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EPIDEMIOLOGIC TRANSITION IN THE CONTEXT OF DEMOGRAPHIC CHANGE: THE EVOLUTION OF CANADIAN MORTALITY PATTERNS

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Résumé – Cette étude examine les indicateurs tirés des données des séries chronologiques sur le mouvement de la mortalité canadienne à partir des hauts niveaux des décades du début du siècle jusq'aux niveaux bas des récentes années. L'étude insiste sur les tendances et les niveaux dans les divers composants âge-cause-sexe de la mortalité, les augmentations en espérance de vie, la régularisation de la courbe de survie, des années potentielles de vie perdues (APVP) par les causes de tête de la mortalité et l'influence de la transition épidémioilogique et l'élimination de la cause spécifique sur les espérances de vie résultantes aux différents âges.

Abstract – This paper examines the derived indicators from time series data on the movement of Canadian mortality from the high levels of the early decades of this century to the low levels of recent years. The paper emphasizes the trends and levels in various age/cause/sex components of mortality, the increases in life expectancy, the rectangularization of the survival curve, potential years of life lost (PYLL) by leading causes of mortality and the influence of epidemiologic transition and specific cause elimination on the resultant life expectancies at different ages.

Key Words – **epidemiologic shifts, demographic transition, rectangularization, satellite accounting**

Introduction

Epidemiology – according to MacMahon and Pugh (1970), the authors of *Epidemiology: Principles and Methods* – is the study of the distribution and determinants of disease frequencies in man. There are, of course, a variety of other definitions.

Epidemiologic transition, according to Omran, focuses on the "shifting web of health and disease patterns in population groups and their links with several demographic, social, economic, ecologic and biologic changes" (Omran, 1977:4). He further elaborates the theory of epidemiologic transition by emphasizing the fact that

> Many countries have experienced a significant change or transition from high to low mortality accompanying either social development ... or a combination of medical development and early social change (... when antibiotics, insecticides, sanitation and other medical technology were introduced after World War II) (1977:4).

In support of these views, Omran (1977) provides some convincing evidence in his paper on the epidemiologic transition in the U.S.A.

What is more important in Omran's statement, however, is the identification of the commonality of the shifts in the kinds of diseases and causes of mortality that are prevalent at specific time-points in the development of a country or a society. The recurring theme, of course, is that during the final phases of epidemiologic transition, epidemic, infectious and parasitic diseases are progressively replaced by degenerative diseases and diseases of man-made variety, both as leading causes of morbidity and mortality. The infectious and parasitic diseases such as TB, "diptheria, plague and the like decline as the leading diseases and causes of death to be replaced by heart diseases, cancer, stroke ... and the like, together with increased mental illness, accidents ... and diseases [due to] a deteriorating environment" (Omran, 1977:4).

Corresponding to the three traditional stages (high mortality and fertility, low mortality and high fertility, and low mortality and fertility) of demographic transition, Omran's identification of the three stages of the epidemiologic transition could be presented as follows: (a) Age of Pestilence and Famine, (b) Age of Receding Pandemics, and (c) Age of Degenerative and Man-made Diseases. Figure 1 presents a comparative perspective of these stages for the classical transition in Western societies. It is clear from this that there is a distinct relationship between demographic changes in mortality and the corresponding epidemiologic shifts.

Demographic Transition	Epidemiologic Transition
Stage 1: Age of Pestilence and Famine	
High Death Rate	a) High & fluctuating mortality
High Birth Rate	b) Dominance of Infectious and Parasitic diseases as causes of mortality
Low Growth Rate	c) Low Life Expectancy
Stage 2: Age of Receding Pandemics	
Low Death Rate	a) Accelerated declines in mortality
High Birth Rate	b) Shifts from Infectious and Parasitic diseases mortality degenerative disease mortality
High Growth Rate	c) Rising Life Expectancy
Stage 3: Age of Degenerative and Man–made Diseases	
Low Death Rate	a) Continuation of mortality declines and its eventual approach to stability at low levels
Low Birth Rate	b) Dominance of Degenerative disease mortality, caused by aging, changing lifestyle, and deteriorating environment
Low Growth Rate	c) Further rise in Life Expectancy

FIGURE 1. DEMOGRAPHIC-EPIDEMIOLOGIC TRANSITION: A BRIEF DESCRIPTION OF THE STAGES

Objectives of this Paper

This paper has a limited aim, attempting to examine some of the epidemiologic shifts – reflected in the Canadian data – corresponding to the demographic changes in the Canadian mortality patterns during the past five to six

decades. To follow through with all the stages of epidemiologic transition requires data for very long periods of time, say 150 to 200 years, which, of course, we do not – and perhaps cannot – have with respect to Canadian mortality. Hence, this study is limited to the Canadian experience of the past 50 years.

Fortunately in Canada, as a consequence of federal-provincial agreements dating back to 1918-19, annual mortality data are available for more than six decades, back to 1921. "Epidemiologic" classifications of mortality data have been available at least since the fourth revision of International Classification of Diseases (ICD). One could reasonably establish a comparative pattern of mortality by leading causes and its transition through time over the past five decades as the Canadian population has progressed to reach one of the lowest overall mortality levels among the developed countries of the world in recent years.

Demographic Changes

Demographic changes in mortality can be assessed by means of several conventional indicators derived annually or quinquennially from the annual series of death data and populations at risk obtained at the time of censuses or revised intercensal estimates. In order to maintain consistency, we have looked at the changes since 1931, though some of the tabulations and mortality indices could be derived and have been available since a decade earlier.

Overall Mortality

The Canadian crude death rate has declined by more than 30 per cent since 1931 (Figure 2). More than half of this improvement occurred during the two decades between 1951 and 1971. Even in the trends of crude rate, a significant differential in the relative improvement has been registered in favour of women. When one examines the age-standardized rates (Table 1), it can be seen that these have consistently and monotonically declined for Canada during the past decades. Between 1931 and 1981, the age-standardized death rate for Canada fell by 54 per cent for the population as a whole. The rate for women improved 50 per cent faster than for men.

Infant Mortality

One of the important links in the chain of improvement of mortality is the significant reduction of infant mortality and its neonatal and post-neonatal com-

TABLE 1. DEATH RATES AND INFANT MORTALITY RATES, CANADA, 1931, 1951, 1971 AND 1981

	Rates per 1,000 population		
	Both Sexes	Males	Females
Crude Rate			
1931	10.2	10.5	9.6
1951	9.0	10.1	7.8
1971	7.3	8.5	6.1
1981	7.0	8.0	6.0
% Change (1931-1981)	-31.4	-23.8	-37.5
Standardized Rate			
1931	12.2	12.7	11.7
1951	9.0	10.0	8.0
1971	6.7	8.4	5.2
1981	5.6	7.2	4.3
% Change (1931-1981)	-54.1	-43.3	-63.2
Infant Rate			
1931	86.0	95.4	74.4
1951	38.5	42.7	34.0
1971	17.6	19.9	15.1
1981	9.6	10.7	8.3
% Change (1931-1981)	-88.8	-88.7	-88.9
Neonatal Rate			
1931	41.5	46.6	35.4
1951	22.6	25.6	19.4
1971	12.4	14.1	10.6
1981	6.4	7.2	5.4
% Change (1931-1981)	-84.6	-84.5	-84.7
Post-Neonatal Rate			
1931	44.5	47.8	39.0
1951	15.9	17.1	14.6
1971	5.2	5.8	4.5
1981	3.2	3.5	2.9
% Change (1931-1981)	-92.8	-92.7	-92.6

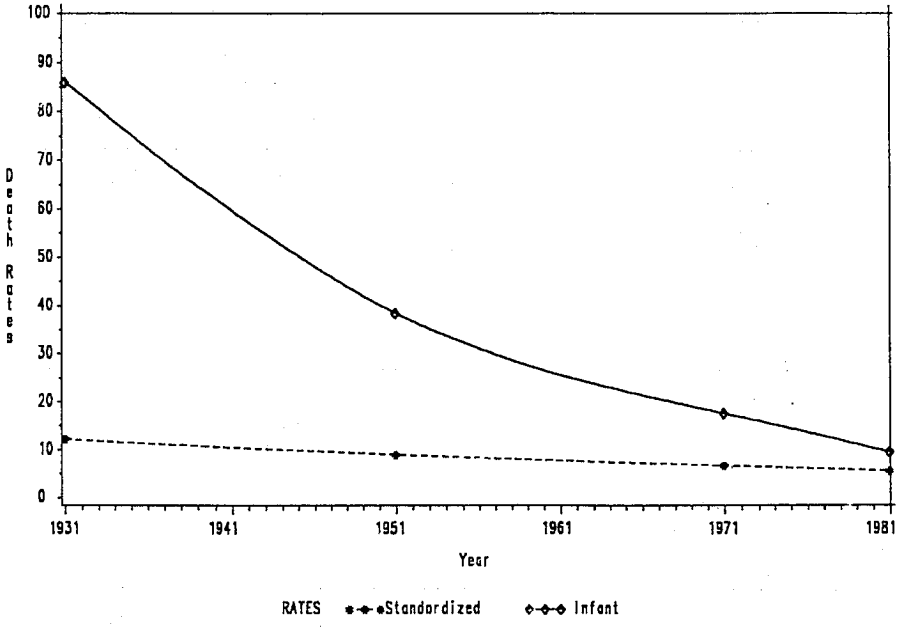

FIGURE 2. DEATH RATES AND INFANT MORTALITY RATES, CANADA, 1931, 1951, 1971 AND 1981

ponents. In 1931, nearly one in 12 live births resulted in infant death; by 1981, infant mortality had declined by nearly 90 per cent, resulting in infant deaths of less than one in 100 live births.

This remarkable achievement has been the consequence of reductions of 85 per cent and 90 per cent in the neonatal and post-neonatal death rates, respectively. The improvements have been uniform for both sexes and, with one or two exceptions, across all provinces. It is of interest to note that in 1931, the neonatal and post-neonatal death rates were practically of the same magnitude, but in 1981, the post-neonatal rate was one-half that of the neonatal rate, as a consequence of the accelerated improvement. As the decomposition of the effects of mortality by age on life expectation shows, these sizeable reductions in the infant, neonatal and post-neonatal rates have contributed signifi-

cantly to the increases in the expectation of life at birth during the past five to six decades.

Life Expectancy Trends

A comparative profile of life expectancy at birth and at selected ages for the years 1931 and 1981 is presented in Table 2 (see also Figure 3). The trend shows that there has been a considerable increase in life expectancy at birth for both males and females – about 12 years and 17 years, respectively. The average increase during the past 50 years has been about three months per year for males and four months per year for females.

Throughout the evolution of this mortality pattern within the period of study, the life expectancy of females has always been higher than the corresponding life expectancy for males. Moreover, it is generally observed that the difference in life expectancy between males and females tended to increase over time (Table 2). In 1931, the difference in life expectancy at birth was about two years; by 1981, the difference in favour of women was more than seven years. The excess years of females over males, however, tended to decline with increasing age: in 1981, at age 75, it was less than three years.

Survival Probabilities to Older Ages

From 1931 to 1981, there were significant increases in the probability of survival and the number of survivors to successively older ages (Figure 4). The values in Table 3 are reproduced from a set of abridged life tables constructed at five-year periods from 1921 to 1981 for Canada and the provinces (Nagnur, 1986a). Generally, the improvements in the numbers of survivors have been greater during the 30 years following 1951, compared to the previous 30 years. Women made greater gains than men and remarkable improvements were registered in the probabilities of survival to older ages of 65, 75 and 85.

Among the male birth-cohorts subject to the 1931 life table, nearly three out of five were expected to survive to the age 65; according to the 1981 life table, the proportion had risen to three out of four. Slightly more than one out of three survived to age 75, according to the 1931 life table; while in the 1981 life table, one-half were expected to make it to that age. Remarkable progress has occurred with respect to the improvements in the chances of survival to the age 85; between 1951 and 1981, the increase in the number expected to reach age 85 was almost three times that between 1931 and 1951 – 6,500 compared to 2,500 per 100,000.

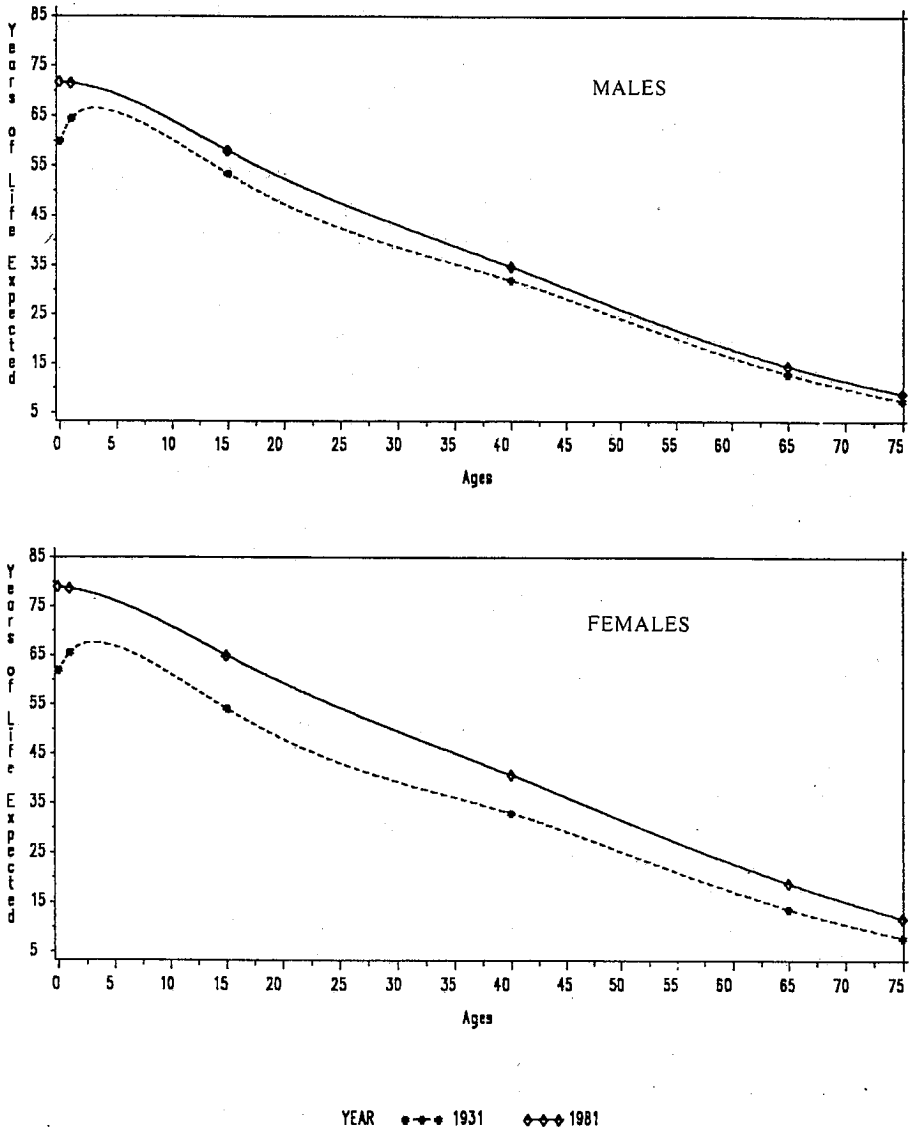

FIGURE 3. YEARS OF LIFE EXPECTED AT SELECTED AGES, MALES AND FEMALES, CANADA, 1931 AND 1981

TABLE 2. LIFE EXPECTANCY OF SELECTED AGES, CANADA, 1931 AND 1981

Males	Years of Life Expected		
Ages	1931	1981	Percent Change
0	60.00	71.88	19.8
1	64.57	71.65	11.0
15	53.41	58.05	8.7
40	31.99	34.74	8.6
65	12.98	14.57	12.2
75	7.57	9.01	19.0

Females	Years of Life Expected		
Ages	1931	1981	Percent Change
0	62.06	79.06	27.4
1	65.64	78.72	19.9
15	54.15	65.02	20.1
40	33.03	40.80	23.5
65	13.72	18.93	38.0
75	7.98	11.88	48.9

Ages	Excess Years of Female Life Expectancy over Male Life Expectancy	
	1931	1981
0	2.06	7.18
1	1.07	7.07
15	0.74	6.97
40	1.04	6.06
65	0.74	4.36
75	0.41	2.87
85	0.32	1.43

TABLE 3. SURVIVORS OF THE SYNTHETIC BIRTH COHORT OF 100,000, TO AGES 65, 75 AND 85, CANADA, 1931, 1951 AND 1981

Number of Survivors

	Males						Females					
	Age:65		Age:75		Age:85		Age:65		Age:75		Age:85	
Years	Number	Pct.	Number	Pct.	Number	Pct.	Number	Pct.	Number	Pct.	Number	Pct.
1931	58694	58.7	36626	36.6	11006	11.0	61635	61.6	40716	40.7	13323	13.3
1951	65877	65.9	41931	41.9	13490	13.5	75585	75.6	54046	54.0	20760	20.8
1981	74681	74.7	50367	50.4	19966	20.0	86088	86.1	70503	70.5	40648	40.6

Increase in Survivors*

	Males						Females					
	Age:65		Age:75		Age:85		Age:65		Age:75		Age:85	
	Number	Pct.	Number	Pct.	Number	Pct.	Number	Pct.	Number	Pct.	Number	Pct.
1951-1931	7183	12.2	5305	14.5	2484	22.6	13950	22.6	13330	32.7	7437	55.8
1981-1951	8804	13.4	8436	20.1	6476	48.0	10503	13.9	16457	30.4	19888	95.8
1981-1931	15987	27.2	13741	37.5	8960	81.4	24453	39.7	29787	73.2	27325	205.1

* Percent increase was derived with 1931 as the base.

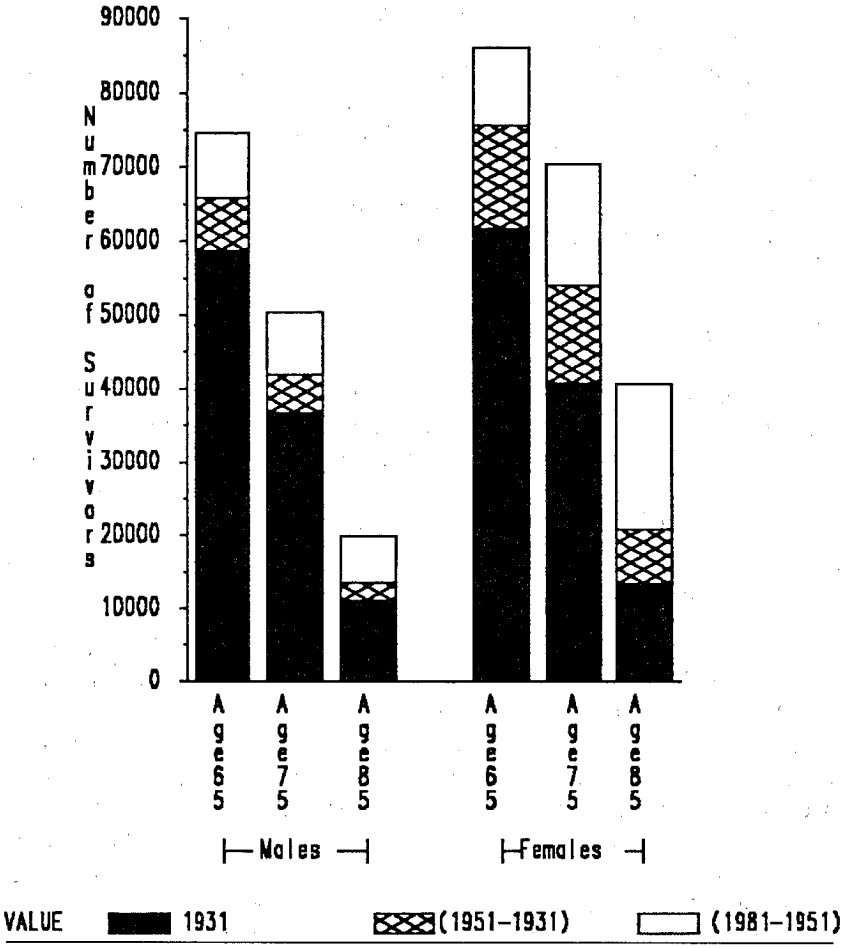

FIGURE 4. NUMBER OF SURVIVORS OF THE BIRTH COHORT 100,000, TO AGES 65, 75 AND 85, CANADA, 1931, 1951 AND 1981

With regard to women, the improvements in the corresponding survival probabilities have been still more spectacular than those for men (Table 3). According to the 1931 life table, women who were expected to survive to age 65 accounted for more than three out of five; the proportion rose to three out of four by 1951 and was almost seven out of eight in 1981. A similar trend

was observed among women expected to survive to age 75: according to 1931 life tables, two out of five were expected to reach that age; the proportion increased to more than one in two by 1951 and was in excess of seven out of 10 in 1981. Similarly, the survival to age 85 doubled to more than two out of five by 1981, compared to two out of 10 in 1951.

The increasing rectangularization of the survival curve (the curve of the number of survivors to age x, lx, plotted against the age x) illustrates the phenomenon rather dramatically. This aspect has been discussed in considerable detail in Nagnur (1986b).

Epidemiologic Considerations

The foregoing looked at the evolution of some of the changes in mortality and life table parameters which could be considered and grouped as "demographic." Now let us examine some of the considerations which could be characterized as epidemiologic shifts that have occurred concurrently with those demographic changes.

Distribution of Deaths by Cause Categories

Table 4 shows the percentage distribution of deaths by selected cause-categories which were leading in 1931 and changes in that distribution over the past five decades. The cause categories are mostly broad chapters in ICD, except in a couple of cases where individual diseases are designated. The total deaths for Canada exclude those for Newfoundland (and for the years 1931 and 1941, exclude those for the Yukon and Northwest Territories, as well). (The percentages in this table do not add up to 100 due to the residual category not being shown.) Table 4 also shows the equivalent ICD codes from the fourth revision to the ninth.

One can clearly see from Table 4 the progressive reduction in the importance of the infectious and parasitic diseases and the increasing importance and impact of the degenerative diseases from 1931 to 1981. For example, TB accounted for more than seven per cent of the deaths in 1931, while it was almost negligible in 1981. Cancer, on the other hand, accounted for less than one in 10 deaths in 1931, while in 1981 it claimed almost one in four deaths. Heart disease claimed two out of five deaths in 1981, while in 1931 it accounted for half that number. Cerebrovascular diseases accounted for three per cent of all deaths in 1931, while that percentage tripled to about nine per cent by 1981.

The shifts which Omran discusses regarding the epidemiologic transition – the shifts from infectious and parasitic diseases to degenerative diseases – are clearly observed in the evolution of Canadian mortality patterns during the past several decades.

Potential Years of Life Lost (PYLL)

Epidemiologic shifts are also reflected in the examination of the PYLL (potential years of life lost) values by leading causes of death. Table 5 considers 11 categories which were the leading causes of death for men in 1931; these, and the corresponding categories for women, are followed through to 1981. The estimates of the PYLL were derived by considering the difference between the age at death due to a particular disease and the life expectancy at birth in the corresponding year under consideration.

The total PYLL for Canada as a whole remained in the neighbourhood of about two million years annually for the three decades from 1931 to 1961 in spite of the increases in the population and the number of deaths. It dropped by about 160 thousand years between 1961 and 1971 and remained at about the 1971 level in 1981. However, the epidemiologic distribtion by cause-categories changed dramatically during the past five decades.

Consistent with the notion of epidemiologic transition, infectious and parasitic diseases, diseases of the digestive and respiratory systems and certain diseases of early infancy which were leading contributors to the PYLL in the earlier decades under study have gradually declined in significance and importance. Diseases of the circulatory system, neoplasms, and the accidents, poisoning and violence category have been the leading contributors to the total PYLL in recent years.

As the number of deaths due to infant and childhood diseases has decreased and the number of deaths due to degenerative diseases has concurrently increased, the mean number of years lived by those dying has increased. This is consistent with the notion of epidemiologic transition and accounts to a large extent for the total PYLL remaining at the same level or declining somewhat despite an increasing population and more annual deaths.

Causes of Death for Selected Age Groups

Infant Mortality by Cause. As we have observed, the infant mortality dropped by about 90 per cent during the past five decades. Epidemiologically, the leading causes of death for infants in the earlier decades under study were immaturity, infectious and parasitic diseases such as diarrhoea

TABLE 4. PER CENT DISTRIBUTION OF DEATHS BY SELECTED CAUSE-CATEGORIES, CANADA, 1931, 1951 AND 1981

Selected Cause Categories	Percent Distribution of Deaths			Equivalent ICD Cause-Categories with Respect to Different Revisions		
	1981 (ICD9)	1951 (ICD6)	1931 (ICD4)	1981 (ICD9)	1951 (ICD6)	1931 (ICD4)
Tuberculosis	0.1	2.8	7.3	010-018, 137	001-019	23-32
Other infectious and parasitic diseases	0.4	1.1	5.0	001-009, 020-139	020-138	1-10, 11e-22, 33-44, 80, 83
Malignant neoplasms	24.1	14.5	9.2	140-208	140-205	45-53
Diabetes mellitus	1.8	1.3	1.2	250	260	59

Cerebrovascular Disease	8.9	10.5	3.2	430-438	330-334	82
Other cardiovascular Disease	39.3	35.6	19.6	390-429, 440-459, 785.4	400-468	56,90-103
Respiratory disease	6.6	8.0	10.8	460-519	240, 241, 470-527	11a-11d, 104-114
Urinary disease	1.3	3.4	5.5	580-599	590-594, 600-609	130-136*
Accidental deaths	5.7	6.6	6.6	E800-E949	E800-E962	77, 176 178-194
Total Number of Deaths	104,517	122,819	167,799			

* 131 included some terms that in later revisions were considered circulatory cardiovascular disease

TABLE 5. POTENTIAL YEARS OF LIFE LOST, BY SELECTED CAUSE OF DEATH CATEGORIES, AND SEX, CANADA, 1931 AND 1981

	Males			Females		
	1931	1981	Percent Change	1931	1981	Percent Change
Life Expectancy at Birth	60.0	71.9	19.8	62.1	79.0	27.2
Leading Causes of Death	(thousands)			(thousands)		
Certain diseases of early infancy	309.1	61.8	-80.0	235.6	48.5	-79.4
Diseases of the digestive system	232.2	39.6	-82.9	176.1	33.2	-81.1
Diseases of the respiratory system	189.2	34.0	-82.3	161.5	33.2	-79.4
Infective and parasitic diseases	187.1	6.8	-96.4	217.7	7.4	-96.6
Accidents, poisonings and violence	135.7	373.0	174.9	43.1	141.7	228.8
Congenital malformations	47.3	57.2	20.9	38.1	48.3	26.8
Diseases of the circulatory system	42.5	228.9	438.6	45.8	180.1	293.2
Diseases of the nervous system	37.3	20.8	-44.2	32.2	20.8	-35.4
Neoplasms	25.3	170.6	574.3	38.5	239.6	522.3
Diseases of the genito-urinary system	18.9	4.9	-74.1	25.8	6.8	-73.6
All Other causes	57.4	53.9	-6.1	89.6	54.9	-38.7
Total	1282.0	1051.5	-18.0	1104.0	814.5	-26.2
Total Both Sexes	2386.0	1866.0	-21.8			

* Percent change is derived with 1931 as the base.

and enteritis, and respiratory diseases such as influenza, bronchitis and pneumonia. Again consistent with the notion of epidemiologic transition, the cause pattern of infant mortality has changed dramatically over the past five decades. Congenital malformations accounted for the highest rate among both male and female babies in 1981. Deaths due to the three leading causes that existed in 1931 were reduced by more than 95 per cent during the past five decades.

Age Group 1-4. The trends in mortality for this age group indicate a precipitous drop in the death rate following the first year of life. The overall death rate for this age group declined by more than 90 per cent between 1931 and 1981. Many of the leading causes of death recorded in 1931 have been either eradicated or reduced to insignificance. The leading causes of death for this age group in 1931 were (a) infectious and parasitic diseases, (b) respiratory diseases, and (c) accidents, poisoning and violence. Of these, the category involving accidents is the only one that remains a predominant cause in 1981.

Age Group 65-74. The leading causes of mortality for this age group were cardiovascular diseases and cancer. Among males, the mortality due to the former increased until 1961 and has been declining since then. In contrast, with the exception of 1951, the mortality rate due to cancer has been increasing steadily from a level of about 700 per 100,000 in 1931 to 1,070 in 1981 – an increase of more than 40 per cent. Among females, the mortality due to cardiovascular disease increased until 1971, but has declined significantly since then. Between 1931 and 1981, the overall mortality declined by about 15 per cent for males and more than 50 per cent for females.

Age Group 75+. Although cardiovascular disease has been the main cause of mortality for this age group – accounting for more than one-half of the deaths for both males and females – the second cause has been cancer. The cancer mortality rate for males increased by 75 per cent in the past five decades, and in 1981, it accounted for almost 20 per cent of all male deaths. For females in this age group, the cancer mortality rate has changed little since 1931. The overall mortality rate for this age group declined by about 12 per cent for males and about 40 per cent for females during the last five decades.

An interesting point to note is the reappearance of respiratory diseases as a significant cause of mortality for this age group. This may not spell the reversal of the shifts in the epidemiologic transition, but as Osler stated, "There is truth in the paradoxical statement that persons rarely die of the [chronic] disease with which they suffer. Secondary *terminal* infections carry off many patients with incurable disease" (Gruenberg, 1977:3).

What is essentially required in this context is a refinement in classifying data and a concerted effort directed towards multiple-cause coding of mortality

data; contributory causes take on added importance, especially at older ages. The general practice of classifying deaths only on the basis of an "underlying cause" might be insufficient to identify important emerging epidemiologic shifts. (For details in the trends of age-cause specific mortality rates, see Nagnur, 1986b.)

Cause-deleted Life Tables

One other important means of looking at the effect of a particular disease on the overall mortality and assessing the impact of epidemiologic shifts is to construct a series of cause-deleted life tables and study the changes over time in the important parameters (such as life expectancy and probability of survival to specified ages) from such life tables. One strong assumption in constructing these tables is that these causes operate independently of each other (which, of course, is not strictly valid).

Preston, Keyfitz and Schoen constructed such tables eliminating 12 leading cause-categories for many national populations (Preston *et al.*, 1972). They included life tables for Canada up to 1964. We have developed similar tables, eliminating the same 12 cause-categories for recent years encompassing the seventh, eighth and ninth revisions of ICD.

For the years 1931 and 1981, Table 6 shows the increases in life expectancy at birth that would result if the deaths due to the cause-category mentioned in the first column were eliminated. One observes the epidemiologic shifts, the decrease in the impact of infectious, parasitic and respiratory diseases, and the increase in the effect of cardiovascular diseases, neoplasms and accidents. For example, according to the 1931 pattern, the elimination of deaths due to TB would have added 1.1 years to the life expectancy at birth for males (Figure 5) and 1.5 years for females (Figure 6); the same elimination in 1981 added a negligible amount of years to life expectancy.

The elimination of cardiovascular diseases would have added 4.4 and 4.8 years for male and female life expectancies, respectively, according to 1931 tables; by 1971, the corresponding years increased to 10.6 and 14.7; by 1981, they declined slightly to 8.7 and 13.1 years, respectively, due to the decrease in cardiovascular disease mortality. The shifts in this cause-category, more than in any other, will have significant impact on the changes in life expectancy in future years.

Eliminating cancer mortality, on the other hand, continues to add increasing years to the life expectancy of both men and women. In 1931, the years added by eliminating neoplasms were 1.5 years for males and 2.0 years for females; by 1981, the corresponding years were 3.2 and 3.5.

TABLE 6. YEARS OF LIFE EXPECTANCY GAINED AT BIRTH IF SELECTED CAUSES WERE DELETED, BY SEX, CANADA, 1931 AND 1981

	Males		Females	
Cause of Death Categories	1931	1981	1931	1981
No Cause Deleted	0.00	0.00	0.00	0.00
Respiratory Tuberculois	1.13	0.01	1.45	0.09
Other Infectious and Parasitic Diseases	1.35	0.06	1.36	0.15
Malignant and Benign Neoplasms	1.48	3.24	2.03	3.53
Cardiovascular Disease	4.35	8.69	4.79	13.05
Influenza,Pneumonia, Bronchitis	2.25	0.37	2.22	0.50
Diarrhea,Gastritis,Enteritis	1.60	0.06	1.25	0.19
Certain Degenerative Diseases	1.12	0.56	1.24	0.66
Complications of Pregnancy	0.00	0.00	0.57	0.09
Certain Diseases of Infancy	2.96	0.33	2.34	0.36
Motor Vehicle Accidents	0.37	0.78	0.14	0.43
Other Accidents and Violence	1.68	1.35	0.56	0.73
All Other and Unknown Causes	3.77	1.69	3.44	1.70

One other category that has shown sustained increase is that involving accidents – motor vehicle as well as other forms of accidents. Elimination of motor vehicle accidents alone would add about half a year to female life expectancy and three quarters of a year to male life expectancy.

Once again, we see the effects of shifts involved in epidemiologic transition on the emerging pattern of life expectancy. A detailed analysis of the cause-deleted life tables and their implications will be dealt with in future publications.

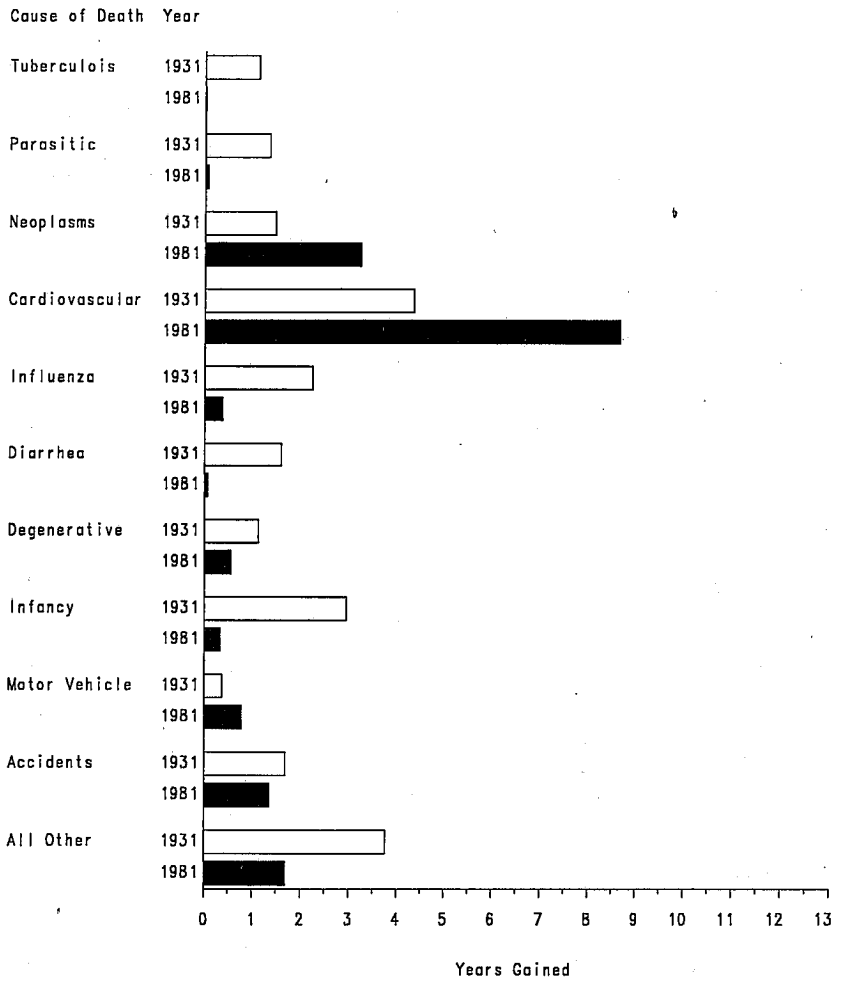

FIGURE 5. YEARS OF LIFE EXPECTANCY GAINED, AT BIRTH IF SELECTED CAUSES WERE DELETED, MALES, CANADA, 1931 AND 1981

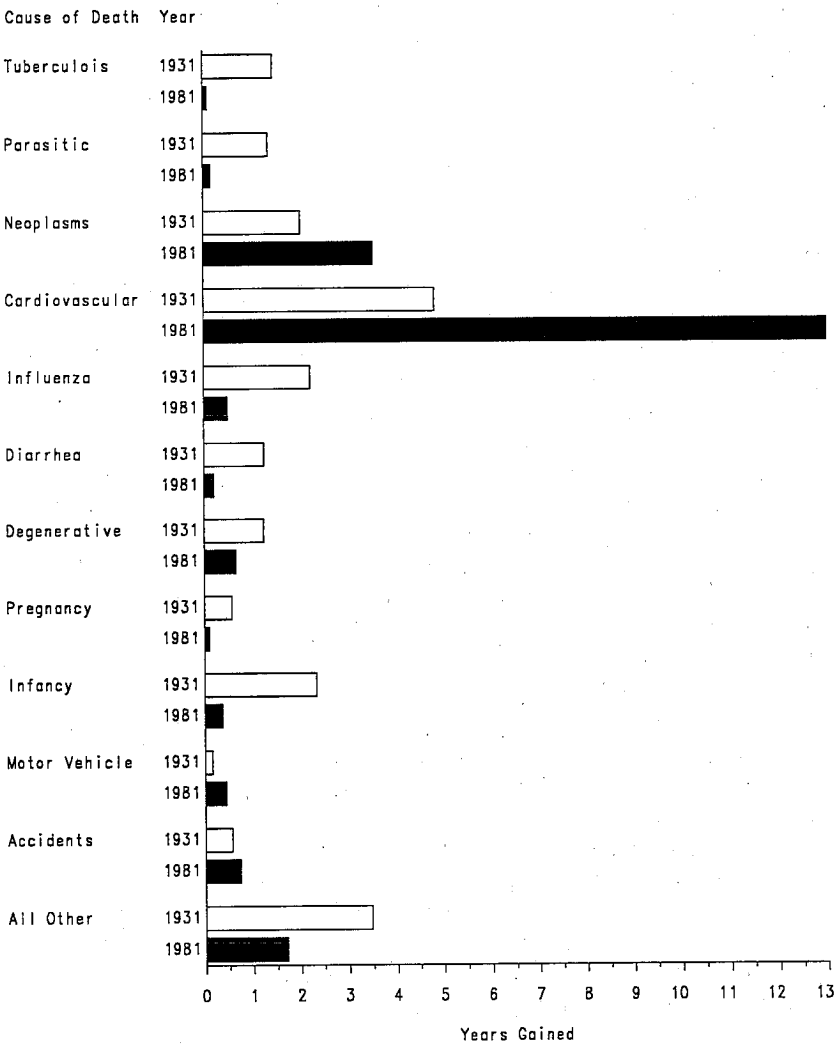

FIGURE 6. YEARS OF LIFE EXPECTANCY GAINED, AT BIRTH IF SELECTED CAUSES WERE DELETED, FEMALES, CANADA, 1931 AND 1981

Concluding Remarks

In the foregoing discussion, we have examined some selected trends in mortality indicators and variations in the life table parameters over the past five decades. We have attempted to provide cause-specific disaggregations and to describe epidemiologic shifts that have taken place concurrent with the demographic changes in mortality.

Now, one might ask how important are the utility and purpose of such a perspective and analysis? There are several important considerations. The first and foremost is its considerable relevancy to health policy. Health, as defined by the WHO (1948), is not just an absence of disease or infirmity, but a state of complete physical, mental and social well-being (see MacMahon and Pugh, 1970). The three important components concerning health – mortality, morbidity and disability – need to be studied in the context of epidemiologic shifts that have already, and are currently, taking place. Epidemiologic transition in morbidity has an equal, if not more important, bearing on the literature related to health-sector accounting and satellite accounting of health and is antecedent to a sizeable portion of health expenditures.

The second most important consideration is in the context of population projections. Most demographers agree that the past improvements in mortality or expectation of life cannot continue indefinitely in the future. Whether there will ever be a cap on the life expectancy or not, the pace of improvement in the future will be much slower than it has been in recent decades. One is certainly on very unsure ground in projecting mortality based only on the trends in age-specific mortality rates or the derived period life tables. In this instance, the past is certainly no prologue to the future; past trends do not offer sufficient clues for the future projections. Thus realistic projections cannot help but take into account the epidemiologic shifts and future plausible changes in them.

Lastly, along with the importance of demographic changes, epidemiologic shifts are important in shaping the future course of population change. There is a need, as Omran implies, to develop models so that epidemiologic shifts and demographic and other relevant changes can be related in such a way that a comprehensive theory of population dynamics could be developed so as to provide a systematic basis for future planning in health, social and economic sectors.

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Disclaimer

The views and opinions expressed in this paper are those of the authors and do not necessarily represent those of Statistics Canada.

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