Leading article

Gender differences in mortality Sri Lanka 1900-1988

M.A.Fernando[1]

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Introduction

Death is the inevitable end of all life it lays its icy hands even on kings! This event is decisive, recordable and quantifiable in the form of rates and ratios and the most likely cause of the death could be assigned, collated and become comparable where a unified diagnostic classification is used. The numerator for the age and sex specific death rate, is the number of deaths in that age group by sex.

A system of registration of births and deaths has been in existence in Sri Lanka since the mid nineteenth century, and was made compulsory in 1893. The present system of registration is governed by the Births and Deaths Registration Act No. 17 of 1951. It is possible that registration was incomplete and was sex and age selective in the first decade of this century. The average decennial sex ratio at birth was 105 males per 100 females during 1900-1920, and since then, it has consistently been around 103.

Three sample surveys conducted by the Department Of Census and Statistics to assess the completeness of registration show that births are better registered than deaths. Data on completeness of registration by sex is not available (Table 1).

Table 1: Completeness of Births and Deaths Registration in Sri Lanka (%)

Year	Births	Deaths
1953	88.1	88.6
1967	98.7	94.5
1980	98.8	92.9

Source : Annual Health Bulletin 1992, Ministry of Health, Sri Lanka

The denominator used to calculate the rate is the relevant age-sex specific population except for the infant and maternal mortality rates where the live births are used.

Since 1871, decennial censuses were taken, that of 1931 was a partial one and that which should have been taken in 1941 was postponed to 1946 due to the World War II and taken by the first Sinhalese Census Director, Sir Arthur Ranasinghe. The first post-independence census was taken in 1953 followed by the censuses of 1963, 1971 and 1981.

The age-sex specific rates will be affected if, either sex is selectively underenumerated. This may be determined using sophisticated statistical tests, post- census sample surveys and by examining the sex ratio (masculinity) of the population.

Sarkar using the "growth rates", "sex ratios" and other tests was of the opinion that there existed a greater underenumeration of females at every census since 1871 up to that of 1946(1). A post-enumeration survey conducted immediately after the census of 1953 by the Department of Census and statistics, indicated a probable net underenumeration of 0.7% and there was a greater underenumeration of males rather than females, as is usually found in censuses of western countries (2).

[1] Emeritus Professor in Community Medicine University of Peradeniya

Sex Ratio of the Population

The high masculinity of the population has been commented on, by several demographers and Census Superintendents, who state that although there is selective underenumeration of females it was not that great so as to negate the fact that masculinity is high.

Turner, the Superintendent of the Census of 1921 referring to the accuracy of the enumeration states" The number of both males and females was probably understated and it is possible that the under statement of females was somewhat greater than that of males, but the differences are not likely to be very great. It does not appear that the high masculinity in Ceylon is to any significant extent due to a faulty enumeration of females (3).

The sex composition of the population is the result of a complex interaction of biological and environmental factors acting together for a period of time, the two basic biological factors being natality and mortality. The average decennial sex ratio at birth was 105.0 for 1911-20 and remained around 103 until 1970 and increased to 104.1 in 1971-80, and it remained at 104 in 1986. If biological factors alone are operative, although less females than males are born alive, their greater power of survival will give them parity and subsequently a superiority in numbers over the males.

However, environmental factors such as war, migration, occupational hazards, socio economic level, sanitary conditions, mortality pattern and the availability and utilization of medical care services determine to what extent the biological factor is permitted expression. It appears that the chance of survival of the female relative to the male is less in the developing than in the developed countries. These differences may also be due to certain social and cultural attitudes towards females, which act in a way leading to a greater female mortality.

The sex ratio of the population of Sri Lanka has gradually decreased from 112 in the census of 1871 to 112 in 1953 and 104 in 1981 (Table 2).

Table 2: Sex ratio of the population of Sri Lanka by census year

Census Year	Males per 100 females	Census Year	Males per 100 females
1871	114	1946	113
1881	114	1953	112
1891	113	1963	108
1901	114	1971	106
1911	113	1981	104
1921	113		

Source: Census Reports of Sri Lanka,
Note- In 1931, it was a partial census

A very simple method of testing for gross selective underenumeration is to assume that there is equal under registration of deaths of males and females, and presuming that the death rate of males is equal to that of females and that the male population is correctly enumerated,is to calculate the expected female population. When this is done for the census population of 1946, there will be an underenumeration of 301, 128 females in excess of the usually accepted underenumeration of both sexes, this is nearly 4% excess underenumeration of females. If we now visualize that the male mortality rate to be higher than the female, we would have to accept a still larger selective underenumeration of females and consequently the females will exceed the males in the population. However, it seems reasonable to assume that there was a relative underenumeration of females at the censuses, and that female deaths were also under registered, although to a smaller degree. The effect of these limitations may be considered to be minimal when examining the trends in the differential mortality.

I will therefore use available secondary data to present the trends from 1900 to 1988 in Sri Lanka, using only selected age groups. (For details refer monograph) (4).

Sex Differential Mortality

It is known that more males than females are conceived, more are aborted or born still and male mortality rates are generally higher than that for females. However this differential varies from one country to another and even between districts and ethnic groups in the same country.

In most countries with reliable statistics, the female mortality was less than that for males during this century, with the exception of Sri Lanka, India and Pakistan. It is also of interest to note that in Ireland the mortality rate was higher for females 5 - 14 years until about 1940 and for 15-39 years as recently as 1945 - 1947. In Sri Lanka, the trend of a higher female mortality changed to a higher male mortality around 1963.

The expectation of life at birth for the world is estimated to be 57.5 years for males and 60.3 for females as at 1980-85. In Sri Lanka the longevity for males which was 36.4 years at the beginning of this century has increased to 67.8 years in 1981, an increase of about 31 years and that for females from 34.2 to 71.3 years which is an increase of 37 years. The male expectation was higher than female until 1963-1964 when it was 63.3 and 63.7 for males and females respectively, and from then onwards it has been higher for females.

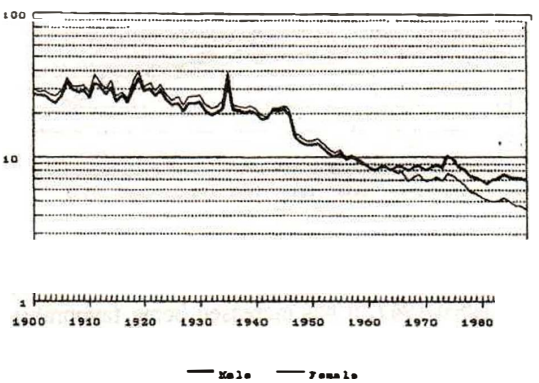
Age and Sex Specific Mortality

All ages

The sex differential for all ages is influenced by the age and sex structure of the population and by mortality in the more vulnerable age groups. The female mortality rate has been higher than male until around 1963 when the cross over occurred, and since then the differential has increased not only because of the declining female rate but also the rising male rate at certain age groups (Figure. 1). The trend in mortality shows "peaking" for either sex during epidemics with the sex difference being relatively more unfavourable to the female.

Figure 1

Sex specific Mortality rates - Sri Lanka 1900 - 1988



During the malaria epidemic of 1935, there were a total of 47,326 deaths ascribed to malaria, and of these 22,079 were males and 25,247 females, giving a ratio of 114 females to 100 males. However during non-epidemic periods there were more deaths from malaria among males than females. It is also of interest to note that during epidemics the unfavourable effect on females is seen in nearly all age groups and even affects infants.

It is therefore useful to examine the trends by age. In this paper, only selected age groups will be presented.

The sex differential will be expressed as the ratio of female to male mortality rates (F:M) using data from the Registrar General's Reports.

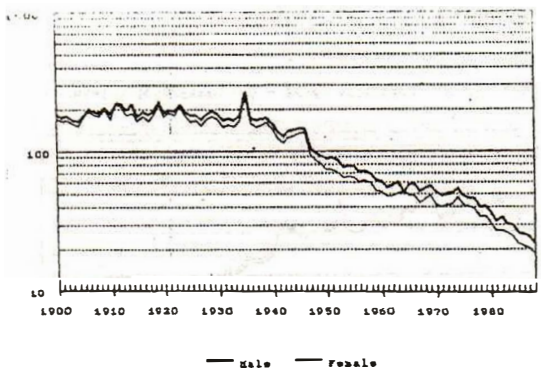
For all ages, these ratios were 1.10, 1.16, 1.00 and 0.62 in the years 1900,1935,1961-64 and 1988 respectively.

Infant Mortality

It is universal that the Infant Mortality Rate (I.M.R) is higher for males than females, this is so in Sri Lanka since 1900 (Figure 2).

Figure 2

Sex specific Infant Mortality rates



The sex difference was minimal from 1900-1946, but since 1947, it has increased being favourable to the female. The F:M was around 0.93 up until 1947, with this ratio increasing during epidemics, and notably increased to 0.98 during the malaria epidemic of 1935, this being less favourable to the female infant. The F:M in 1988 was 0.85.

It may be of interest to look for differences within shorter intervals during infancy. The first week sex-specific death rates were calculated using relevant live births while the rates for other intervals were calculated using the survivors at the beginning of each period, as the denominator.

The first week death rates were 94.6 and 83.8 per 1000 live births for males and females respectively in 1910 with a F:M of 0.89 while in 1986 they were 14.3 and 11.4 with a F:M of 0.80 indicating a relative and increasing advantage to the female. (Figure 3.1)

The death rates for the interval one week and under one month during the period 1937 to 1986 (data available) the sex differential has not substantially changed, the F:M being 0.86 in 1937 and 0.83 in 1986. (Figure 3.2)

In the interval three months and under one year the rates were 42.2 and 42.0 for males and females respectively in 1910 with a F:M 1.00 and were 4.9 and 4.5 in 1986 the F:M being 0.91. In this interval, the female mortality was equal to or slightly higher than the male until around 1948 (F:M 1.01) after which it was less (Figure 3.3).

Mortality 1 - 4 years (Pre School)

The population 1 -4 years (referred to as pre school age) was not available from the Registrar Generals Report for the early years of this century. The relevant population was computed from figures of births and deaths since 1900 using a statistical procedure and based on certain assumptions (5).

The female mortality was higher than male until around 1982 when it become equal. The F:M was 1.22 in 1904 and was around 1.0 from 1982 until 1988 (Figure 4).

Examining the rates by single years in this age group, the female mortality was consistently higher. The female to male ratio of rates were least unfavourable to the female in the first pre school year (1-2 years)(4).

Mortality 5-9 years

The mortality in this age group was higher for female until 1974 when it was equal until 1980 and crossed over and was higher for the male. The F:M was around 1.22 during 1900-1905 was 1.00 until 1980 and 0.87 in 1988 (Figure 5).

Mortality 20-24 years

In this age group the female mortality rates were well above that for males, with the differential tending to be unfavourable to the female, during

Figure 3.2

Sex specific Mortality rates 1 week and under 1 month, 1937 - 1986

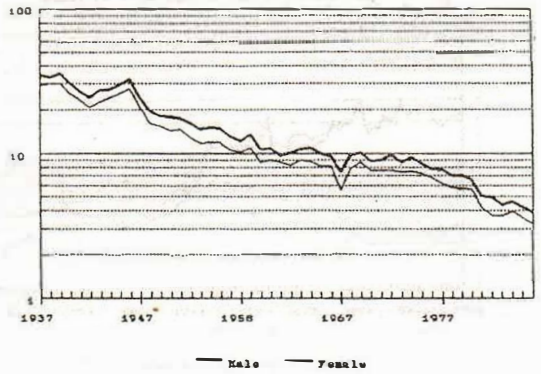


Figure 3.1

Sex specific mortality rates for under one week

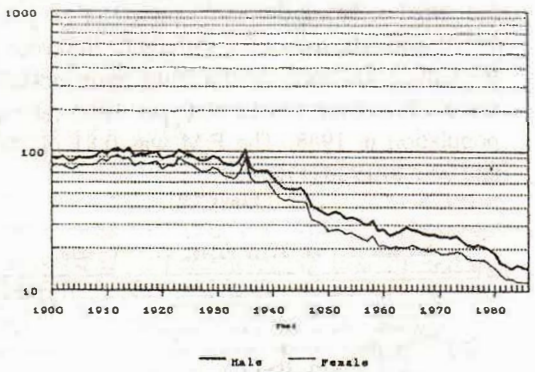


Figure 3.3

Sex specific mortality rates for 3 months and under 1 year

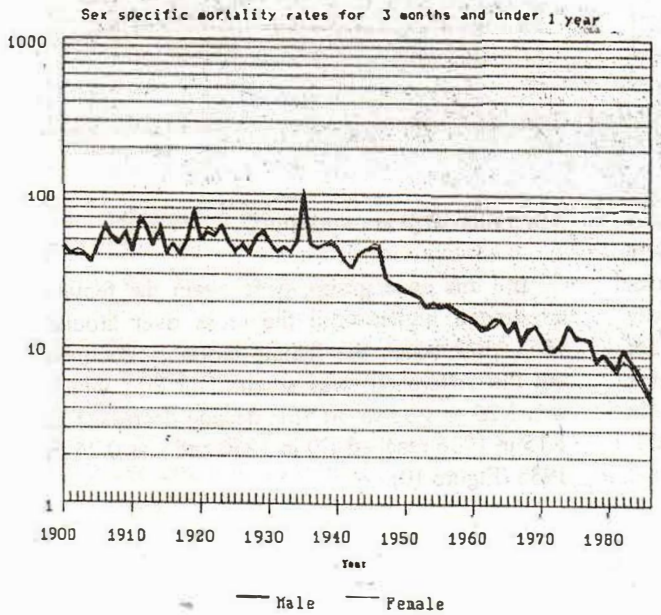


Figure 4

Sex specific Pre-school mortality rates

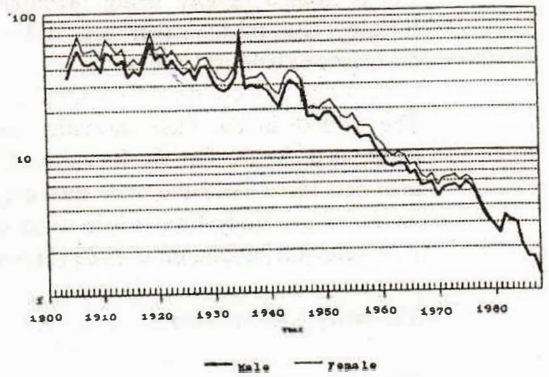


Figure 5

Sex specific mortality rates, 5 - 9 years

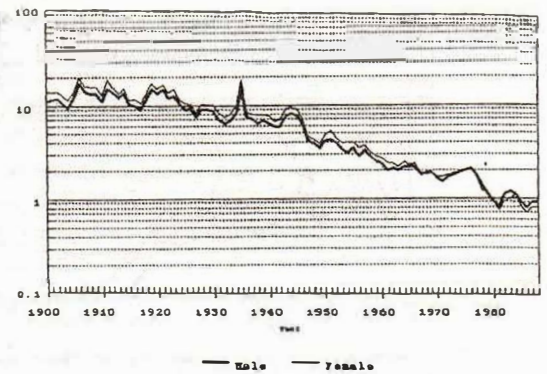
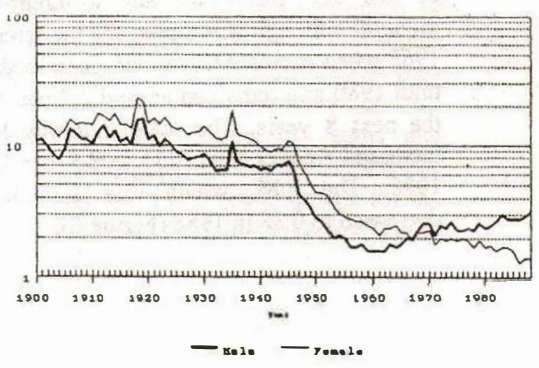


Figure 6

Sex specific mortality rates, 20 - 24 years



epidemic years, until it crossed over around 1958 and decreased rapidly being favourable to the female. The F:M, which was 1.45 in 1900, decreased to 0.44 in 1988.

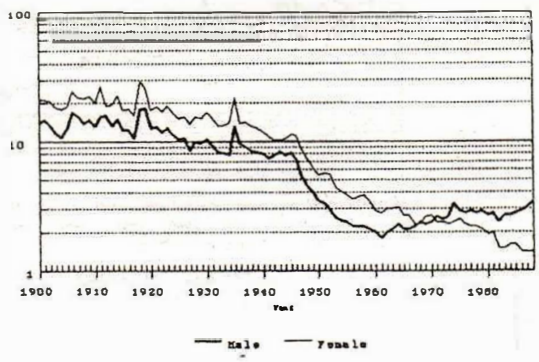
The decline in the male mortality commenced earlier than for the female. It is also of interest to note that since 1965 the male mortality rate has increased gradually from 1.8 in 1965 to 3.2. per 1000 relevant population in 1988 (Figure 6).

Mortality 25 - 34 years

The pattern of a higher female mortality is similar to the previous age group, but the cross over was in 1971, the F:M being reduced from 1.51 in 1900 to 0.41 in 1988. Here too the male mortality rate has increased rather rapidly from 2.0 in 1960 to 3.4 per 1000 relevant population in 1988 thus exaggerating the sex difference. (Figure 7).

Figure 07

Sex specific mortality rates, 25 - 34 years

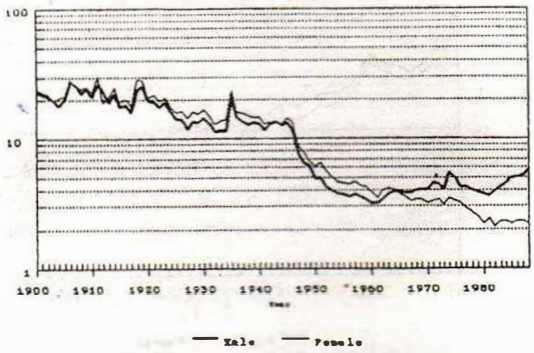


Mortality 35-44 years

In this age group, the sex differences were minimal although still higher for the female until 1965 when it crossed over and decreased rapidly until 1980 and remained around 2.2 per 1000 for the next 8 years. The male mortality however increased from 3.2 in 1960 to 5.8 per 1000 in 1988. The F:M, which was 1.16 in 1911, decreased to 0.38 in 1988 (Figure 8).

Figure 8

Sex specific mortality rates, 35 - 44 years

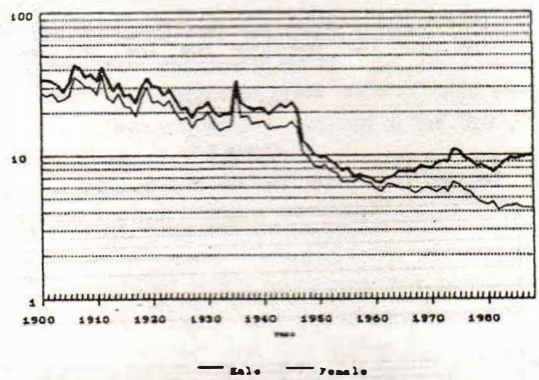


Mortality 45-54 years

In this age group, male mortality exceeds that for females during the entire period of 88 years. Since 1960, the increasing difference in favour of the female was because of a rising male mortality since 1961. from 6.4 to 10.0 per 1000 relevant population in 1988. The F:M was 0.81 in 1900 and 0.42 in 1988 (Figure 9).

Figure 9

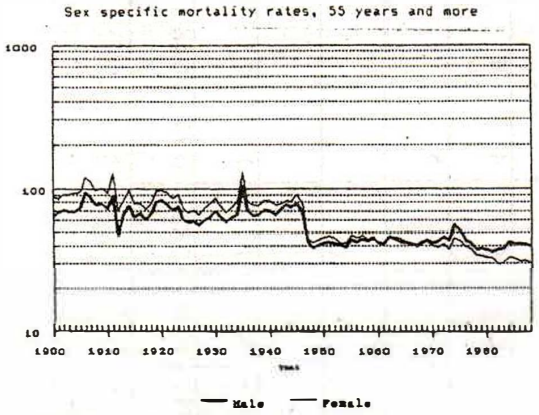
Sex specific mortality rates, 45 - 54 years



Mortality 55 years and more

In this age group, once again the female rates were higher until the cross over around 1967 after which the female mortality declined but the differential was small. The F:M which was 1.25 to 1.35 in the first decade decreased to 1.15 in 1936 reached 1.0 in 1960 and was 0.76 in 1988 (Figure 10).

Figure 10



Effect of Maternal Mortality on Sex Differential

Maternal deaths may affect the age-sex specific mortality rates in the age group 15-44 years. The maternal mortality rate which was around 20 per 1000 live births in 1910 remained at that level until 1936 and declined rapidly to around 0.4 in 1988.

The proportion of maternal deaths to total female deaths in this age group (15-44 years) which was 22 percent during 1948-1957 decreased to 3.6 percent during 1980-86 and was 2 percent in 1988 (Table 3).

Table3: Average annual maternal deaths as a percentage of female deaths 15 -44 years

Year	Average No. of deaths 15-44 years		%
	maternal	female.	
1911-20	3631	18104	20.1
1948-57	1633	7318	22.3
1965-74	598	6161	9.7
1980-86	151	4208	3.6

This reduction in the number of maternal deaths will influence the sex differential mortality. In 1946 with the commencement of the malaria control programmme the deaths from malaria and its complication were reduced. The introduction of the sulpha-drugs, at this time followed by the antibiotics contributed to the reduction of deaths due to sepsis, which indicated a rate of 4.2 per 1000 live births in 1945 to zero in 1981. The pattern of causes of maternal deaths has also changed due to many reasons, chief of them being the improved maternal care services.

Patterns of causes of death by age and sex

The cause of death may not be as accurate as desired, because for a majority of deaths the cause is given by lay registrars on information obtained from family members when a death certificate is not available. This is evident by the large number ascribed to the broad group classified as "Signs, symptoms and ill-defined conditions". The accuracy of deaths certified by doctors of modern medicine is also in doubt. It has been observed that "the great excess of symptomatic statements among deaths registered through lay registrars is to be expected. What is disturbing is the relatively large number of statements among the urban area deaths, which are predominantly medically certified or at least medically examined" (6). A study of death certificates written by doctors of the General Hospital, Colombo for November 1986, revealed that of 253 deaths, only in 38% was the cause of death correctly recorded and in 19% "wrong or incomplete causes" were given as the cause of death (7).

In Sri Lanka the 5th revision of the "International Classification of Diseases injuries and causes of death" (ICD) was used before 1950, and revisions thereafter. The changes in nomenclature, coding procedures and the selection of the underlying cause may affect the pattern of causes of death from one period to another. However, it may be assumed that these constraints will apply to either gender equally or since the comparisons are between seventeen broad cause groups any gender differences may be considered valid. For purposes of this presentation the cause group of "signs and present the pattern of causes of death in summary form, indicating the first 5 cause groups for the two comparison years, 1953 and 1988, four cause

Table 04
Pattern of causes of death (prioritized) by age for the years 1953 and 1988

Years	1953							1988						
Age in Years) / Cause Group	All Ages	<1	1-4	5-14	15-44	45-64	65 & more	All ages	<1	1-4	5-14	15-44	45-64	65 & more
Infective and parasitic diseases (A 01-07)	3		2	1	1	2	5	5	3	1	2	3		
Neoplasms (A 08-17)														
Endocrine, metabolic and nutritional diseases (A 18-20)	5		1	3	5	4	4							
Diseases of nervous system and sense organs (A 22-24)	2	2	3	5		5	2	3	4	4	3		5	2
Diseases of the circulatory system (A 25-30)			3			1	1	2	5		5	2	1	1
Diseases of respiratory system (A 31-32)	4	4	4	2	2	3	3	4	2	2	4	4	4	3
Diseases of the digestive system (A 33-34)		5	5		4					5		5		
Diseases of skin and subcutanous tissue (A 42)		3												
Certain conditions in the perinatal period (A 45)	1	1							1					
Accidents, poisoning and violence (E 47-56)				4	3			1		3	1	1	2	4
F:M mortality rates – all causes	1.08	0.85	1.22	1.16	1.51	0.88	1.11	0.62	0.85	0.96	0.82	0.43	0.46	0.85

ICD Numbers in paranthesis

groups that were not relevant were omitted (group v, xi, xiii and xiv). However, the F: M was calculated using the sex specific mortality rates per 10,000 for all causes (refer monograph) (4) (Table 4).

Discussion

The sex specific mortality rates may be affected by selective under-registration of deaths and under-enumeration of the population. It is assumed that such constraints are minimal. Hence secondary data as given in the reports of the Census Directors and the Registrar General was used for this study.

The high masculinity of the population of Sri Lanka has been commented on, by demographers and visitors to the country. It is the consensus that it is not due to gross under-enumeration of females. Although there may have been some selective under-enumeration in the early decades of this century. A post-enumeration sample survey in 1953 indicated a greater under-enumeration of males rather than females, as is the case at censuses in developed countries (8). The immigrants of Indian origin on the plantations were mostly families, since both males and females could be employed. However, the small group of traders who immigrated to this country, were predominantly males. Emigration was minimal. However, in recent times cyclical emigration of females is evident.

It may therefore be surmised that at least part of the masculinity of the population may be due to sex-differential mortality being unfavourable to the female in the early decades of this century and also due to a carry over of a higher female mortality from the previous century. Other factors such as socio-cultural status of women in society, and the morbidity patterns leading to death, especially epidemics, may have made women more vulnerable than men.

The trends in mortality by sex, show "peaking" at intervals, markedly so until 1946. This "peaking" due to epidemics, which are common to both sexes, appears to be less favourable to the female. During the pandemic of influenza in 1919 and the epidemic of malaria in 1935 the natural decrease was much greater for females. Mortality ascribed to geohelminth infestation affected females unfavourably which is borne out by a higher female mortality rate for nearly all age groups in 1952-54, the sex difference being nearly four times as high in the age group 15-44 years(4).

The crossover from a higher female to male mortality occurred at varying times for the age groups. For most ages it was in the sixth decade of this century, but for age groups 1-4, 5-9 and 25-34 this occurred in the years 1982, 1984 and 1971 respectively.

The sex differential , which is higher for males in infancy although minimal from 1900 to 1946, increased since and it remained nearly the same until 1988. The sex specific IMR vary at shorter intervals in infancy. After 3 months, female infant mortality was higher until 1948 after which it became minimally higher for males. It therefore appears that the pattern of a higher female mortality commenced in the latter half of infancy.

In the age group 1-4 years (pre school) the female mortality rates have been consistently higher than male until around 1981 when they became equal. In 1981, the proportions of deaths in this age group to total relevant deaths were 3.8 percent for males and 5.3% for females corroborating the higher female mortality. A higher female mortality in this age group is seen also in some countries of South America, Africa and Asia (4). There is no valid explanation for a higher female mortality in this age group. On examining the rates by single ages, it is seen that the sex differential was more in the 2nd pre

school year than in the 1st and remained so. It may be surmised that this is due to the "displaced female child" syndrome arising out of short birth intervals and or it may be attributed to the culture based preference for male children and relative neglect of the female child. Its persistence until recent times may point to the continuation of this attitude towards the sexes, although to a lesser degree.

In the age group 5-9 years female mortality was higher until around 1981. Here again, it is difficult to explain, but it may be that the factors operative in the pre-school age have been sustained.

In the childbearing age group 15-44 years, the female mortality was demonstrably higher and the crossover of the different age intervals occurred at different times, but generally around 1970, and from then on declined rapidly. Since this time the sex differential widened mainly because the male mortality was a rising trend since 1960. This upward trend is probably multifactorial and partly affected by the change in the pattern of morbidity leading to mortality, which is relatively unfavourable to the male.

The mortality rates in the age group 45-54 years has consistently been higher for males for which no explanation could be offered except that it is an universal observation. The sex differential is widening since 1960, with a rising male mortality.

In the age group 55 years and more, female mortality was higher until 1967 when it crossed over. The previously observed rise in male mortality was not evident and hence the sex differential was also reduced. In this age group the trend shows two static phases - one before 1946 with a rate around 60 and after, the rate decreasing to around 40 per 1000 relevant population.

The pattern of causes of death has changed since the nervous system and sense organs, infective and parasitic diseases, nutritional disorders, diseases of the respiratory and digestive system, to the more contemporary pattern in 1988 which included accidents, poisoning and violence coming first in importance, this being three and one half times higher for males, diseases of the circulatory system, it being twice as high for males, along with the other cause groups being minimally higher for males.

References

1. Sarkar, N.K. - The Demography of Ceylon, Government Press, Ceylon, 1957.
2. Department of Census and Statistics "Postenumeration Survey 1953" - Monograph No. 1, 1953.
3. Turner, L.J.B.- Report of the Census of Ceylon, 1921-Vol.1,Part II, Government Printer, Colombo, 1923.
4. Fernando, M.A. - Gender differences in Mortality, Sri Lanka, 1900 - 1988. Monograph, Department of Community Medicine, University of Peradeniya,1994.
5. Fernando, M.A. - Patterns of mortality among pre-school children in Ceylon, Ceylon Journal of Public Health Association, 1962 - 63, 3-4, 19-32
6. Padley, R. - "Cause of death statements in Ceylon- A case study in levels of diagnostic reporting" Bulletin of the World Health Organization, 1959,20, 677.
7. Fernando, R. - "Medical Certification of the cause of death in the General Hospital, Colombo", Ceylon Medical Journal, 1990, 35, 71-74.
8. Department of Census and statistics "Post enumeration survey 1953" Monograph N0. 1, 1953