemic diseases
Cause 10: Circulation of the respiratory system
Cause 11: Cerebrovascular
Cause 12: Other circulatory
Cause 13: Intestinal infections

Cause 14: Tuberculosis
Cause 15: Whooping cough
Cause 16: Measles
Cause 17: Other infection and parasitic
Cause 18: Anemias
Cause 19: Nutritional deficiencies
Cause 20: Senility without ment./psychosis
Cause 21: Ill defined conditions
Cause 22: Conditions Orig. in perinatal period
Cause 23: Cirrhosis of liver
Cause 24: Digestive system
Cause 25: Other causes of death

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