CHANGING MORTALITY PATTERNS AND CARDIOVASCULAR DISEASES

DEPARTMENT OF HEALTH

NETHERLANDS INSTITUTE FOR PREVENTIVE MEDICINE

This study is part of a series of publications from our department on mortality problems in the Netherlands.

For the last year the analysis of mortality from cardiovascular diseases has found its logical continuation in a survey on the prevalence of ischaemic heart disease, as part of a comparative morbidity study in certain European countries, sponsored by the Regional Office for Europe of the World Health Organization.

CHANGING MORTALITY PATTERNS AND CARDIOVASCULAR DISEASES

by

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HAARLEM

PREFACE

In wide circles there is great interest in mortality figures from the Netherlands, because Dutch rates belong to the lowest in the world. This is especially the case with perinatal mortality, child mortality, tuberculosis mortality and mortality from infectious diseases. These low mortality rates go hand in hand with a relatively high birth rate.

Total mortality is also low and for some time it looked as though total mortality in both sexes were moving downwards continuously, apart from calamities.

About ten years ago the "stronger" sex had to give up — at least partially — its triumphal march through the domain of vital statistics, while mortality rates in the "weaker" sex continued their downward trend uninterruptedly. Total mortality in men began to *in*crease at the age of 50-70 and that due to special causes of death even from 30-40 years of age onwards.

What changes have taken place in the pattern of mortality in men? This monograph tries to give an answer to this question. In conformity with the trend in other countries it was anticipated that cardiovascular diseases, neoplasms and diseases of the respiratory system would be found responsible for the increase of mortality in adult men. Our analysis confirms this expectation. Ischaemic heart disease, lung cancer and chronic aspecific respiratory diseases contribute to the increase.

Most attention has been given to ischaemic heart disease, not only as a prominent contributor to the rise in total mortality, but mainly because it kills people at the height of their capacities, while prevention is unknown.

Epidemiology has the task of collecting as many facts as possible for an unbiased approach to aetiological factors in ischaemic heart disease.

The most striking fact which our analysis has brought to light is the great and increasing divergence in mortality from ischaemic heart disease between men and women. This sex difference has already been known for a long time, but has not always been given enough stress in relation to external factors, considered of paramount importance in the epidemiology of cardiovascular diseases.

All studies on the aetiology of ischaemic heart disease have to take into account the gap between the rates in men and women in all countries, the evolution for both sexes in the last few decades and the differences in rates between countries or areas with different ecological conditions.

On these three epidemiological facts our analysis is focused.

Leiden, March 1964 J. H. DE HAAS

CONTENTS

—	= nil
0 (0.0)	= less than half of unit chosen
+ 8.5	= increase of 8.5 per 100, 1.000, 10.000 or 100.000
— 8.5	= decrease of 8.5 per 100, 1.000, 10.000 or 100.000
30-34	= men or women of the age of 30 to 34 inclusive
1959/1961	= average for the years 1959, 1960 and 1961
1959-1961	= 1959 to 1961 inclusive
CVD	= cardiovascular diseases
IHD	= ischaemic heart disease

Tables and graphs have been compiled from basic data on causes of death drawn up by the Central Bureau of Statistics in The Hague according to the detailed list of the International Statistical Classification of Diseases, Injuries, and Causes of Death.

TABLES

all tables and graphs by sex and age

GRAPHS

o 1950-1961
x 1959-1961

1 SCOPE OF THE PROBLEM

During the last decade a change in the trend of mortality has occurred in European countries, which had not been indicated by the development during the last century.

In the Netherlands, after 1875 when total mortality amounted to 25‰, the death rate has fallen continuously (with interruptions on account of calamities such as wars and epidemics), as stated alongside: 20 in 1895, 15 in 1905 and 10 in 1925. Sex differences gradually disappeared.

total mortality per 1000 population			
year	♂	♀	♂ + ♀
1895	21	19	20
1905	16	15	15
1925	10	10	10
1938	8.5	8.2	8.4
1950	6.8	6.3	6.6
1952	6.5	5.9	6.2
1960	6.5	5.1	5.8

rounded off up to 1925
from 1938 onward adjusted to population in 1936

Mortality in 1938 and the death rates of 1950 and 1960, adjusted to the population as in 1936, were 8.4, 6.6 and 5.8 per thousand respectively. Sex differences reappeared and increased further. During the decade 1950-1960 total mortality in men dropped by 5% and in women by 20%.

Table 1 shows the risks of dying for both sexes by age before and after world war II. Until 1940 mortality in men and women was decreasing in all age groups. During the twenties the relative decrease was about equal for both sexes, but during the thirties the percentage decrease in women was stronger than in men. For ages between 30 and 50 total mortality in *women* remained somewhat *higher* than in men.

In this analysis the war years should be left out of consideration.

During the fifties the fall in mortality in women was relatively sharper than before world war II. In all age groups mortality in *men* become *higher* than in women. For men up to 45-50 years the decrease was about as great as before the war, turning into an increase at the age of 50 and over.

From the trend of mortality according to sex and age it appears that since about 1952 the older age groups of *men* have *not* contributed to the fall (fig. 1.1) and that for *women* of all age groups mortality keeps falling (fig. 1.2). This fall has been maintained during the last few years (fig. 2.1).

For older *men* not only is the decrease in mortality absent, but an *in*crease in mortality is manifest. When the 1950-1961 period is split up into four three-year periods — in order to eliminate annual fluctuations — the rise

appears to be continuing systematically (fig. 2.2). The increase in men and the decrease in women result in the death rates for the two groups diverging further.

The increase in mortality amongst men is an international phenomenon. In other West-European countries and in U.S.A. a rise in mortality, i.e. a stagnation of the fall, took place (long) before 1950 (Enterline-1960, Moriyama-1961). For the Netherlands Van Rooyen (1962) has drawn attention to the rise.

If the 1950 death rates according to age had remained constant in the Netherlands, 1000 fewer men between the ages of 50 and 70 would have died per year than actually did so in about 1960. For two reasons the situation is far more unfavourable than this. The groups of causes of death responsible for the increase in mortality in men contribute to a *rise* of 1750 deaths between 50 and 70. On the other hand there is a *fall* of 725 cases from causes of death having decreased rates.

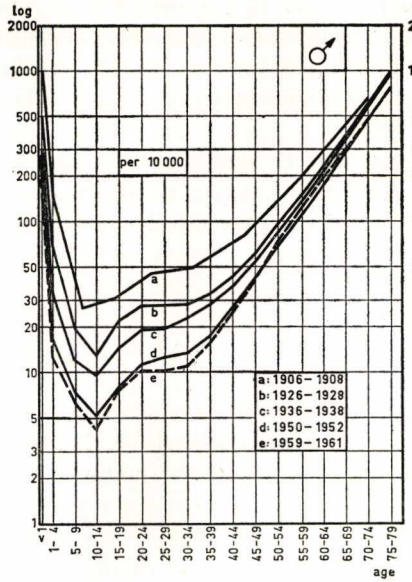
The second factor — increase of mortality under 50 and over 70 from special causes of death, (over) compensated by a decrease from other causes -- has not even been taken into account.

Some causes of death have reached so low a level, or have come so close to zero, e.g. tuberculosis, that they will no longer produce any compensating effect in the near future. If, for men, the rise of mortality from certain causes of death should continue at the speed of the last decade, total mortality will keep on increasing more and more.

The increase of mortality amongst men in the Netherlands, the continued decrease amongst women, and the resultant increasing divergency of mortality in men and women have formed the subject of this analysis.

Fig. 1 DEATH RATES BY AGE IN DIFFERENT PERIODS

1.1 MALES



1.2 FEMALES

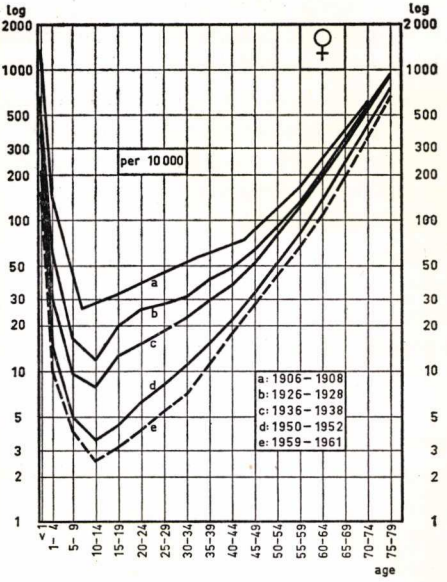
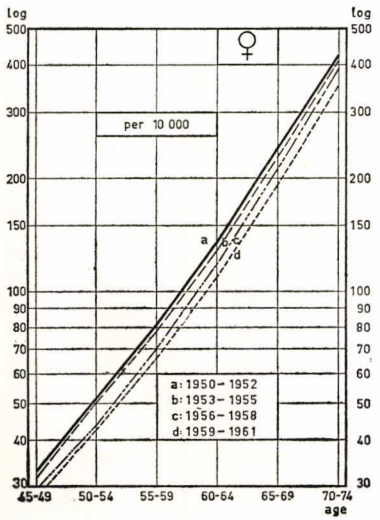
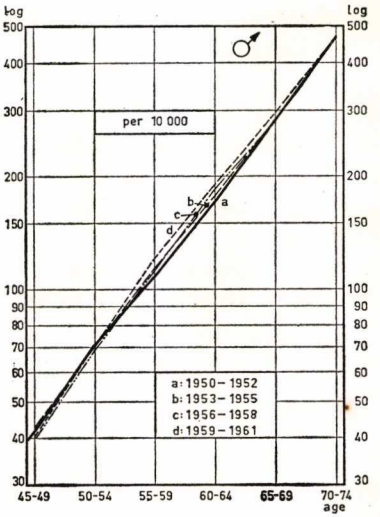


Fig. 2 CHANGING DEATH RATES FROM 45-75 YEARS

2.1 FEMALES



2.2 MALES



2 METHODS OF STUDY

The analysis extends over the years after 1950. It does not (with some exceptions) deal with the preceding periods, because a new international classification of causes of death (revision 1948) was introduced as from 1950. This still remains in use, apart from insignificant changes which became effective from 1st January 1958 (revision 1955).

The basic data have been derived from mortality figures by sex, age and cause of death, drawn up by the Central Bureau of Statistics according to the detailed list of the international classification of diseases, injuries and causes of death (Ed. 1948 and 1955).

The analysis has been arranged as follows:

1- grouping of mortality according to sex, age and (combinations of) causes of death
2- differentiation of the groups of causes of death mainly contributing to the increase (and decrease) into sub-groups of the international nomenclature
3- comparison of mortality in the Netherlands with the corresponding rates in other countries.

In order to answer the question which (groups of) causes of death have contributed to the increase of mortality in men and to the decrease in women, the division into chapters of the international nomenclature has been followed mainly, but not exactly. In some cases parts of different chapters have been combined, e.g. to make the group cardiovascular (-renal) diseases.

For the following groups of causes of death the decrease and increase have been studied and broken down by sub-groups (rubrics) as follows:

group	sub-groups (numbers) of detailed list
a- cardiovascular (-renal) diseases	330-334, 400-468, 592-594
b- neoplasms	140-239
c- diseases of respiratory system	470-527
d- tuberculosis	001-019
e- diseases of digestive system	530-587
f- diseases of genito-urinary system	590-591, 600-637
g- accidents, poisoning, violence	E 800-999
h- symptoms, senility, ill-defined	780-795
i- all other diseases	residual

In the accompanying tables, causes of death have been grouped in this manner.

Groups a, b and c have been given prominence in the analysis because — as will appear — they have contributed 45, 35 and 10% respectively to the increase of mortality in men.

The most attention has been paid to group a, CVD being a focus of international interest on account of their growing importance and unknown aetiology, while an analysis of mortality of CVD had not so far been made in the Netherlands.

Quantitatively, the increase in mortality from neoplasms (b) seems equally important. As in other countries lung cancer is mainly responsible for the increase in mortality from neoplasms, thus allowing a limited analysis.

The increase of mortality from diseases of respiratory system (c) is not so large, but is sufficiently important to be analysed by sub-groups.

3 PATTERN OF CAUSES OF DEATH

The great increase of mortality in men is such that one would expect it to be due mainly to the most important causes of death. This does not exclude the quantitatively less important causes of death from sharing responsibility for the increase. Evaluation of the contributions of the various causes of death to the increase and decrease of mortality requires first a study of the pattern of causes of death.

In the five-year age groups 35-39, 45-49, 55-59 and 65-69 the average numbers of persons who now die per year are 600, 1300, 3300 and 5400 respectively for men and 400, 900, 1900 and 3900 respectively for women.

Table 2 shows the death rates by sex, age and cause of death during the three-year periods 1950/1952 and 1959/1961. Between 30 and 70 years of age the total mortality of men increases from 100 to 4000 and for women from 60 to 3000 per 100,000 of each age group.

The rates of death from CVD for men of 30 to 70 years rise from 15 to 2000 (per 100,000), for women from 10 to 1500; those of death from neoplasms from 25 to 1000 and from 20 to 700, respectively.

Under 60 age-specific mortality rates for CVD are more than twice as high in men as in women (table 2 and fig. 3.1). The rates for neoplasms by age are alternately higher or lower for men than for women (fig. 3.2) with important differences by site. For women, mortality from CVD at about 60 years of age exceeds mortality from neoplasms, for men this crossing lies between the ages of 40 and 50 years (fig. 4.1 and 4.2). For men and women mortality from CVD increases even more with age than is the case with neoplasms.

As a cause of death little is left of the importance of tuberculosis, so little even that the further fall in tuberculosis mortality — which has been of a spectacular nature during the post-war years — may provide only a small contribution to the decrease of mortality in the near future.

Death rates from accidents at an older age are far less than from CVD or neoplasms and of a similar order to those from diseases of digestive system.

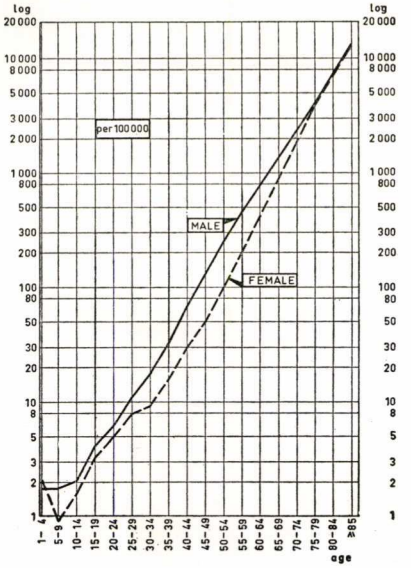
Table 3 shows that the proportion of CVD to total mortality increases with age. For men and women aged 30 one seventh of total mortality is caused by CVD, at the age of 40 for men 25% and for women 15%, at 50 years 35% and 20% respectively, at 60 years 40% and 35% respectively and at 70 for both sexes about 50%.

Neoplasms are responsible for one quarter of mortality amongst men aged 35, one third at about 50 and over one quarter above 70; for women of about 30 one third, about 50 one half and over 60 one third.

Fig. 3 MORTALITY BY SEX, AGE AND CAUSE OF DEATH

1959/1961

3.1 C.V.D.



3.2 NEOPLASMS

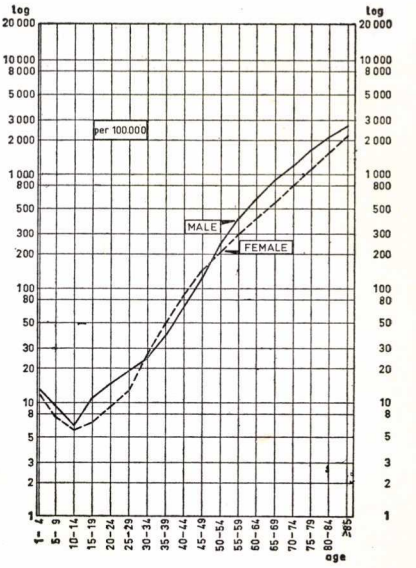
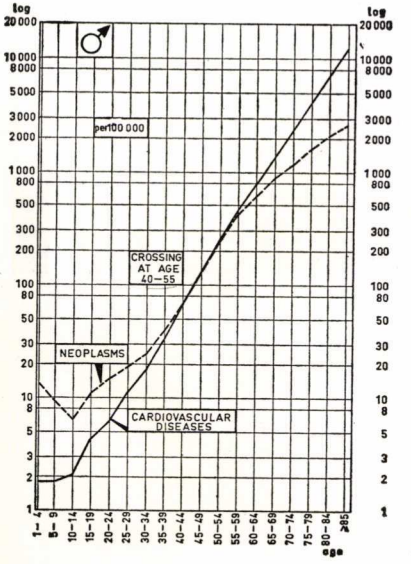


Fig. 4 MORTALITY FROM NEOPLASMS AND CARDIOVASCULAR DISEASES

1959/1961

4.1 MALES



4.2 FEMALES

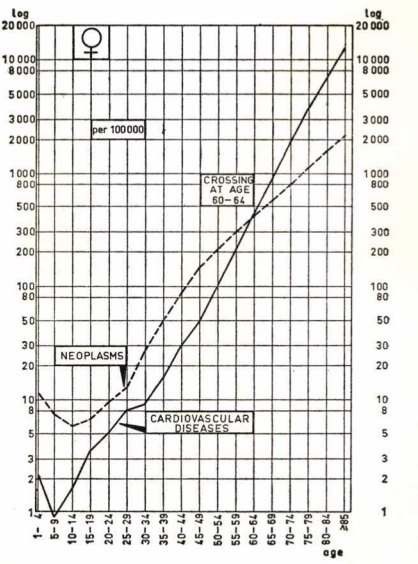
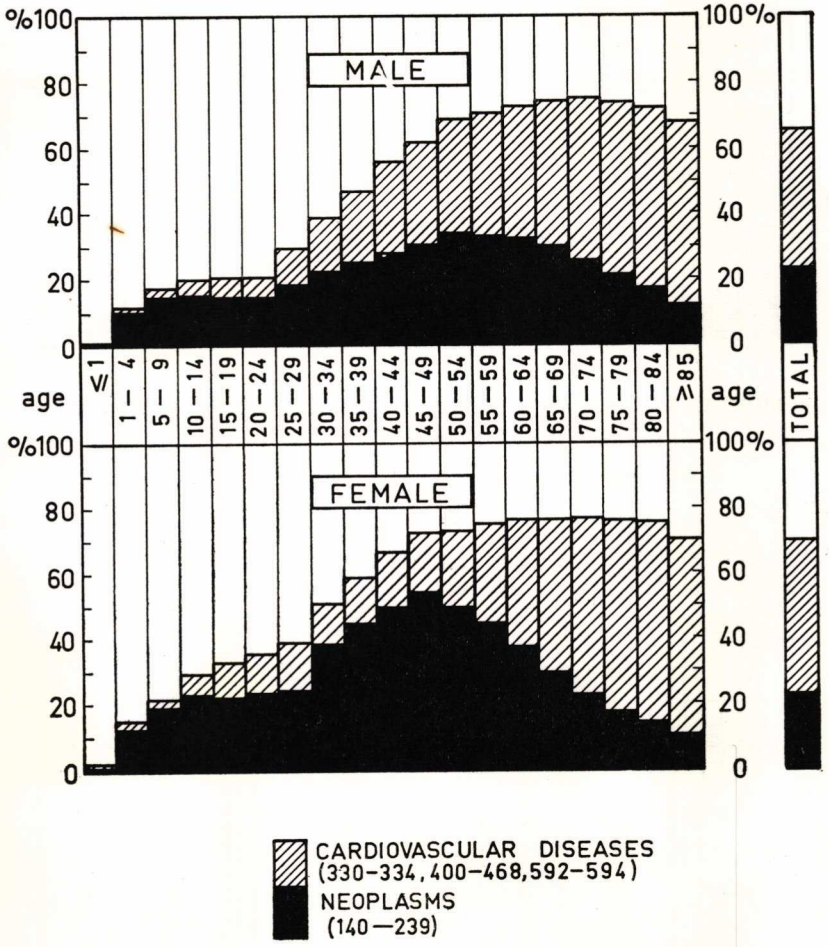


Fig. 5

MORTALITY FROM NEOPLASMS AND CARDIOVASCULAR DISEASES

in percent of total mortality

1959/1961



CVD and neoplasms together account for one half to three quarters of mortality for men older than 40 years of age and for women older than 30 (fig. 5).

For both women and men over 60 the seven other groups of causes of death provide about one quarter of total mortality (table 3), a relatively important part being taken up by diseases of respiratory system (c) and accidents (g). As will appear later (table 4), both these groups of causes of death are concomitantly responsible for the increase of mortality amongst men, diseases of respiratory system somewhat more than accidents.

Of the other three groups of causes of death (d, e and f) tuberculosis (d) has become relatively the least important (table 3). All three have in common — as have also the remaining groups (h and i) — that their significance is decreasing (table 4 and 5).

4 EVOLUTION IN LAST DECADE

Until 1940 total mortality in men under 70 was diminishing in the Netherlands. World war II caused a considerable rise and the first post-war years showed a horizontal course. After 1950 a rise for ages over 50 appears. In women of all ages the pre-war decrease has continued uninterruptedly since the war.

Table 4 shows the *in*crease or *de*crease in mortality during a decade according to sex, age and cause of death. The 1950/1952 period has been taken as the starting point because the increase began after 1950 and the change in the international classification of causes of death became effective as from 1950.

As the youngest age group that of 30-34 years has been chosen, since the increase of mortality in adult men according to cause of death starts at about 35 years, i.e. in the CVD group. Total mortality — the balance sheet of all causes of death — increases as from 50 years of age. Both levels shift to a lower age.

The upper age limit has been taken as to 70-74, because as a rule at and above that age death will be due to more than one disease, the most important one often being difficult to determine, so that it is not possible to state a specific cause of death. Moreover, the increase of total mortality in men is manifest up to about 70 years and is relatively small above 70 years in the CVD and neoplasms groups. For diseases of respiratory system the increase changes to a decrease at the age of 70; for diseases of digestive system a reversal takes place. These dissociations point to difficulties in diagnosis above 70 years of age.

The data of table 4 are represented in eight figures, in order to show the *in*crease and *de*crease in mortality rates in relation to sex, age and cause of death (fig. 6.1-6.8).

Table 5 has been drawn up so as to indicate the *proportional* increase or decrease. The four corresponding figures (7.1-7.4) apply to total mortality and the three causes of death which have contributed most to the increase of mortality amongst adult men.

4.1 Sex differentials

Paragraphs 3 and 4 show that differences between men and women appear both in the pattern and in the evolution of mortality. These differences are so evident that mortality according to age and cause of death has to be analysed by sex.

4.1.1 Males

Table 4 and fig. 6.1-6.8 show that the increase of mortality in men during the last decade proceeds at an age *below* or far below the average age reached by men during this period. Total mortality is increasing above the 50th year, the rise of CVD starting at 35-39 years, that of neoplasms at 40-44 years and that of diseases of respiratory system at 55-59 years, the expectation of life for men lying at 70-75 years.

CVD, neoplasms and diseases of respiratory system contribute 45, 35 and 10% respectively to the total increase of mortality in men from all causes of death. The proportion of CVD to the total increase is highest (80%) at the age of 45-49 and lowest (30%) at 65-69 years, for neoplasms the differences by age are small.

Fig. 6.1-6.4 show that, for ages 35-54, the increase of the rates for the three causes of death which are the most important for this analysis is not yet of great significance in absolute numbers. As against a rather small decrease of *total* mortality at 35-49 years an *in*crease of mortality of CVD is seen to climb with age from 10 to 35 per 100,000 per five-year group, while for neoplasms an increase occurs of 5 per 100,000 at 45-49 years to 30 at 50-54 years. The numbers of population decrease with age (table 2).

Table 4 and fig. 6.5-6.8 which are not on the same scale — nor on that of fig. 6.1-6.4 — show that at 50-54 the total of increases becomes somewhat higher than the total of decreases and that at 55-59 the increase of total mortality amounts to 125, at 60-64 years to 185 and at 65-69 to 135-140 per 100,000. From 70-74 years on there is a slight drop. For both CVD and neoplasms the increase of the rates at 60-64 years amounts to more than 100 per 100,000.

The increase of mortality according to rates should be compared with the proportional increase (table 5 and fig. 7.1-7.4).

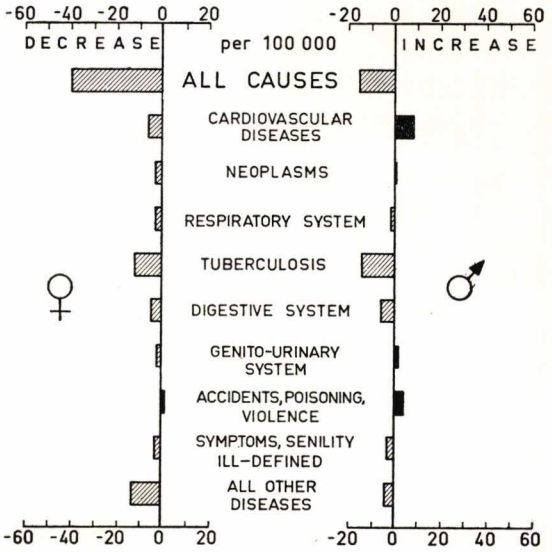
Between 50 and 55 years the relative increase of *total* mortality is of no significance as yet, but between 55 and 65 total mortality has increased by more than 10% (fig. 7.1).

The percentage increase of mortality from CVD (fig. 7.2) is obvious from the age of 35-39, but applies to low rates. From 40 to 60 years the average increase is 20 to 25% at ever-increasing rates.

Fig. 6 CHANGE IN MORTALITY RATES BY CAUSE OF DEATH

1959/1961 - 1950/1952

6.1 AGE 35 - 39



6.2 AGE 40 - 44

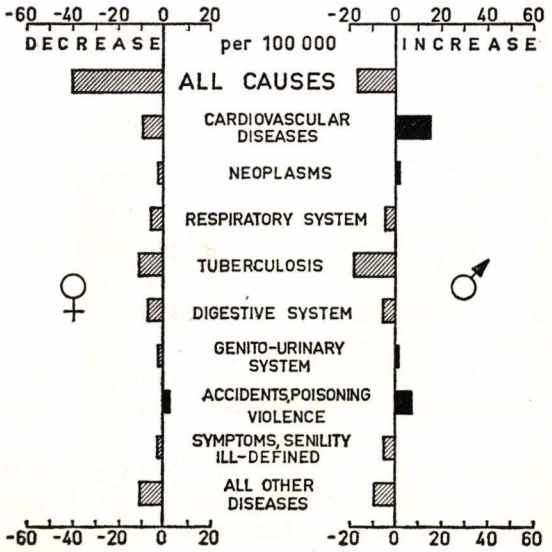
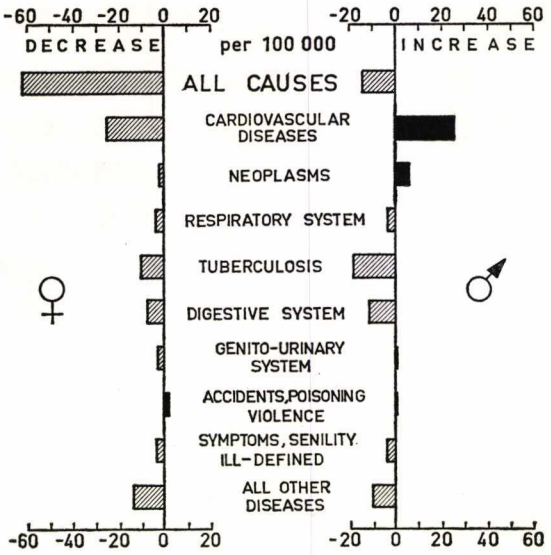


Fig. 6 CHANGE IN MORTALITY RATES BY CAUSE OF DEATH

1959/1961 - 1950/1952

6.3 AGE 45 - 49



6.4 AGE 50 - 54

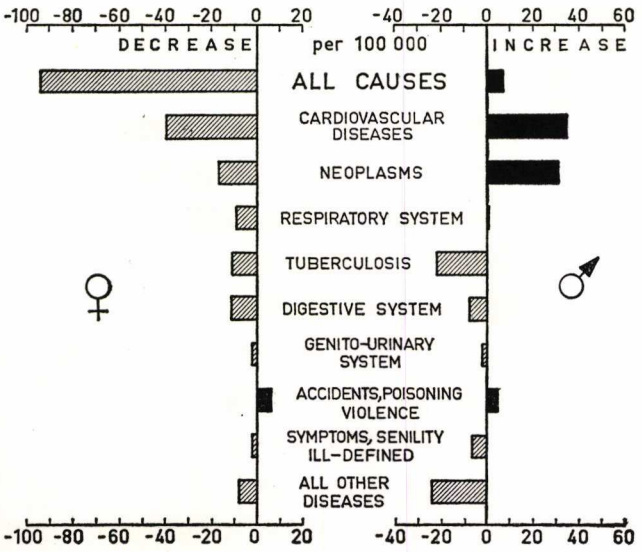
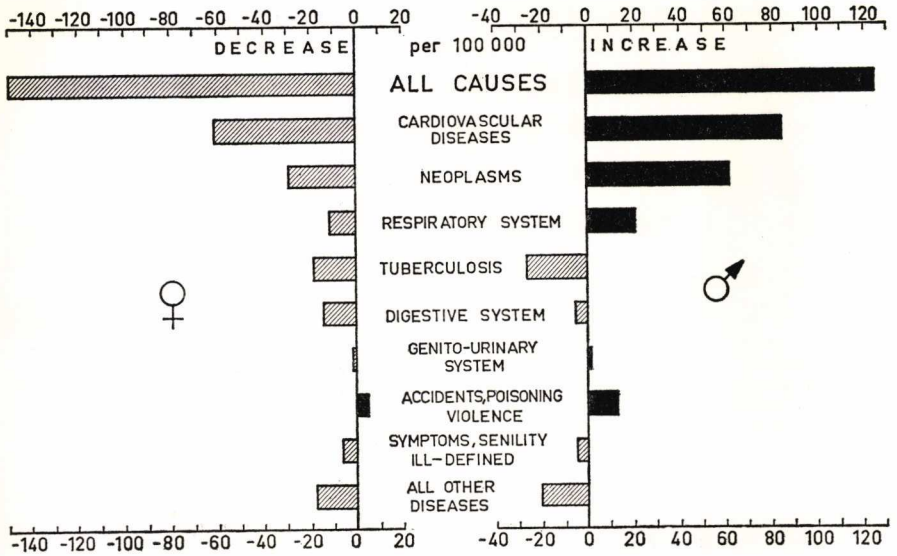


Fig. 6 CHANGE IN MORTALITY RATES BY CAUSE OF DEATH

1959/1961 - 1950/1952

6.5 AGE 55 - 59



6.6 AGE 60 - 64

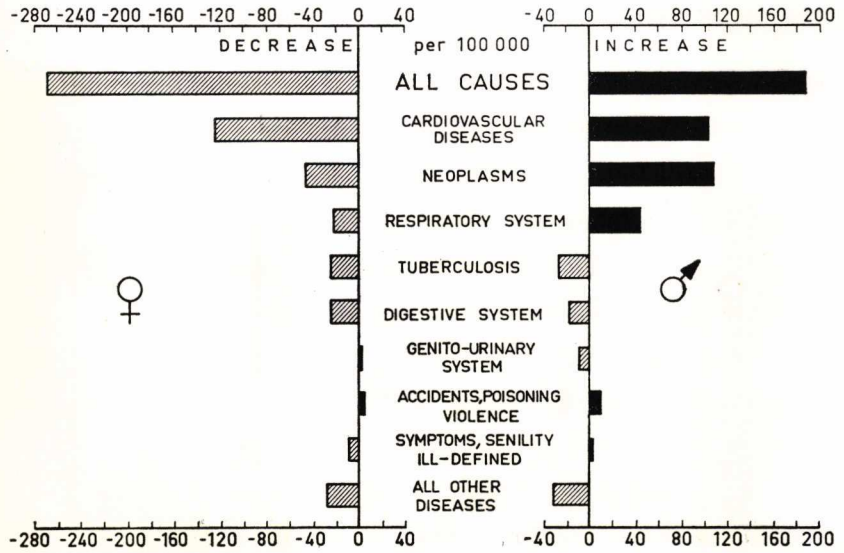
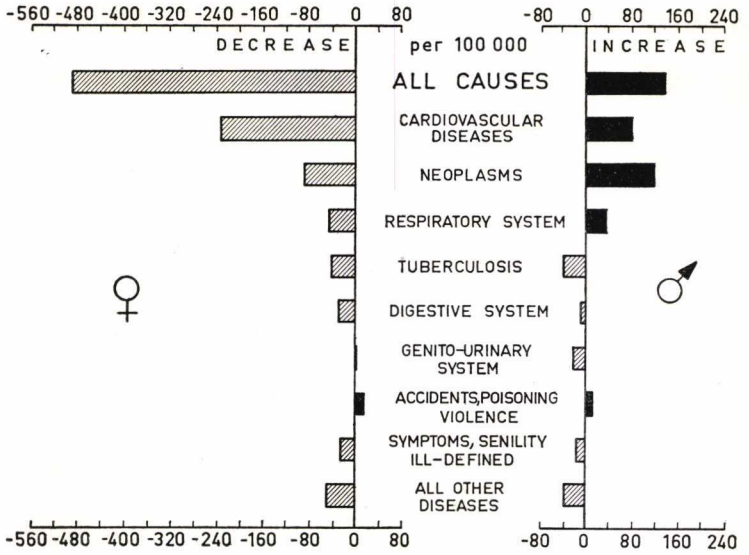


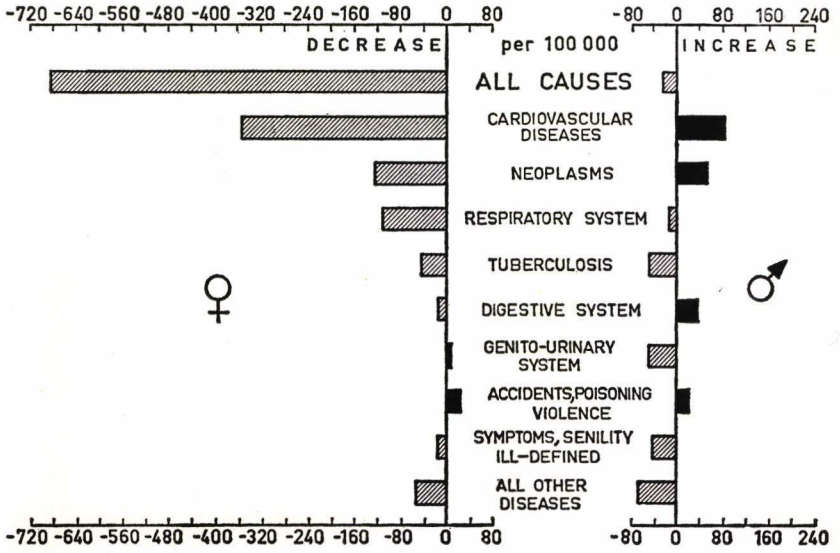
Fig. 6 CHANGE IN MORTALITY RATES BY CAUSE OF DEATH

1959/1961 - 1950/1952

6.7 AGE 65 - 69



6.8 AGE 70 - 74



Mortality caused by neoplasms (fig. 7.3) has risen by 15-20% between 50 and 70 years, mainly by an increase of lung cancer. From 40-50 years the rise is less than 5%.

The increase of mortality from *diseases of respiratory system* (fig. 7.4) has two special features: the increase starts at an older age than those for CVD and neoplasms, and is relatively greater: between 55 and 70 years it averages 35%, with a peak of 50% at the age of 60-64.

Since about 1950, mortality according to age in men has been spreading fan-wise. With the younger age groups the decrease continues, in the 50-54 years group the trend is almost horizontal and for the older men it changes into a rise.

The rise or fall of total mortality according to age group is composed in a heterogeneous manner. At 35-39 years, while total mortality is still clearly decreasing, an increase in mortality from CVD has already started. In men of 40-44 and 45-49 total mortality is still decreasing, but mortality from CVD is increasing and also that from neoplasms (for the first time). At 50-54 total mortality starts to increase. This rise would have happened at a lower age — and in an increasing degree at a higher age — were it not for the fact that, at all ages, tuberculosis has until recently greatly contributed to the decrease.

Now that tuberculosis rates have fallen so low that in the near future a further drop in tuberculosis mortality can hardly influence the picture of total mortality any more, it is to be expected that the increase of total mortality in men which set in during the last decade and manifested itself over 50 years of age, will start under 50, if not under 40, during the decade to come.

The gravity of the problem is beyond any doubt.

4.1.2 Females

Fig. 1.2 and 2.1 show that the decline in mortality in women continues while an increase has set in amongst men.

Table 4 and fig. 6.1-6.8 show that from 35 up to 75 years of age the decrease for *all* ages and for *all* causes of death continues, apart from a slight increase in the group accidents for all age groups and an insignificant increase for diseases of the genito-urinary system between ages 60 and 70, which, however, hardly affect the mortality pattern.

Table 5 and fig. 7.1-7.4 show the decline in mortality (percent change) according to age: for total mortality and three important causes of death. The decrease in mortality between 1950 and 1960 for all age groups amounts to about 20% (fig. 7.1) and proceeds gradually (page 1 and fig. 2.1). Under 40 years the decrease is nearly 30%.

The decline for CVD amounts to about 25% and is roughly independent of age (fig. 7.2).

For neoplasms the decrease under 50 years is of little significance and for 50 years and over it is 10% on an average (fig. 7.3).

Mortality from diseases of respiratory system shows a decline of approximately 35% (fig. 7.4), ranging from 25-50%.

Tuberculosis mortality, although showing the relatively strongest decline (80-90%) did influence the decrease of total mortality, but not to a dominating extent: by 20-30% under 45 years and approximately 10% for 50 years and over.

In 1960 roughly, 4000 fewer women between 35 and 75 years died than would have been the case if the 1950/1952 rates had still prevailed. Only accidents cause a "loss" which — however regrettable — is almost negligible (130) when compared with the total "profit" (4100).

The decline of mortality from CVD, neoplasms, respiratory diseases and tuberculosis "saves" 1770, 650, 420 and 400 women respectively. The decrease of mortality from CVD is of greater importance than that from the three other causes together.

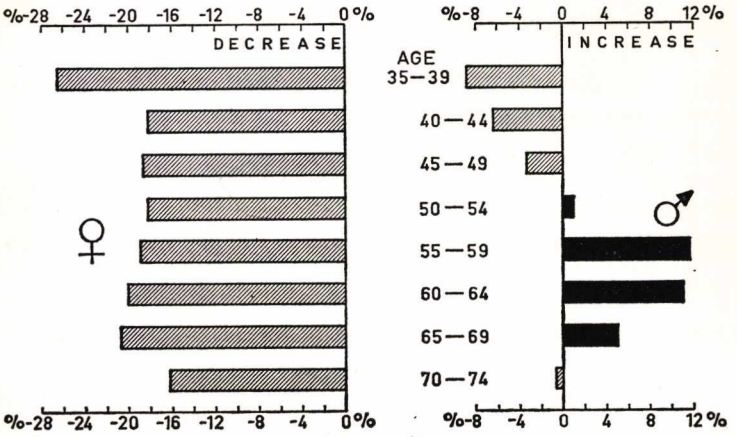
Tuberculosis mortality has fallen so low that a further decline can practically no longer influence the decrease of total mortality. The fall of mortality from other causes of death — in fact from CVD — will probably be maintained, so that in the near future total mortality amongst women may continue to fall, but the pace will slow down.

Fig. 7

PERCENT CHANGE IN MORTALITY RATES BY CAUSE OF DEATH

1950/1952 - 1959/1961

7.1 TOTAL MORTALITY



7.2 CARDIOVASCULAR DISEASES

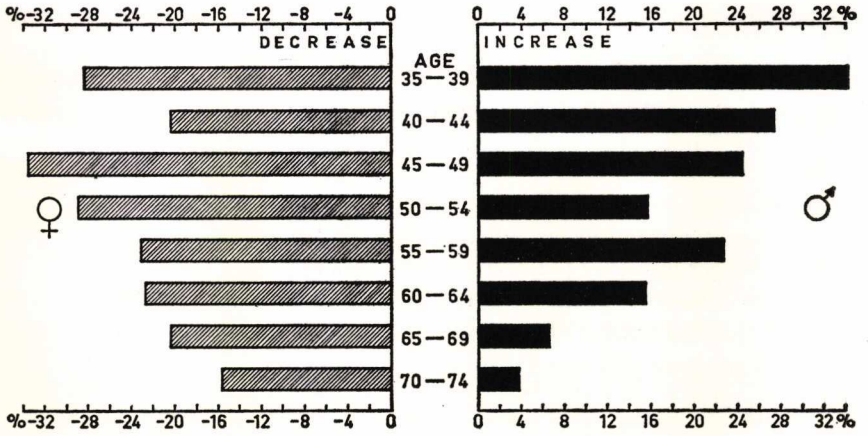
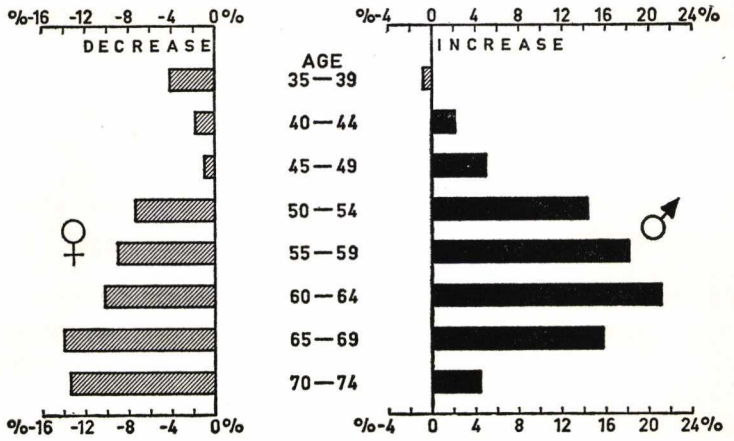


Fig. 7

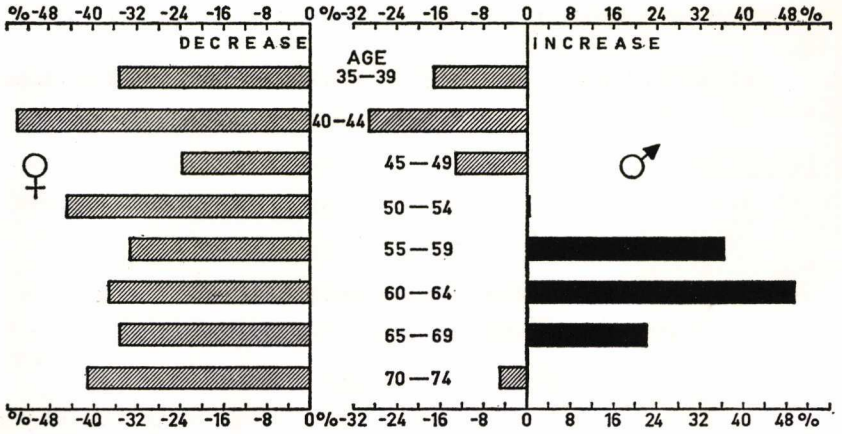
PERCENT CHANGE IN MORTALITY RATES BY CAUSE OF DEATH

1950/1952 - 1959/1961

7.3 NEOPLASMS



7.4 DISEASES OF RESPIRATORY SYSTEM



4.1.3 Males and females

The course of mortality during the last ten years shows an evident sex differential: as against a continued decrease for women at all ages there is a clear increase for older men. It is true that the increase for men (over 10% between 55 and 65 years) is less than the decrease for women (average 20% between 35 and 75 years), but before 1940 mortality was decreasing for men also, so that in the increase the absence of a decline must be accounted for as well. Between 35 and 50 years the decrease for men is only 5%.

In fig. 6.1-6.8 the changes in mortality rates by sex, age and cause are given. For CVD and neoplasms the increase among men and the decrease among women are almost mirror-images. On the other hand there is a certain similarity in the decline for other causes, including tuberculosis, and the small increase for accidents. Mortality from respiratory diseases amongst women shows a steep fall at all ages, and for men a decrease under 50 years and a sharp rise for over 55 years.

The differences and similarities of decrease and increase for both sexes are more accentuated in table 5 and fig. 7.1-7.4, which refer to *percent* changes in total mortality and by cause of death, than in the changes in mortality *rates* shown in table 4 and fig. 6.1-6.8.

According to the rates the increase for men is greatest in the 60-64-year group and the decrease for women greatest in the highest age group.

Relatively, the *increase* of total mortality in men is greatest between 55 and 65 years (over 10%). For women the *decrease* is greatest between 30 and 40 years (over 25%) and after that is almost constant at a slightly lower level (20%): table 5 and fig. 7.1.

The main causes of death show the following proportions.

For CVD the rise for men decreases with age (to about 5 per cent over 65 years). The decrease for women is roughly a mirror-image of the increase for men (fig. 7.2).

For mortality from neoplasms the increases for men and the decreases for women also show a certain symmetry (fig. 7.3).

For mortality from respiratory diseases a decrease for both men and women under 50 is apparent, this being greater for women than for men (fig. 7.4). Between 50 and 55 years neither decrease nor increase is shown for men, but there is a decrease of 40 to 50% for women. Against the high rise for men between 55 and 70 there is a sharp decline for women between 55 and 70 years. The steepest fall for women lies between 40 and 45 years, the steepest rise for men between 60 and 65 years. Both amount to 50%.

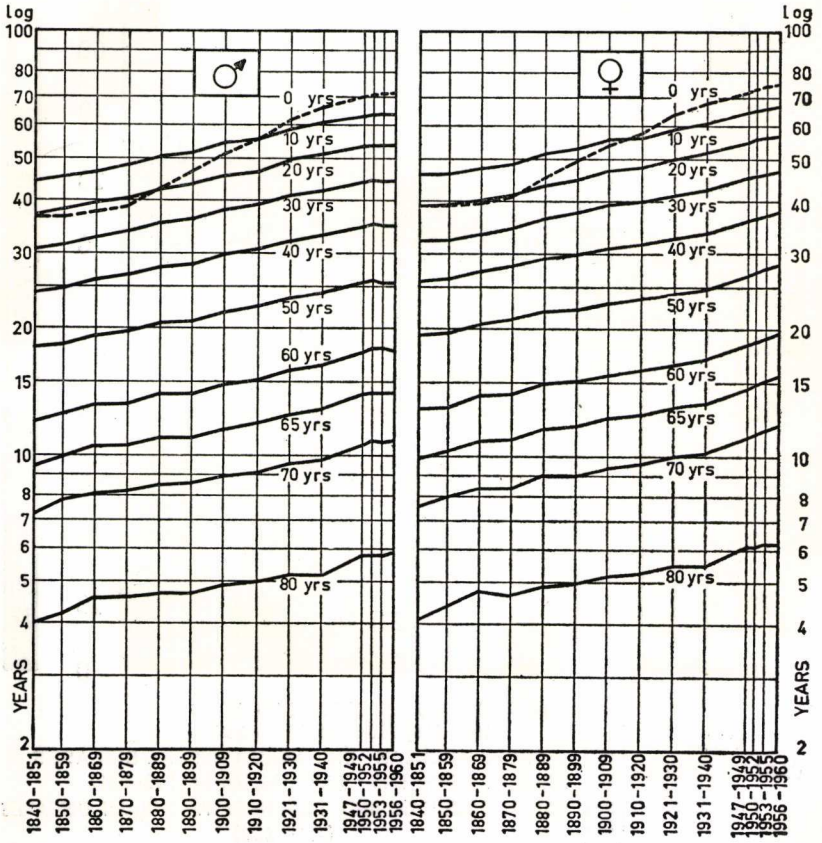
Fig. 7.1-7.4 show clearly that for both men and women aged 35-70 years mortality — by sex, age and cause of death — is subject to large shifts.

In fig. 8 the increase of the expectation of life in ages from 1840 until 1960 is shown semi-logarithmically. The relative increase per sex for each age (over ten years) is equal. Non-logarithmic curves suggest — wrongly — that the increase at an older age may be less important than at a younger age.

The divergency of mortality rates for men and women results in the expectation of life for women continuing to rise, even with acceleration, while for men for the last ten years no increase in expectation of life has taken place.

The pattern of causes of death in adult males suggests that for the near future life expectation for men will slightly decrease.

Fig. 8 EXPECTATION OF LIFE DURING LAST CENTURY



4.2 Causes of death

4.2.1 Cardiovascular diseases

According to the international classification of diseases, injuries and causes of death, CVD is divided into three sub-groups:

4.2.1.1 ischaemic heart disease (420-422)

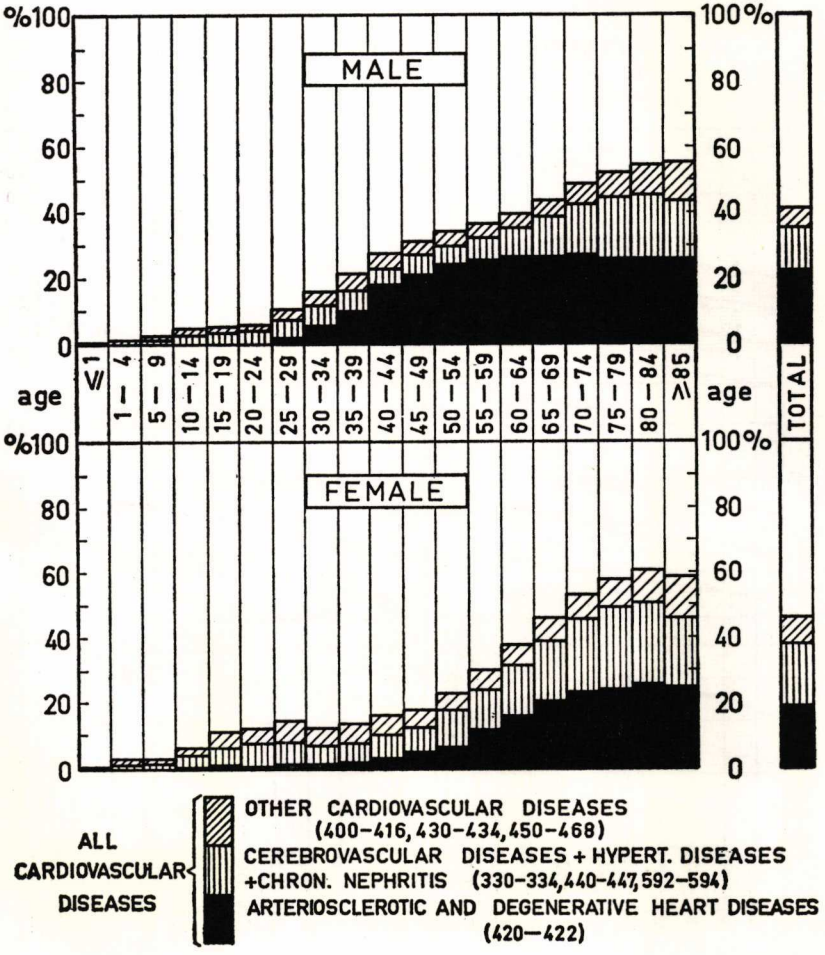
4.2.1.2 cerebrovascular and hypertensive diseases (330-334, 440-447 & 592-594)

4.2.1.3 other CVD (400-416, 430-434 & 450-468).

Fig. 9 MORTALITY FROM CARDIOVASCULAR DISEASES BY SUB-GROUPS

in percent of total mortality

1959/1961



In conformity with this grouping fig. 9 has been drawn up, giving the share of the entire group and the sub-groups in total deaths. In the detailed list the group IHD comprises numbers 420-422 and in the abbreviated list the "notorious" number B 26. For men from 40 to 70 years B 26 accounts for two thirds of deaths from all CVD, for women from 55 years almost half.

Cerebrovascular and hypertensive diseases are relatively more prominent for women than for men.

The trend of mortality from all cardiovascular (-renal) diseases from 1950-1961 according to sex is shown in fig. 10.

In each age group the rates for men are rising and those for women are falling. The trend is somewhat irregular — this applies also to total deaths — because from year to year mortality rates are influenced directly and indirectly by a divergent complex of factors (e.g. influenza), while in the younger age groups they apply to relatively small numbers.

Fig. 10 MORTALITY FROM CARDIOVASCULAR-RENAL DISEASES

(330 - 334, 400 - 468, 592 - 594)

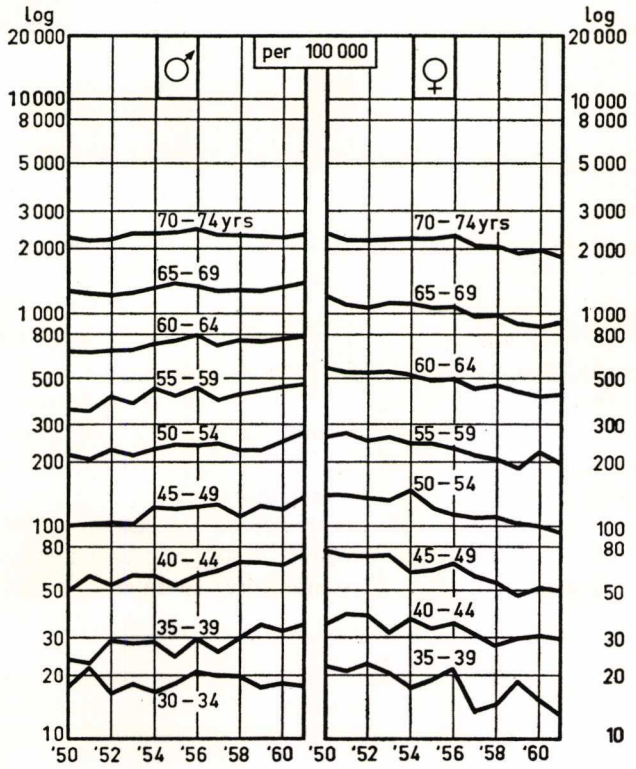


Fig. 7.2 shows that the rise for men decreases from 35 to 5% according to age, the fall for women from 30 to 15-20%. The percentage increase for men is already strongly evident at the age of 35.

In accordance with chapter 3, fig. 9 demonstrates that for men at 40 years of age CVD accounts for one quarter, at 50 years one third, at 60 years 40% and at 70 years almost one half of total deaths and for women 15, 20, 35 and 50% respectively.

In this paper the term CVD is taken to comprise diseases of the circulatory system, cerebrovascular diseases and chronic nephritis. The reason why chronic nephritis has been included is stated in § 4.2.1.2.

The mortality rates of the three sub-groups by sex and age at the beginning and at the end of the decade are given in table 6.

4.2.1.1 *Ischaemic heart disease*

This sub-group is formed by number 420 (= arteriosclerotic disease, including coronary disease), 421 (= chronic endocarditis not specified as rheumatic) and 422 (= other myocardial degeneration). Non-rheumatic endocarditis is such a rare cause of death that number 421 can be disregarded.

The trend of 420 is given in fig. 11. For both sexes there is an evident rise in all age groups, much stronger for men than for women: roughly a doubling for men in ten years and for women an increase of 50%.

Against a sharp rise of number 420 — for men stronger than for women — a sharp fall of 422 is apparent, relatively the same for men and women (fig. 12). It appears from the rapid decline that the diagnosis of myocardial degeneration is falling into disuse.

Mortality from arteriosclerotic disease (420) greatly exceeds mortality from myocardial degeneration (422). Thus for men from 55 to 65 years the rate from arteriosclerotic heart disease is now 400 per 100,000 and that from myocardial degeneration only 30; for women 100 and 25 per 100,000 respectively. The rates from number 420 for men are many times higher than those for women, the rates from number 422 are roughly the same.

The numbers 420 and 422 are combined into the sub-group IHD, this eliminating the influence of "fashions" (and of improved quality) in medical diagnosis, whereby myocardial degeneration gradually merges into arterio-(athero) sclerotic heart disease. From this combined sub-group emerges B 26, epidemiologically renowned (on account of its great and increasing importance) and notorious (for its high mortality) in men.

Fig. 11

MORTALITY FROM ARTERIOSCLEROTIC HEART DISEASE CORONARY DISEASE INCL.

420 = B 26 part

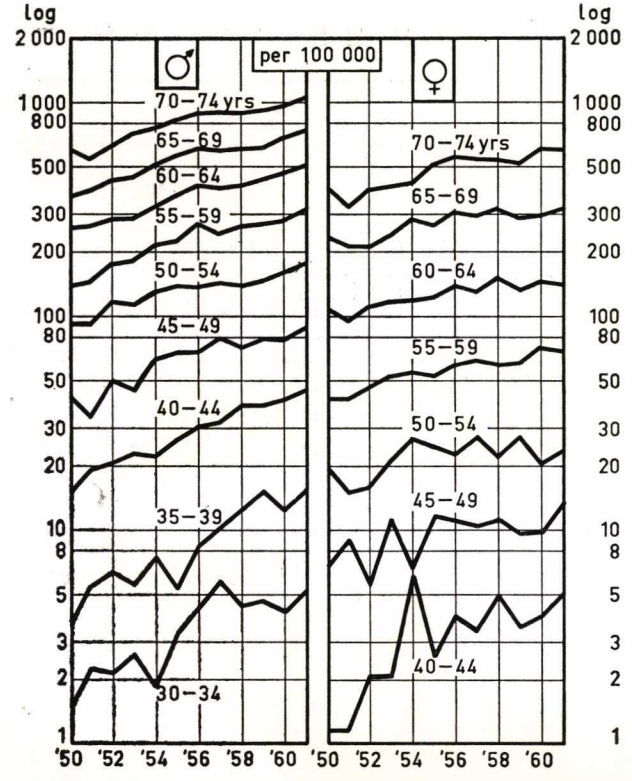


Fig. 12

MORTALITY FROM MYOCARDIAL DEGENERATION

422 = B 26 part

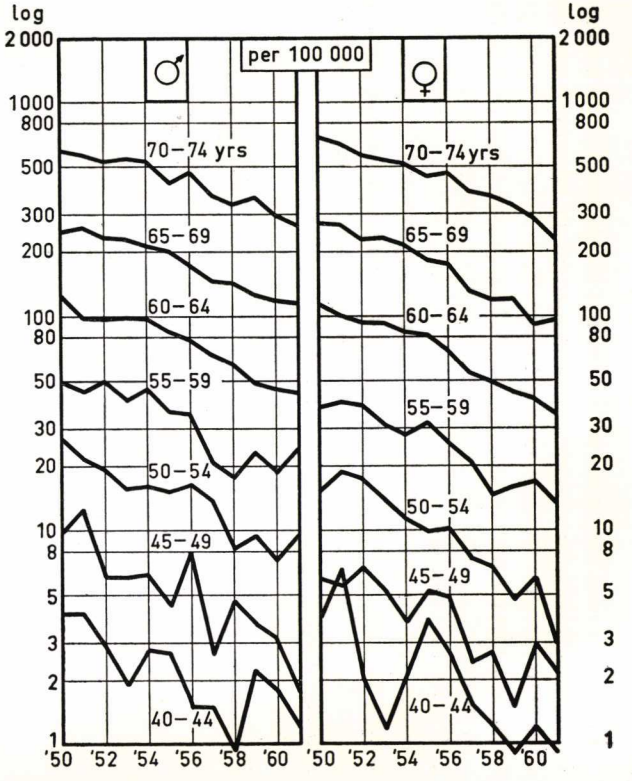
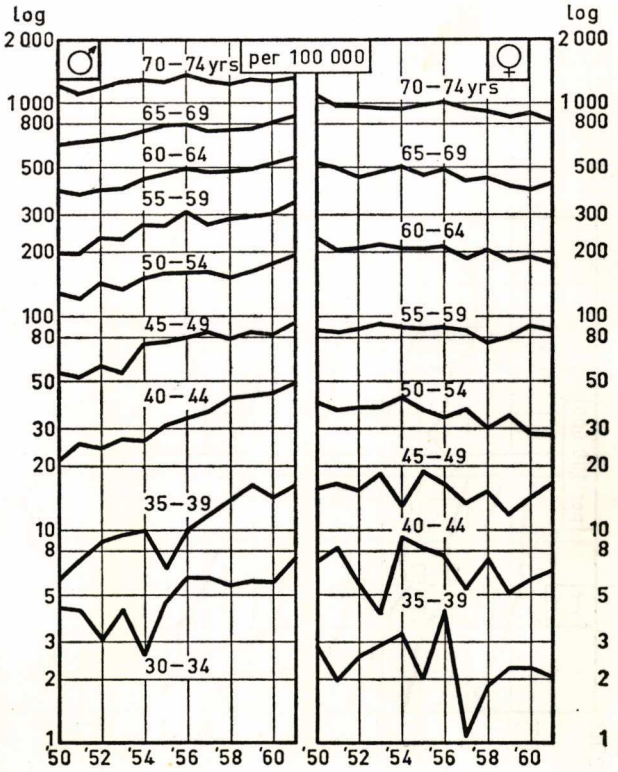


Fig. 13 depicts the trend of B 26 during a decade. As in the case of total CVD, for IHD also the increase for men of all ages and the decrease for (older) women are striking. Owing to this divergency the sex ratio of mortality from B 26 in all age groups — and that from all CVD — has risen greatly (fig. 14). Fig. 13 and 14 are the most illustrative graphs of the analysis on CVD in the Netherlands.

With men the proportional rise of mortality from B 26 decreases with age: between 35 and 45 years a doubling has taken place, between 55 and 65 years an increase of 40%. The rates under 40 years are low, but *a relatively important rise starts as early as at or under 30 years.*

Fig. 13 MORTALITY FROM ARTERIOSCLEROTIC AND DEGENERATIVE HEART DISEASE

420 - 422 = **B 26**



The present rates for men over 35 years are as high as for ten years older women, and those for men over 60 years are as high as for five years older women. At 75 years women have almost caught up with men. It appears that over 55 years mortality rates for women from IHD start catching up with those for men. The influence of the menopause cannot be read simply from the mortality figures, but this influence is very suggestive as a long-term effect.

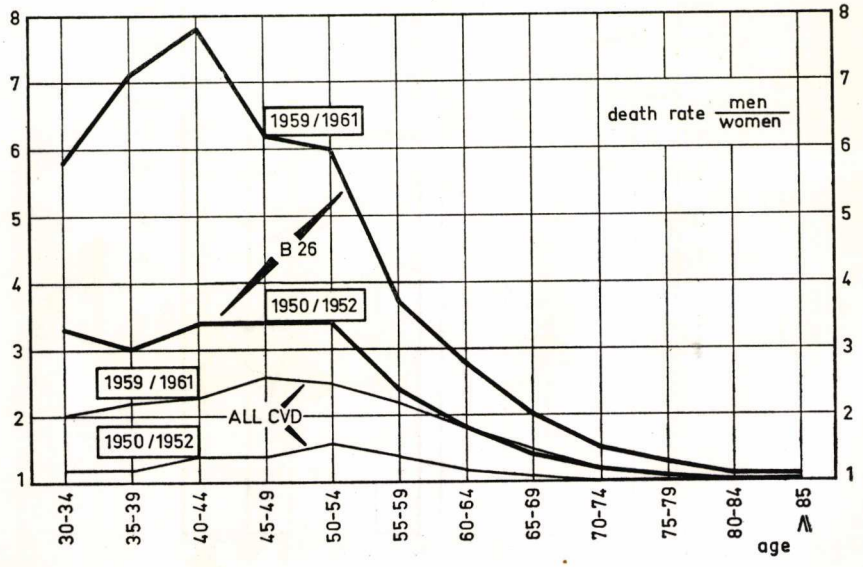
The present differences between the rates in men and women for all CVD are the same as the sex differences in B 26.

The sex ratio of IHD rises from 6 to 8 from 30 to 40 years (fig. 14). At 50 years the sex ratio is 6 and at 60 years 3. From different causes of death a more or less marked excess mortality of men occurs. Only for traffic accidents is the peak as high as for IHD, but at a younger age (25 years) than for IHD (40 years).

At the present rates men run a risk of about 5% of dying from IHD between 50 and 65 years, as compared with a total risk of death amounting to 15-20%. For women these risks are 1-1½% and rather more than 10%, respectively.

Fig. 14 INCREASING SEX RATIO OF MORTALITY FROM ARTERIOSCLEROTIC AND DEGENERATIVE HEART DISEASE = B 26 AND FROM ALL CARDIOVASCULAR DISEASES

1950/1952 & 1959/1961



4.2.1.2 *Hypertensive and cerebrovascular diseases*

This sub-group consists of:

a- cerebrovascular diseases, comprising numbers 330-334 in the detailed list and B 22 in the abbreviated list

b- hypertensive disease (400-447 = B 28-29) and

c- chronic nephritis (592-594 = B 38 pt).

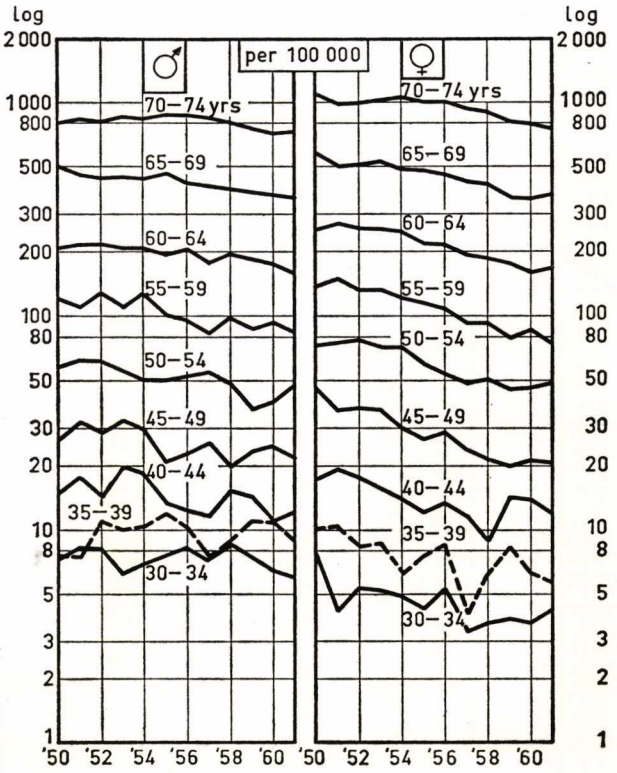
This combination has been adopted in the literature in order to neutralize errors made in completing certificates of death and in the coding of diagnoses.

Apoplexy is by far the most important component; hypertensive disease in the strict sense of the term forms less than one fifth and chronic nephritis a fraction of the sub-group.

The rates of the hypertensive group are moving downward for both sexes, but more rapidly for women. In 1950 the rates for women were still higher than for men, but now are almost equal (fig. 15).

Fig. 15 MORTALITY FROM CEREBROVASCULAR DISEASES + HYPERTENSIVE DISEASE + CHRONIC NEPHRITIS

330 - 334, 440 - 447, 592 - 594



As against the clear and ever-increasing sex differences for IHD there is a certain conformity for men and women as far as death from cerebrovascular diseases, hypertensive disease and chronic nephritis is concerned.

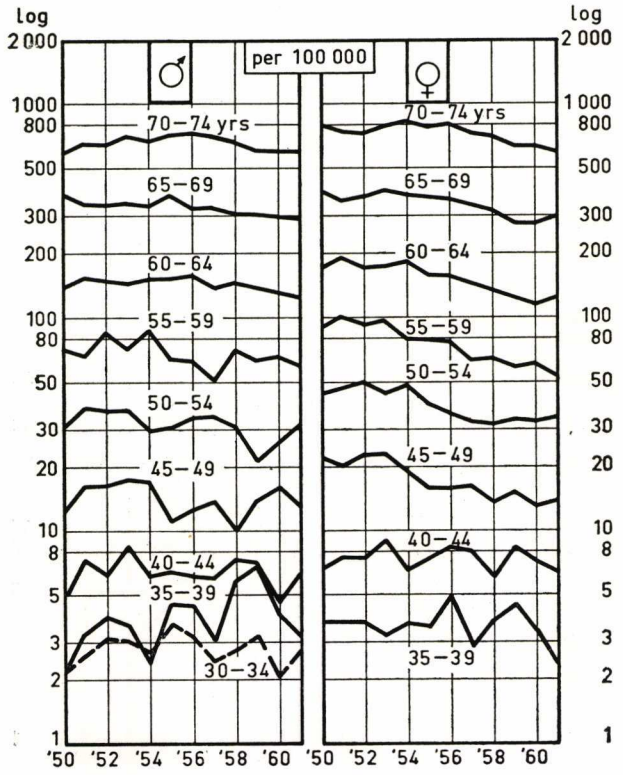
For men and women above 55 years the share of IHD in CVD is highest, and for women under 55 the hypertensive group. For both men and women the hypertensive rates rise strongly with age: from 20-25 per 100,000 between 45 and 50 years to 350-360 between 65 and 70 years.

Fig. 16, which applies only to cerebrovascular diseases (B 22), is almost a duplication of fig. 15, but at a lower level. From 45-50 years onwards a fall is apparent, up to 70 years this is greater for women than for men. For men B 22 accounts for about the same part of the hypertensive group as B 26 does of all CVD (1/2-3/4), for women respectively 2/3 and 1/3. The importance of B 26 for men continues to *in*crease; the importance of B 22 is *de*creasing for both sexes.

The *de*crease of mortality from all CVD for women is due to a decrease

Fig. 16 MORTALITY FROM CEREBROVASCULAR DISEASES

330 - 334 = B 22



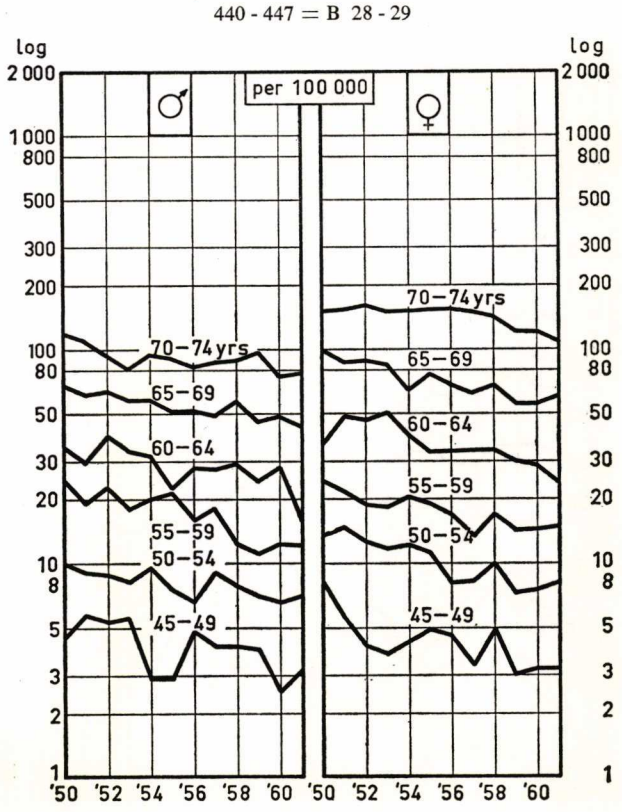
for both B 26 and B 22. For men the *in*crease of mortality from all CVD is due to the increase of B 26 being higher than the decrease of B 22.

Fig. 17 shows that for both sexes the sub-group hypertensive disease (440-447 = B 28-29) is not of great importance, and that mortality rates are moving downward.

In a case of sudden death the differentiation between apoplexy and myocardial infarction may produce difficulties. Nowadays myocardial infarction (B 26) is more frequently diagnosed, in contrast to a previous tendency to record a diagnosis of apoplexy (B 22).

In 1950 the rates for B 26 were already several times higher than for B 22, and now the difference is still greater, at any rate for men. The rates for B 22 in men and women both are moving in a downward direction, and those for B 26 are *in*creasing in men and *de*creasing in women. From this dissociation it may be deduced that the "fashionable diagnosis" factor is not of great importance in differential diagnosis between B 22 and B 26.

Fig. 17 MORTALITY FROM HYPERTENSIVE DISEASE



4.2.1.3 *Other cardiovascular diseases*

This remainder group of CVD (400-416, 430-434 & 450-468) comprises rheumatic heart disease, acute infectious diseases of heart and acute or chronic diseases of arteries. It is possible that under 450 (general arteriosclerosis) cases may occur which properly belong to B 26 (or B 22), but the effect of this substitution is negligible.

The remainder group does *not* comprise number 782 (symptoms referable to CVD and lymphatic system). Quantitatively this number is of very little importance. Acute heart failure (782.4) and syncope or collapse (782.5) contribute most to it. [1]

B 45 of the abbreviated list comprises the numbers 780-795 of the detailed list, thus including number 782. For both sexes the vague group B 45 (senility without mention of psychosis, ill-defined and unknown causes) decreases, number 782 increasing. These shifts are so small in comparison with the rates of all CVD that they do not even partially provide an explanation of the increase of B 26 for men and the decrease of B 22 for men and women.

The existence of group B 45 does not interfere with the analysis of CVD, but from a general medical and epidemiological point of view it would be desirable that the vague group B 45, comprising 4% of all causes of death for men of 35-74 years and 2% for women, should gradually disappear. Both for B 45 and 782 the rates for men are much higher than for women, thus indicating that for men cases of CVD occur under both numbers.

[1] The figures for deaths from 782 during the years 1951 and 1952 are extremely low (change in nomenclature?).

4.2.2 Neoplasms

In this paragraph the neoplasms comprise the numbers 140-205 of the international classification, i.e. the malignant neoplasms only. The column "neoplasms" of tables 2-5 incl. inevitably applies not only to malignant neoplasms, but includes also numbers 210-239 (benign neoplasms and neoplasms of unspecified nature); however, these represent only 3% of the total of neoplasms. Only the malignant tumours have been included in the further analysis.

Table 7 and fig.18 show the trend of mortality rates of (malignant) neoplasms, by sex and age since 1950.

For men of 50-54 years an increase from 205 to 235 appears, at 60-64 years from 505-610 and at 70-74 years from 1120 to 1170 per 100,000.

The proportional increase and decrease by sex and age have been mentioned in paragraphs 4.1.1 and 4.1.2 (fig. 7.3).

Neoplasms are expected to contribute to the increase of mortality in men, because tumours form an important part of total mortality: 25-30% at the age at which the increase of mortality in men takes place (40-75 years).

In women neoplasms form a still more important part of total mortality (45-55% from 35 to 60 years and an average of 30% from 60 to 75 years) as compared with men. The mortality rates of neoplasms remain equal below 50 years and fall by 5-15% above that age. The rates amount to 200 at 50-54 years, 400 at 60-64 years and 800 at 70-74 years.

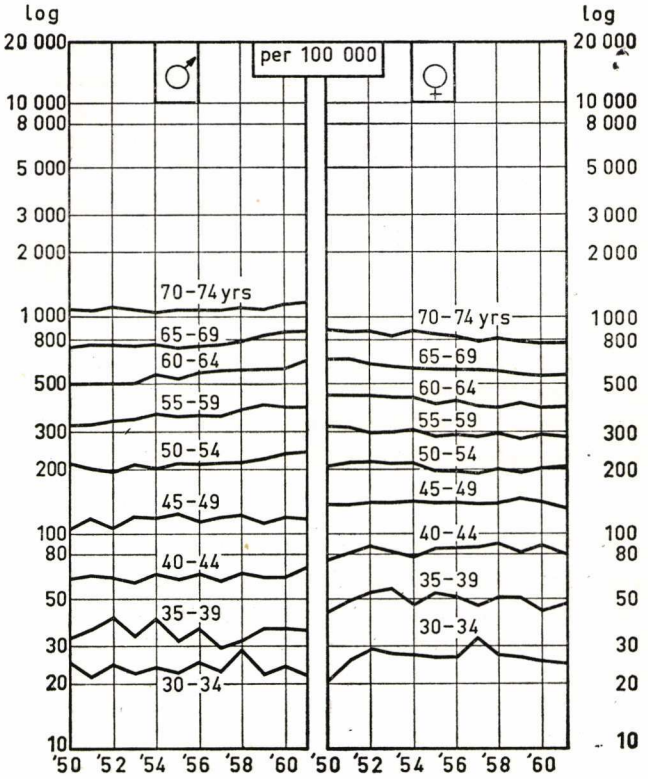
Over 50-55 years the rates for men rise and those for women fall, with the result that the sex divergencies become more marked: from 5-25% in 1950/1952 (rising with age) to 30-60% in 1959/1961.

Fig. 3.2 mentioned in paragraph 3, shows the present sex differences by age in mortality from neoplasms. Under 30 years the rates for men are higher, from 30-50 years for women and over 50 again for men. These sex divergencies result from differences in rates by site.

Fig. 18

MORTALITY FROM ALL MALIGNANT NEOPLASMS

140 - 205



4.2.2.1 *All sites*

The percentage distribution by site is depicted in fig. 19. For *men* of 35-44 years the neoplasms of digestive and respiratory system make up together 40-60% of mortality from all tumours; over 50 years the figure is 75%. From 45 to 64 the tumours of bronchus and lung dominate (40%) followed by the digestive system (30%) and the genito-urinary system with less than 10%.

From 65 years onwards mortality in men from neoplasms of digestive system becomes relatively prominent (40-45%), followed by respiratory system 30% and genito-urinary system 15%.

For *women* the proportions are entirely different because then neoplasms of bronchus and lung form only one thirtieth part of mortality from all neoplasms.

The shares in mortality of neoplasms of digestive and genito-urinary system in women at 45-64 years and 65-74 years are mirror-images: 50% genito-urinary system at 45-64 years and over 30% at 65-74 years; 30% digestive system at 45-64 years and 50% at 65-74 years.

Leukaemia and bone tumours play only a small part in mortality from neoplasms at higher age, and neoplasms of central nervous system an insignificant part.

In *women* lung tumours are of minor importance. Over 45 years tumours of digestive system and genito-urinary system together form 80% of mortality from tumours. The rates for neoplasms of digestive system fall for all age groups and remain almost equal for breast and genito-urinary organs (fig. 20.1 and 20.2).

In *men* over 45 years neoplasms of respiratory, digestive and genito-urinary system together form almost 90% of the mortality from all neoplasms. For these three main groups the rates for digestive system fall (fig. 19) — especially stomach and oesophagus tumours — and those for genito-urinary system rise slightly (fig. 20.2), owing to a rise for neoplasms of kidney and bladder. On the other hand, above 45 years a sharp rise of the rates of (malignant) neoplasms of bronchus and lung is manifested. For that reason lung cancer — as notorious amongst neoplasms as B 26 under CVD — should be dealt with separately.

Fig. 19

MORTALITY FROM NEOPLASMS BY SUB-GROUPS

percentage distribution

1959/1961

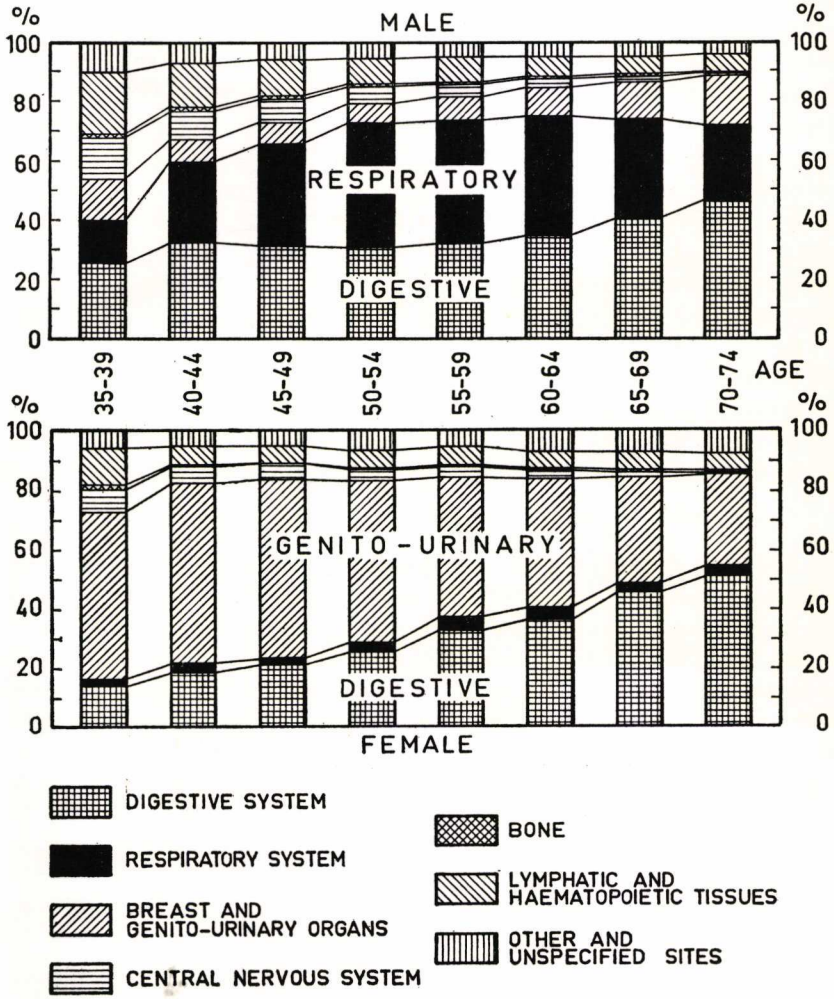


Fig. 20

MORTALITY FROM MALIGNANT NEOPLASMS

20.1 DIGESTIVE ORGANS

150 - 159

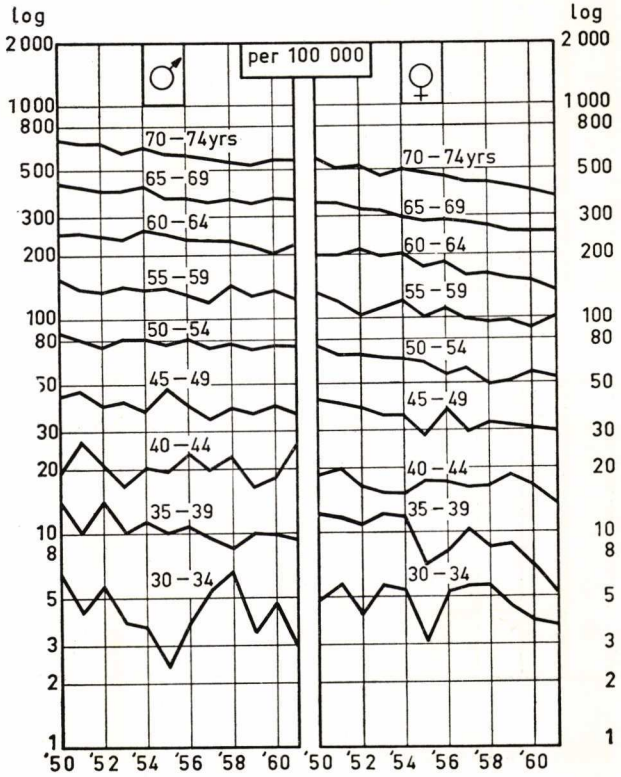


Fig. 20

MORTALITY FROM MALIGNANT NEOPLASMS

20.2 BREAST AND GENITO-URINARY ORGANS

170 - 181

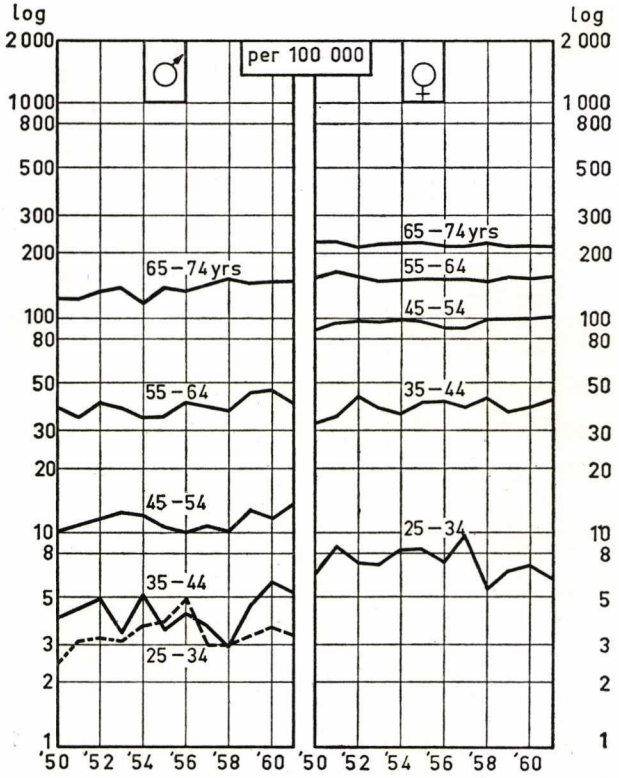
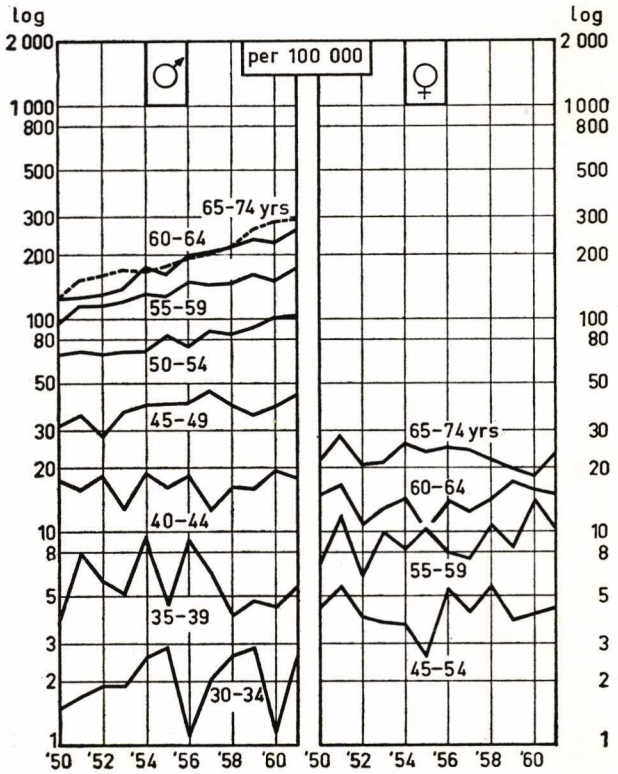


Fig. 20

MORTALITY FROM MALIGNANT NEOPLASMS

20.3 BRONCHUS AND LUNG

162 - 165



4.2.2.2 *Bronchus and lung*

Neoplasms of respiratory system form an average of 15% of all malignant tumours from 35-39 years; of 30% at 40-49, 40% at 50-65 years and of 20% at 75 years (fig. 19).

Amongst mortality from neoplasms of respiratory system in men the bronchus- and lung tumours occupy such a predominant part (95%) that discussion may be limited to this group.

From fig. 20.3 it appears that in the course of about ten years mortality from lung cancer in men of 45-54 years has risen by 50% and has more than *doubled* over 55 years of age: a shocking situation. The rates in women remain low. In men of 45-49 years mortality is now about 40, from 55-59 years 170 and from 65-69 years 300 per 100,000. Nowadays more than 3000 men and 300 women die annually of lung cancer, as against 400 and 100 respectively a quarter of a century ago. These great differences have also been influenced by diagnosis and age-structure, but it may be said with certainty that the incidence of lung cancer in men has multiplied (5 to 10 times) in the course of a generation, and keeps on increasing.

4.2.3 Diseases of respiratory system

Mortality from diseases of respiratory system has been subjected to an analysis similar to that of mortality from CVD and neoplasms: according to sex, age and sub-groups.

Apart from the insignificant mortality from acute diseases of upper respiratory tract, the international classification of causes of death gives the following grouping of diseases of respiratory system:

influenza (480-483)
pneumonia (490-493)
bronchitis (500-502)
other diseases of respiratory system (510-527)
bronchiectasis (526) and emphysema (527.1) incl.

Mortality rates for all diseases of respiratory system are much lower than for CVD and neoplasms. From 40 to 70 years they amount in men to less than one tenth of mortality from CVD and neoplasms together and in women to barely one twentieth (table 2 and 3).

The low rates of and the epidemic influences on respiratory diseases explain the irregular trend. Mortality from diseases of respiratory system has decreased somewhat in men under 50 and over 70, has increased in men from 55 up to 65-69 and has decreased in women of all age groups. Up to 70 years the rates in men for all acute and chronic respiratory diseases together are considerably lower (about half) than for lung cancer alone.

In both men and women the level of mortality from diseases of respiratory system rises with age. The rates per age group are higher for men than for women. Both characteristics apply to all diseases of respiratory system and to the sub-groups.

Mortality from influenza is subject to epidemic rises. For this reason no graph is given. Under 75 years death from influenza in men is hardly commoner than in women, and it represents for men one tenth, for women a somewhat higher fraction of mortality from all diseases of the respiratory system.

Deaths from complications are entered under influenza; i.e. influenzal pneumonia. All other forms of pneumonia come under numbers 490-493 (fig. 21).

In 1950-1960 mortality from pneumonia up to 75 years has been roughly halved for men, and reduced to one third for women. The rates for men and women having been almost equal ten years ago, the smaller decrease of mortality from pneumonia in men than in women has resulted in the rates for men now being higher than for women.

Under 50 years mortality from pneumonia is insignificant. Up to 75 years mortality in men is lower than $1^0/_{00}$ and in women lower than $\frac{1}{2}^0/_{00}$. In men of 55-65 years mortality from lung cancer is 20 times as high as that from pneumonia.

Fig. 21

MORTALITY FROM PNEUMONIA

490 - 493

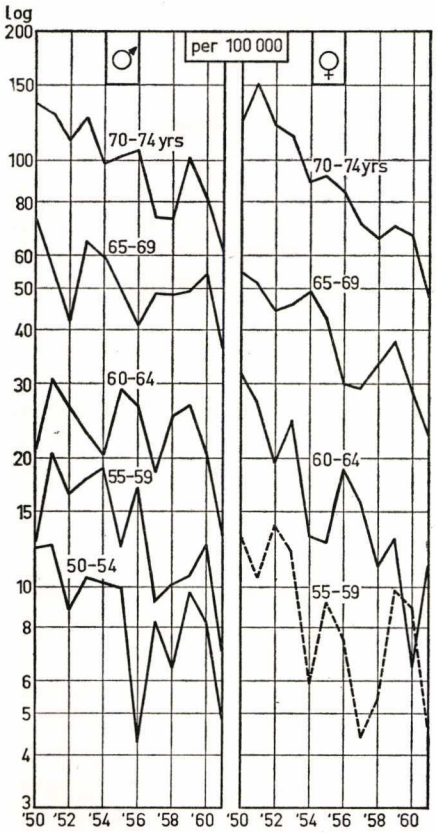
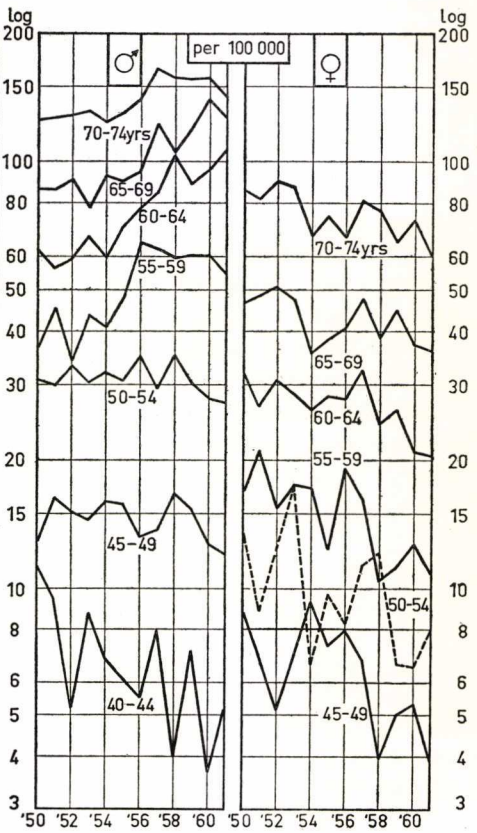


Fig. 22

MORTALITY FROM CHRONIC ASPECIFIC RESPIRATORY DISEASES

241, 502, 526, 527.1



Changes have been introduced in the registration of the sub-groups bronchitis and other diseases of respiratory system (bronchiectasis and emphysema incl.) between 1950 and 1960, including a shift of asthmatic bronchitis — formerly coded as asthma (241) — towards chronic bronchitis (502) as a result of revision of classification. The sub-groups 502 (chronic bronchitis), 526 (bronchiectasis) and 527, especially 527.1 (emphysema) cannot be dealt with separately, but — at the suggestion of the Central Bureau of Statistics — they have been taken together with 241 (asthma) into the combination: chronic aspecific respiratory diseases (number 241, 502, 526 and 527.1). Combining these sub-groups has the disadvantage that the epidemiological picture is blurred, against the advantage that fashions in diagnosis and revision of subgroups have little influence on the combined rates.

For the chronic aspecific respiratory diseases the rates by sex and age are given in fig. 22. As far as any epidemiological value may be attached to this collective group fig. 22 shows that mortality in women is considerably lower than in men, and that for men it does not amount to 1 per 1000 until over 65 years. The rates for women are moving in a downward direction for all ages, but in men a rise is seen over 55 years; this is evident but not alarming in view of its low level.

The increase of mortality from chronic aspecific respiratory diseases in men (fig. 22) is suggestive of the rise of mortality from neoplasms of bronchus and lung (fig. 20.3) and to a certain extent from B 26 (fig. 13) although with distinct differences for age and level.

To this triad attention will be paid in the discussion.

5 COMPARISON WITH OTHER COUNTRIES

5.1 Total mortality

The rise (or stagnation of decrease) of mortality in men of 30-40 up to 70 years, while mortality in women continues to fall, is a feature that made its appearance in various countries about 1950 or before.

From a socio-medical and demographical point of view the situation in the Netherlands can best be compared with that in the Scandinavian countries, and also as far as the registration is concerned. The U.K. and U.S.A. have been chosen for side-by-side comparison because mortality rates are higher than in the Netherlands, while within these countries themselves a comparison between two population groups is feasible, either topographically (England & Wales and Scotland) or socially (white and non-white).

For *men* mortality in U.S.A. is highest, followed by the rates for U.K. (table 8). The Scandinavian countries have almost the same age-specific mortality as the Netherlands.

For *women* the U.S.A. rates for non-white are by far the highest, followed by Scotland. From 55 years onwards mortality according to age in U.S.A. (white) and U.K. are approximately equal. Denmark almost corresponds to England & Wales, the rates for Norway, Sweden and the Netherlands being somewhat lower.

In the U.S.A. (white) total mortality in men has not increased, but the decrease of mortality has been stagnant since about 1954 (when in the Netherlands mortality started increasing). For white and non-white men together there is a tendency towards increase above 50 years of age.

In the U.K. the stagnation of decrease in mortality in men set in about 1952. As a presage, mortality in men over 60 had been running horizontally since about 1942.

In women, in both U.S.A. and U.K., the decrease of total mortality continues undiminished.

In Sweden no increase for men has occurred, but in about 1953 the decrease for men over 60 years came to a standstill. It seems that for men of 45-60 years the standstill appeared in about 1957. In Denmark the trend from 50 years onwards has been horizontal since about 1951. For 30-50 years the stop appeared about 1957. The curves for Sweden and Denmark show great similarity.

A striking agreement exists between total mortality in Norway and the Netherlands. The rates for both countries have increased since 1952 for men over 55 years, and run horizontally under 50 years.

For women the decrease in mortality has continued in the three Scandinavian countries, although it seems that since about 1958 a flattening has set in.

Analysis of mortality by sex, age and cause of death shows that the same groups of causes of death: CVD, neoplasms and respiratory diseases, which are involved in the increase of mortality in men in the Netherlands, determine to a large extent the differences in mortality between various countries.

In the comparison with other countries the neoplasms and respiratory diseases have not been included, since the increase of mortality from neoplasms in the Netherlands is practically limited to cancer of lung and bronchus, the aetiology of which is known according to epidemiological standards.

For the purposes of this study the increase of mortality from respiratory diseases is not an important subject. A comparison with other countries would require a detailed analysis falling outside the scope of this investigation.

5.2 Cardiovascular diseases

In this publication emphasis falls on CVD since the increase in men is of great importance and the aetiology is unknown. By comparing the situation in one country with that in other countries a better understanding of the epidemiology may be gradually achieved.

The increase for *men* has been apparent in various countries during the last quarter of a century. In the U.S.A. mortality rates above 40 years of age have been rising since 1930. In the U.K. the rise set in during or before world war II. In the U.S.A. the rise changed into a horizontal trend about 1950, in the U.K. the rise is continuing from 35-40 years onwards.

In Sweden the trend over 45 years has been horizontal between 1950 and 1960, the rates for Denmark and Norway over 40 years showing a similar increase to that in the Netherlands.

The horizontal trend in one country and the increase in the other have the effect that the rates approach each other, although there are distinct differences (table 9.1): the U.S.A. rates (non-white) are the highest, followed by the U.K. (Scotland), then come the Scandinavian countries and the Netherlands as lowest.

For *women* the sequence is the same as for men. In all countries the rates for both men and women rise with age.

As in the Netherlands, the rates for men under 65 years in other countries are twice as high as those for women. If the data for the U.S.A. are divided into white and non-white groups this proportion changes. The extreme rates for non-whites are only 10-20% higher in men than in women; for whites under 55 years three times and from 55-64 years $2\frac{1}{2}$ times as high. Over 65 years in the U.S.A. and the U.K. the rates in men are $1\frac{1}{2}$ times as high as in women, in the Scandinavian countries and the Netherlands $1\frac{1}{3}$ times as high. In all countries the sex difference decreases relatively with age.

From 55-64 years in men the extreme rates per *country* are 1300 per 100,000 (U.S.A.) and 600 (Netherlands), and in women 600 and 300 respectively. From 35-64 years the rates in American men are three times as high as for men of the same age in the Netherlands, and above 65 years they are twice as high.

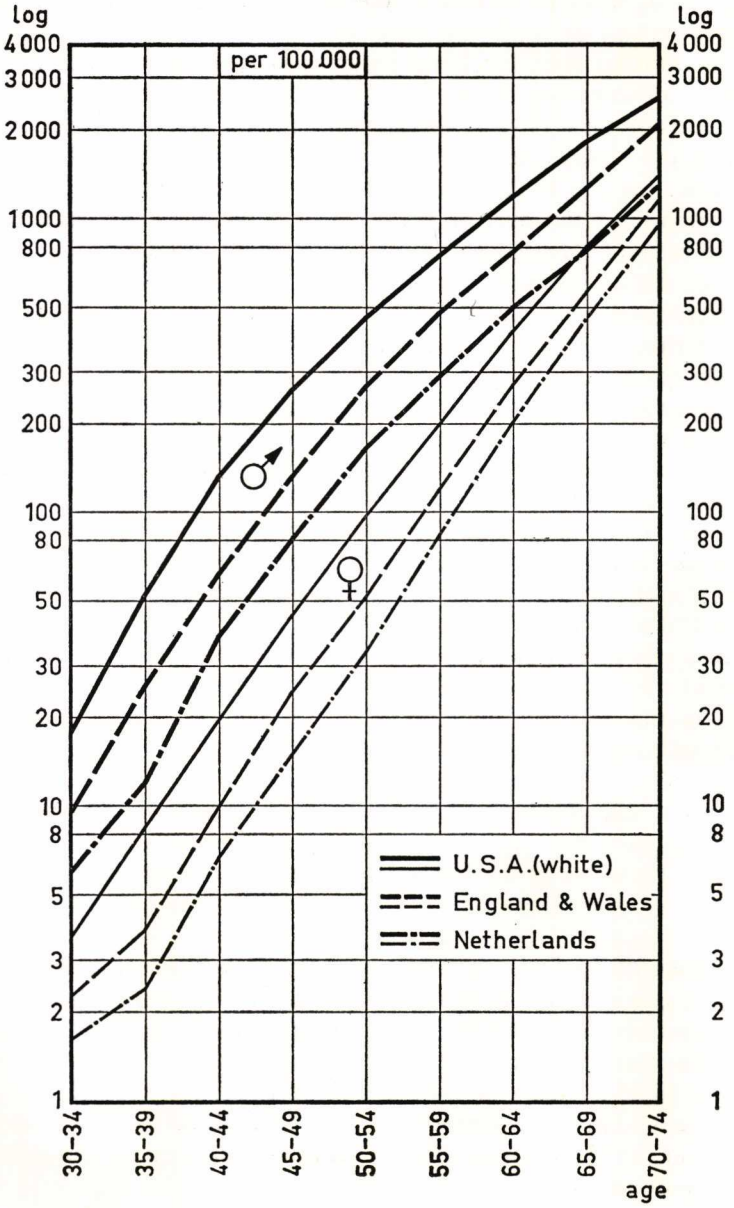
The difference in total mortality between the extremes: U.S.A. and the Netherlands, in men and in women, originates almost entirely from the difference in mortality from CVD, while the difference in total mortality from other countries is largely due to this cause.

In men of 55-64 years in U.S.A. CVD account for over 55% of deaths from all causes, in U.K. over 45%, in the three Scandinavian countries 45-50% and in the Netherlands almost 40%. For women these percentages are 50, 45, 35-40 and 35% respectively (table 9.2).

Fig. 23 MORTALITY FROM ARTERIOSCLEROTIC AND DEGENERATIVE HEART DISEASE IN SOME COUNTRIES

420 - 422 = **B 26**

1956/1958



These relative percentages are determined not only by the level of mortality from CVD, but equally by (the trend of) the rates of other causes of death.

As far as total mortality is concerned, the comparison of mortality rates by sex and age of the countries reviewed is not influenced by differences in diagnosis or in frequency of post mortems, and for large groups such as CVD, these factors also have hardly any influence. The kind of diagnosis does affect a sub-group such as IHD (B 26), but not to such an extent as to result in great differences in rates.

5.2.1 Ischaemic heart disease

The sharp rise in IHD in men in the Netherlands, as against a slight fall in women, makes it necessary to compare the rates for arteriosclerotic and degenerative heart disease (B 26) in different countries (table 10.1).

Between 1950 and 1960 the rates for IHD in the European countries reviewed rose in men from 40 years onwards, and in the Netherlands even from a younger age. In U.S.A. the rates up to 65 years for white and non-white run horizontally between 1950 and 1960, while a rise is seen above 65 years, particularly in non-white men.

The present rates for B 26 show, as is the case for all CVD, great differences between men and women, and within each sex between different countries. For both men and women the U.S.A. has the highest mortality rates from IHD, closely followed by Scotland; then come England & Wales, the Scandinavian countries and — lowest — the Netherlands.

In fig. 23 the mortality rates from IHD for U.S.A., England & Wales, and the Netherlands are compared according to sex and age (five-year groups). The period 1956/1958 is not exactly the same as in table 10.1 (1958/1960), because for 1960 the data from U.S.A. by ethnic group (per five-year group) are not yet available. The rates of table 10.1 and fig. 23 are practically in agreement.

The curves show clearly the differences in level between mortalities from IHD according to sex and age in the three countries.

In fig. 23 the semi-logarithmic curves by country (per sex) run parallel. For men the difference in age between the U.S.A. and England & Wales and between England and the Netherlands amounts to five years. If the U.S.A. curve is shifted five years to the right and the Netherlands curve five years to the left the three curves become practically congruent. For women the difference in age between the three countries, both to the left and to the right, amounts to 2 to 4 years.

The present differences between the male rates from all CVD in U.S.A. (white), England & Wales and the Netherlands originate mainly from the differences between the rates from IHD.

In the Netherlands a man between 55 and 65 years has a risk of 4% of dying from IHD, against 4½% in the Scandinavian countries, 6% in England & Wales, 8½% in Scotland and over 9% in U.S.A. For *women* of the same age the risks of dying from IHD are 1½% for the Netherlands and Scandinavia, 2⁻% for England & Wales and 3⁺% for Scotland and U.S.A. (3⁻% for white and 5½% for non-white women).

Between 55 and 65 years, in Western Europe the risk of dying from IHD is 1 man in 20, and in the U.S.A. 1 in 10, as against 1 woman in 60 and 1 in 30, respectively.

Table 10.2 gives mortality from IHD as percentage of mortality from all CVD. IHD in men in Western Europe (almost irrespective of age and country) accounts for 60-70% of mortality from all CVD, and in the U.S.A. for 70%, as compared with 20-50% and 30-55% respectively in women, the percentage rising with age.

In Western Europe IHD in men between 45 and 75 years forms 30% of total mortality and in the U.S.A. 40%, in women 10-20% and 25% respectively.

5.2.2 Hypertensive and cerebrovascular diseases

Table 11.1 gives the same picture of hypertensive and cerebrovascular diseases (in short hypertensive disease) as table 10.1 of IHD. In the countries reviewed the rates for hypertensive disease in men of all ages are much lower than those for IHD. This difference applies to an extreme degree to white men in U.S.A. but not or barely to non-white men. A non-white man in the U.S.A. has almost equal risks of dying from either hypertensive disease or IHD.

In men of 55-64 years in the U.S.A. mortality from hypertensive disease in non-whites is 760 (!), in whites 220; in the U.K. 250 (Scotland higher), in the Scandinavian countries 130-160 and in the Netherlands 120 per 100,000. The averages for U.S.A. and U.K. are twice as high as for the Netherlands and Denmark, and for non-whites six times as high.

In women, mortality from hypertensive disease by country and age is about as high as in men, the rates from IHD lying far below those for men. In the U.K., Denmark, Sweden, Norway and the Netherlands mortality from hypertensive disease in women is, on an average, somewhat lower than from IHD.

IHD and hypertensive disease in white and non-white women in U.S.A. are mirror-images: in white women (U.S.A.) the rates for IHD are much higher than those for hypertensive disease, and in non-white women the picture is reversed. In non-white women (U.S.A.) the rates for IHD are still much higher than in white women and in women in European countries.

In non-white men (U.S.A.) hypertensive disease comprises over 40% of all CVD, in non-white women 50-60% (table 11.2).

In men of 55-64 years in the countries reviewed, hypertensive disease constitutes 20-25% of mortality from all CVD, and in women 35-45%. Only in non-whites (U.S.A.) are these percentages much higher: men 40-45 and women 55%.

In non-whites, both men and women, mortality from hypertensive disease is extremely high as compared with that in whites in the U.S.A. and with that in European countries. The same holds good for mortality from IHD in non-white women.

As these high values occur together and go hand in hand with high rates of total mortality and of all CVD, a major influence of incomplete diagnosis can practically be excluded.

In Japan mortality from hypertensive and cerebrovascular diseases is higher than in men and women in Europe, but the rates are lower than in non-whites in U.S.A.

5.2.3 Other cardiovascular diseases

In this third sub-group the numbers 022, 023, 400-402, 410-416, 430-434, 450-456, 460-468, 754 and 782, not previously mentioned, have been placed.

Contrary to this paragraph on other CVD in various countries, paragraph 4.2.1.3 on other CVD in the Netherlands applies also to number 592-594 (chronic nephritis) and does not apply to 022, 023, 754 and 782. The differences may be disregarded.

In table 12 the great similarity between Sweden, Norway and the Netherlands, for both men and women, is striking. The rates for Denmark are higher; this is probably a question of coding, as the rates for hypertensive disease are lower in Denmark. Non-white men and women (U.S.A.) have the highest rates both in mortality from other CVD and in mortality from hypertensive disease.

The sub-group other CVD is a collective group in which only general arteriosclerosis (450), acute heart failure (782.4) and syncope (782.5) may be of some importance for a study of the epidemiology of CVD within the scope of this publication.

In the countries mentioned the significance of number 450 is small and that of number 782 may be disregarded, so that the sub-group *other* CVD will be omitted from the discussion.

6 DISCUSSION

In industrialized countries mortality rates have been moving downward for the last 50-100 years, temporarily interrupted by wars and epidemics, which — however disastrous and however profound their effects during the years concerned — have not strongly influenced the general trend.

A stagnation of the decrease in mortality in the older age groups of men was already manifest in some countries in 1930; in other countries this retardation has appeared only during the last decade, and not infrequently the decrease has been replaced by an increase.

Our analysis is concerned with this revolution in the history of mortality as far as the Netherlands are concerned. The reversal from fall to rise in men is only too evident; in women the decrease still continues. Mortality rates for older males and females are diverging more and more. The expectation of life for women at all ages keeps rising, but for men over 40 it is falling.

This increasing sex divergency in mortality is of great importance from the medical, social and demographic points of view.

6.1 Total mortality

An analysis of the increase of mortality in men and the continuing decrease in women should be based on a differentiation by age and cause of death. In demography it is too often overlooked that mortality patterns are not determined only by figures, medical problems forming the underlying conditions. Pattern and evolution of mortality in men and women differ greatly.

The dissociation of the trends of mortality in men and in women is not a recent occurrence; it started in the thirties as a result of a decreased fall in mortality in men. During the fifties the divergency in mortality rates in men and in women grew, owing to the uninterrupted fall in mortality in women and the beginning rise in men.

The scope of the problem cannot be sufficiently evaluated from the increase of total mortality in men, either by age or in its totality.

Splitting up of total mortality by cause of death is indispensable. The increase of mortality from CVD starts in men under 40 years, whereas total mortality continues to fall until the age of 50. Between 40 and 50 years the mortality from neoplasms starts rising.

Between 50 and 70 — the age group showing an upward trend of total mortality in men — 1000 more men died around 1960 than should have died in

accordance with the rates that applied to 1950. This figure — an increase of ½-1% in total mortality per year — is inexact, the *in*crease for some causes of death having been compensated to an important extent by the *de*crease for others (e.g. tuberculosis). Little or no further compensating influence is to be expected therefrom in the near future. For the time being the rise of mortality in men will continue.

In one decade the annual "gain" of lives in women between the ages of 35 and 75 has become 4000, with more than half (2400) between 50 and 70 years. Almost all causes of death, accidents excepted, have contributed to this progress, which made total mortality in women of 35-70 years decrease by 2% per year.

The increase of mortality in men may be divided into three components:
1- increase of CVD
2- increase of lung cancer
3- increase of chronic respiratory diseases.

From the epidemiological point of view it is tempting to think of *one* common cause, or complex of causes, for the three components.

The increased smoking of cigarettes (combined with air pollution) has lead to the increase of lung cancer. Has cigarette-smoking also caused, or at least promoted the increase in IHD and chronic respiratory diseases?

Our investigation cannot provide an adequate reply to this question. It may be safely assumed, however, that smoking, in combination with air pollution is, either primarily or secondarily, a not unimportant contributory cause of the increase of mortality from chronic respiratory diseases and from CVD.

The main cause of the increase of mortality in men lies in the rise in mortality from CVD and lung cancer.

Fig. 13 and fig. 20.3 reflect a development in the mortality pattern which is changing the general aspect of society in industrialized countries more and faster than is being realised.

This study is concerned primarily with CVD.

6.2 Ischaemic heart disease

For men aged 40-70 years CVD comprise 30-50% of total mortality (changing with age) and IHD two thirds of all CVD. For women these proportions are 20-50% and 20-40% respectively. Over 50 years of age, IHD accounts for one quarter of total mortality in men and one fifth in women.

IHD is the most important sub-group and is almost entirely responsible for the increase of mortality from all CVD. From 30 to 70 years the IHD rates in men rise from 5 to 1000 and in women from 1 to 600 per 100,000. Comparison of IHD as to period and place is only valid if age-specific or age-adjusted rates are used.

In the analysis of mortality from IHD in the Netherlands the following are the most conspicuous factors:

1 - extreme sex divergencies
2 - recent increase for men
3 - similarity to Scandinavian countries and difference from the U.K. and the U.S.A.

Hypotheses on the aetiology of IHD must account for such facts. In the literature much importance is credited to environmental factors — such as nutrition, hardness of water, physical activity and last but not least mental stress — in the development of IHD, to subsidiary factors such as smoking and alcohol, and to obesity.

As to the *nutrition* of husband and wife there is no difference in quality but at the most a difference in quantity. For this reason alone it is unlikely that nutrition (and water) can be a dominant factor in the origin of IHD.

Mutatis mutandis the same applies to *physical activity*. Men doing strenuous manual labour or sporting achievements perform heavier work than women, but the amount of effort connected with household duties should not be underestimated.

References in the literature pointing to differences according to occupation and social class, to the effect that IHD is more prevalent among managers than among employees, are not very convincing, unbiased analyses rather indicating the contrary.

The factor *mental stress*, to which great value is at present attached, is difficult to quantify. It is known that men have more difficulty in working off their mental stress than have women. It is also known that one man's reactions to mental stress are different from another's.

Heavy mental stress is often blamed for the recent increase of IHD in men. Is a modern man being more or less exposed to stress than his father, who had to cope with disease and death in his family, not to speak of unemployment and undernourishment? But he is exposed to *another* type of stress. Moreover, "modern" stress is a less recent phenomenon than is often suggested.

The marked sex differences lead to the inference that *biological factors* play an important part in the pathogenesis of IHD; either by promoting the development of IHD in men during a series of years, or by retarding the development of IHD in women, or both.

This hypothesis is corroborated by the trend of mortality rates by age in women and by the appearance of IHD in women after ovariectomy. As women grow older the difference in mortality rates from IHD, as compared with men, diminishes. At 70-74 the difference is insignificant.

This decrease in difference with age seems to be connected with the climacterium, although the latter is not sharply delimited (45-50 years), while IHD appears during a series of years.

Sharper indications of endocrine influences than the trend of mortality are given by the literature on the connection between ovariectomy and the pathogenesis of IHD. It has been known for ten years or longer that (with very few exceptions) in women bilaterally oophorectomized before the menopause the risk of IHD — 5 to 10 years, or longer after the operation — is considerably higher than in women with intact ovaries. From this observation the conclusion is drawn that endocrine factors play an aetiological part in coronary heart disease. Animal experiments point in the same direction.

The function of thyroid hormone makes it probable that hormonal and dietary influences are interrelated in the pathogenesis of IHD.

The fact that female diabetics have almost the same incidence of IHD as males, indicates that metabolic influences can neutralize the "protective" function of the female endocrine system.

Giving prominence to endocrine factors in the progress of IHD does not mean that the influence of external factors is denied, but merely that external factors are modified or overshadowed by hormonal influences.

In the British Medical Journal it was recently recommended "that oestrogen replacement therapy should be given to all pre-menopausal women who have had both ovaries removed."

This implies hormonal treatment as a preventive measure against IHD. Oestrogen therapy in men with a history of myocardial infarction may reduce mortality rates. Oestrogens might be useful not only in the treatment but also in the prevention of coronary heart disease in men. It will be difficult and for many reasons objectionable to use the administration of oestrogens as a preventive against IHD, but hormonal prophylaxis cannot be rejected out of hand. Desperate diseases require desperate remedies.

The hormonal hypothesis on the evolution of IHD may account for the sex divergencies during a certain period (cross-section), but it does not seem to explain the fact that during the course of time mortality from IHD is in-

creasing in men and decreasing in women (longitudinal trend). The small decrease for women above 50 years may be explained by the gradual moving up of the menopause thus causing a prolongation of the protection by female hormones, which may slow down the development of IHD.

A comparable secular change is apparent in men. The secular shift in growth up to adulthood is generally known. The changes in metabolism are maintained during adulthood and cause present-day man to be biologically younger than his father was at the same age.

If this shift should bring its influence to bear on the production of hormones, it would be understandable that the prevalence of — and hence the mortality from — IHD in men is still increasing.

If *morbidity* from CVD amounts to 30-50 times the mortality — as a prevalence study in Odense suggests — then in the Netherlands morbidity in men at the ages of 35-39, 50-54 and 60-64 must be about 1%, 10% and 20% respectively. Roughly half of these are (potential) myocardial infarction patients. Men of fifty have a chance of one in ten (increasing with age to one in five) of getting a more or less damaged heart before attaining the age of seventy.

6.3 Lung cancer

The increase of mortality from neoplasms is due practically only to lung cancer. Other sub-groups show little rise or fall.

Mortality from lung cancer is increasing alarmingly: multiplied several times during a generation and doubled in ten years. In the Netherlands more than 3000 men die from lung cancer per year nowadays, two thirds of them aged 50-70. Above 60-64 years the rates no longer increase with age, but they do increase in time: in 1950 about 130 and in 1960 about 270 per 100,000.

The age-specific rates are considerably lower than for IHD and the increase starts at a later age (45-49), but above 55 years of age the slope is steeper than for IHD.

During the coming decade the increase will be at least as great as during the past ten years, which means that in about 1970 the Dutchman of 50 years will have a chance of 1 in 20 of dying of lung cancer before reaching the age of 65: the same risk as now exists for IHD.

The sharp increase of lung cancer in men and the low level for women indicate that — by analogy with the situation in other countries — in the Netherlands also the greatly increased consumption of cigarettes has caused the increase of lung cancer in men to a predominant degree, possibly in combination with air pollution.

For women the mortality rates are not yet rising, but the increase of cigarette-smoking among women will in the near future be paid for by an increase of mortality from lung cancer.

The cases at present occurring in women — climbing from 5 to 25 per 100,000 with age between 45 and 75 — have practically not been caused by smoking. If lung cancer in women is caused by various factors other than smoking — as in non-smoking men — then the shockingly high rates for men, climbing from 40 to 300 with age between 45 and 75 years, are practically only caused by chronic smoking. This death toll would be decimated if men could only bring themselves to stop smoking cigarettes, without replacing this bad habit by another.

Propaganda for *non*-smoking ought to be organized as intensively as advertising for smoking now is, but non-verbal education — especially the example of the doctor — is more important.

6.4 International comparison

An analysis of mortality within one country is indispensable, but it needs as a background the situation in other countries. Comparative research is the basis of modern epidemiology.

The necessity for international comparison applies particularly to diseases of which the aetiology is unknown — e.g. CVD — and for which a rational prevention still remains to be found.

The increase of mortality from CVD in men started in the U.S.A. about 1930 and in the U.K. about 1940. The trend in these two countries presaged the trend now evident in European countries. The present high rates in U.S.A. and U.K. reflect the future picture for Scandinavia and the Netherlands. In these Western European countries middle-aged men will have reached present age-specific IHD rates of England & Wales in about 1975. For the time being we seem to be powerless against this increase.

In all countries the rates for men are much higher than those for women. For men in Western Europe and the U.S.A. ischaemic heart disease comprises two thirds of mortality from all CVD, as against a quarter to half in women, increasing with age in both sexes.

The high rates of mortality from IHD in non-white women (U.S.A.) — higher than for men in Europe, but lower than in non-white men — indicate that the rates for women *can* be high. If mental stress has a predominant influence on the origin of IHD — as held by many — then American men and women (particularly non-whites) and Scottish men and women are being exposed to extreme stress.

The striking similarity in mortality from IHD in Scandinavian countries and in the Netherlands applies to both sexes and all ages. In all these countries the sex differences diminish with age.

This similarity between countries with a comparable socio-economic and socio-hygienic structure supports the hormonal influence on the development of IHD, but the hypothesis seems to be contradicted by the difference in IHD prevalence between men and women of the same age in Anglo-Saxon and North-Western European countries. This difference leads to the conclusion that external factors are also of importance in the origin of IHD.

Geographical differences within the same country — clearly demonstrated in U.S.A. — also underline the significance of external factors.

The foreign-born groups contribute to the high rates in different American states, even when they originate from countries with relatively low death rates such as Scandinavia.

The differences in cardiovascular mortality between different regions, e.g. U.S.A. and Scandinavia, are less essential than would appear at first sight. When Scandinavians migrate to the U.S.A. their rates rise.

From the mortality rates in Western countries it may be deduced that in non-industrialized countries mortality from IHD will be only very low. Between 35 and 55 years of age, according to European standards, 1 in 1000 men dies of IHD per year.

In developing countries life expectation is about 50 years (as in the Netherlands in about 1900), with high mortality, also amongst adults. Under primitive hygienic conditions mortality from IHD shrinks into insignificance beside other causes of death. Coronary heart disease only becomes an epidemiological problem in countries where life expectation of men lies over 60 and a fortiori over 70.

From a public health point of view, medical problems of far wider scope require our attention in developing countries. From a scientific point of view, cases of IHD in technically under-developed countries are of great importance.

The results of this study show once more how an analysis of mortality data — longitudinally and transversally — according to sex, age and cause of death can provide information as to the epidemiology of certain diseases — in this case CVD. The complex nature of the aetiology of CVD is evident from this analysis, but it seems probable that the hormonal factor is of considerable importance in the occurrence of IHD.

We are at present practically powerless in the face of the alarming increase in IHD or the already existing alarming prevalence among middle-aged men in industrialized countries.

To achieve effective prevention it will be necessary to approach the problem of IHD without bias. An important part of such an approach is a uniform analysis of mortality in different countries, supplemented as far as possible by morbidity surveys. This international comparison — by sex and age — is indispensable as an epidemiological check on the theories advanced by clinical and laboratory workers.

The striking sex differences in every country, the differences in rates between countries and population groups and the longitudinal trend of these sex, international and group differences are the key problems in the epidemiology of cardiovascular diseases.

7 SUMMARY

Since about 1952 in the Netherlands for older *men* an increase in mortality is manifest. For *women* at all age groups mortality has kept on falling so far. The resultant increasing divergency of mortality in men and women — by age and cause of death — has formed the subject of this analysis, against the background of the situation in other countries.

7.1 Netherlands

7.1.1 Total mortality

Under 55 years the relative increase of total mortality in men is of no significance as yet, but between 55 and 65 total mortality has increased by more than 10%. In women the decrease for all ages and for all causes of death continued. The decrease between 1950 and 1960 amounts to about 20%.

Cardiovascular diseases, neoplasms and diseases of respiratory system contribute 45, 35 and 10% respectively to the total increase of mortality in men.

Total mortality in men is increasing above the 50th year, the rise of CVD starting at 35-39 years, that of neoplasms at 40-44 years and that of diseases of respiratory system at 55-59 years, the expectation of life for men lying at 70-75 years.

7.1.2 Cardiovascular diseases

The proportion of CVD to total mortality increases with age for men and women, reaching one half of total deaths at the age of 70.

For men from 40 to 70 years IHD accounts for two thirds of all deaths from all CVD, for women from 55 years almost half.

For men from 40 to 60 years the increase of mortality from CVD during a decade is 20 to 25% at ever-increasing rates.

The *de*crease of mortality from all CVD for women is due to a decrease for both IHD (B 26) and cerebrovascular diseases (B 22). For men the *in*crease of mortality from all CVD is due to the increase of B 26 being higher than the decrease of B 22. The present differences between the rates in men and women for all CVD are the same as the sex differences in B 26 (IHD).

With men the proportional rise of mortality from IHD decreases with age: between 35 and 45 years a doubling has taken place, between 55 and 65 years an increase of 40%. The rates under 40 years are low, but a relatively important rise starts as early as at or under 30 years.

Over 55 years mortality rates for women from IHD start catching up with those for men. The influence of the menopause cannot be read simply from the mortality figures, but this influence is very suggestive as a long-term effect.

For CVD and neoplasms the increase among men and the decrease among women are almost mirror-images.

7.1.3 Neoplasms

The proportion of neoplasms to total mortality is highest at the age of 50: one third for men and one half for women. Over 50-54 years the mortality rates of neoplasms for men rise and those for women fall, with the result that the sex divergencies become more marked.

In men between 50 and 70 years mortality from neoplasms has risen by 15-20%, mainly by an increase of lung cancer.

During the last decade mortality from lung cancer in men of 45-54 years has risen by 50% and has more than doubled over 55 years of age. The rates in women remain low.

In men of 55-64 years mortality from lung cancer is 20 times as high as that from pneumonia.

7.1.4 Diseases of respiratory system

The increase of mortality from diseases of respiratory system starts at an older age than those from CVD and neoplasms and is relatively greater, but much smaller in absolute numbers.

Under 50 years mortality from pneumonia is insignificant. Up to 75 years mortality in men is lower than $1^0/_{00}$ and in women lower than $\frac{1}{2}^0/_{00}$.

Mortality from chronic aspecific respiratory diseases in women is considerably lower than in men, and for men it does not amount to 1 per 1000 until over 65 years. The rates for women are moving in a downward direction for all ages, but in men a rise is seen over 55 years; this is evident but not alarming in view of its low level.

7.2 International comparison

7.2.1 Total mortality

The rise (or stagnation of decrease) of mortality in men of 30-40 up to 70 years, while mortality in women continues to fall, is a feature that made its appearance in various countries about 1950 or before. The situation in the Netherlands can best be compared with that in Scandinavian countries. For special reasons the U.K. and U.S.A. have also been chosen.

Analysis of mortality by sex, age and cause of death shows that the same groups of causes of death: CVD, neoplasms and respiratory diseases, which are involved in the increase of mortality in men in the Netherlands, determine to a large extent the differences in mortality between various countries.

In the comparison with other countries the neoplasms and respiratory diseases have not been included.

In this publication emphasis falls on CVD since the increase in men is of great importance and continues uninterruptedly, while the aetiology is unknown.

7.2.2 Cardiovascular diseases

7.2.2.1 *Ischaemic heart disease*

The present differences between the male rates from all CVD in U.S.A. (white), England & Wales and the Netherlands originate mainly from the differences between the rates from IHD.

IHD in men in Western Europe (almost irrespective of age and country) accounts for 60-70% of mortality from all CVD, and in the U.S.A. for 70%, as compared with 20-50% and 30-55% respectively in women, the rate rising with age. In Western Europe IHD in men between 45 and 75 years forms 30% of total mortality and in the U.S.A. 40%, in women 10-20% and 25% respectively.

The present rates for B 26 show, as is the case for all CVD, great differences between men and women, and within each sex between different countries. For both men and women U.S.A. has the highest mortality rates from IHD, closely followed by Scotland; then come England & Wales, the Scandinavian countries and — lowest — the Netherlands.

Between 55 and 65 years, in Western Europe the risk of dying from IHD, is 1 man in 20 and in the U.S.A. 1 in 10, as against 1 woman in 60 and 1 in 30, respectively. In non-white women (U.S.A.) the rates for IHD are still much higher than in white women and in women in European countries.

7.2.2.2 *Hypertensive and cerebrovascular diseases*

In men of 55-64 years in the countries reviewed, hypertensive diseases constitute 20-25% of mortality from all CVD, and in women 35-45%. Only in non-whites (U.S.A.) are these percentages much higher: men 40-45 and women 55%.

In men the average rates for U.S.A. and U.K. are twice as high as for the Netherlands and Denmark, and for non-whites in U.S.A. six times as high. In women, mortality from hypertensive diseases by country and age is about as high as in men.

In the U.K., the Scandinavian countries and the Netherlands mortality from hypertensive diseases in women is, on an average, somewhat lower than that from IHD.

IHD and hypertensive diseases in white and non-white women in U.S.A. are mirror-images: in white women (U.S.A.) the rates for IHD are much higher than those for hypertensive diseases, and in non-white women the picture is reversed.

Hypotheses on the aetiology of ischaemic heart disease and hypertensive disease must account for epidemiological facts.

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TABLES

Table 1

RISK OF DYING
by sex and age

Netherlands 1920—1961

age	1920—1930			age	1931—1939			1950—1961		
	a	b	c		a	b	c	a	b	c
MALES										
20—29	301	—11.5	—3.8	25—29	202	— 6.5	—3.2	106	— 2.9	—2.7
30—39	326	—10.3	—3.2	30—34	229	— 4.7	—2.1	121	— 3.0	—2.5
				35—39	280	— 3.1	—1.1	155	— 2.7	—1.7
40—49	528	—10.9	—2.1	40—44	366	— 4.6	—1.3	250	— 2.4	—1.0
				45—49	536	— 7.7	—1.4	408	— 3.5	—0.9
50—59	1,200	—21.5	—1.8	50—54	818	— 4.5	—0.6	705	— 0.0	—
				55—59	1,318	—10.8	—0.8	1,154	+11.5	+1.0
				60—64	2,116	—24.5	—1.2	1,810	+21.2	+1.2
				65—69				2,843	+13.2	+0.5
FEMALES										
20—29	295	—11.2	—3.8	25—29	199	— 9.1	—4.6	66	— 3.1	—4.7
30—39	392	—15.3	—3.9	30—34	244	—10.0	—4.1	91	— 4.6	—5.1
				35—39	308	—10.2	—3.3	132	— 4.8	—3.6
40—49	588	—12.0	—2.0	40—44	387	—11.3	—2.9	196	— 4.4	—2.2
				45—49	542	—12.1	—2.2	303	— 7.4	—2.4
50—59	1,140	—12.3	—1.1	50—54	830	—15.1	—1.8	470	—11.4	—2.4
				55—59	1,231	—17.1	—1.4	738	—17.9	—2.4
				60—64	2,004	—27.7	—1.4	1,230	—31.1	—2.5
				65—69				2,181	—54.8	—2.5

a = mean mortality rate (per 100,000) = mean probability of dying
b = mean annual *de*crease or *in*crease (coefficient of regression)
c = b in percent of a

Table 2

MORTALITY FROM SPECIFIED CAUSES OF DEATH
by sex and age

Netherlands — per 100 000 — 1950/1952 & 1959/1961

Population x 1000	age	total mortality		cardiovasc. diseases		neoplasms		respir. system		tuberculosis		digest. system		gen.-ur. system		accidents		ill-defined		other diseases		age
B		A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	
	MALES																					MALES
377	30-34	132	109	19	18	25	24	4	3	17	1	8	3	1	1	35	40	9	6	15	11	30-34
375	35-39	168	154	25	34	39	39	5	4	16	2	13	7	1	2	37	42	11	8	20	16	35-39
332	40-44	260	244	54	69	67	69	13	9	20	3	17	12	2	3	40	47	18	13	29	20	40-44
323	45-49	414	400	103	127	116	122	21	18	23	5	29	18	3	3	53	52	27	24	40	29	45-49
303	50-54	706	712	216	250	213	243	41	41	29	7	42	33	6	4	58	61	41	35	61	37	50-54
269	55-59	1080	1210	370	454	344	407	56	77	35	9	59	54	10	10	69	82	58	53	83	62	55-59
225	60-64	1710	1900	662	766	515	623	87	130	38	13	85	69	29	22	88	98	79	80	126	95	60-64
182	65-69	2810	2950	1240	1320	771	893	163	199	53	15	116	109	72	51	91	106	125	109	184	150	65-69
138	70-74	4620	4600	2200	2290	1140	1190	297	282	65	18	143	181	164	113	135	155	186	146	285	222	70-74
	FEMALES																					FEMALES
381	30-34	110	71	15	9	28	27	5	3	14	1	5	3	1	1	8	10	6	2	29	15	30-34
388	35-39	152	111	22	16	52	50	6	4	14	2	8	4	3	2	9	11	5	2	34	22	35-39
343	40-44	216	177	37	30	89	88	9	4	12	3	12	6	4	3	10	14	6	4	36	26	40-44
339	45-49	332	271	74	49	148	147	12	9	12	3	18	11	6	4	16	18	8	5	38	25	45-49
322	50-54	518	424	139	99	227	210	20	11	13	2	28	18	8	7	20	26	14	11	49	41	50-54
291	55-59	811	661	262	202	325	295	33	22	20	3	45	31	10	9	23	28	20	15	73	55	55-59
250	60-64	1360	1090	541	418	455	409	60	37	29	4	73	48	13	15	30	33	35	29	123	95	60-64
205	65-69	2410	1920	1120	893	659	567	124	80	45	7	115	85	25	25	42	58	65	40	211	161	65-69
155	70-74	4220	3540	2260	1910	919	796	280	165	52	11	160	144	30	41	63	87	111	92	344	295	70-74

A = 1950/1952 B = 1959/1961

rates above 1000 rounded off in tens

Table 3

CAUSES OF DEATH BY SEX AND AGE
percentage distribution

Netherlands 1959/1961

cause of death	MALES					FEMALES				
	30	40	50	60	70	30	40	50	60	70
cardiovasc.diseases	14	26	34	39	47	14	16	21	35	51
neoplasms	21	27	33	33	28	32	47	51	41	26
CVD + neoplasms	35	53	67	72	75	46	63	72	76	77
respir. system	2	3	5	7	6	5	3	3	3	5
tuberculosis	1	1	1	1	0	1	2	1	0	0
digest. system	3	5	5	4	4	5	3	4	5	4
gen.-ur. system	1	1	1	1	2	2	2	2	1	1
accidents	42	23	10	6	4	14	8	6	4	3
ill-defined	6	5	5	4	4	2	2	2	2	2
other diseases	10	9	6	5	5	25	17	10	9	8
all causes	100	100	100	100	100	100	100	100	100	100

Table 4

CHANGE IN MORTALITY RATES BY CAUSE OF DEATH
by sex and age

Netherlands — per 100 000 — 1950/1952 — 1959/1961

age	C V D		neo-plasms		respir. system		tubercu-losis		digest. system		gen.-ur. system		accidents		ill-defined		other diseases		sum of changes		remain-der		age
	+	—	+	—	+	—	+	—	+	—	+	—	+	—	+	—	+	—	+	—	+	—	
MALES																							MALES
30-34		1		1		1		16		4	0		5			2		4	6	29		23	30-34
35-39	9			0		1		14		6	1		4			3		4	13	28		15	35-39
40-44	15		1			4		18		5	1		7			5		8	24	40		16	40-44
45-49	25		6			3		18		11	0		0			3		10	31	45		14	45-49
50-54	34		30		—	—		22		8		1	4			6		24	68	61	7		50-54
55-59	84		62		21			26		5		0	14			5		20	181	56	125		55-59
60-64	103		108		43			24		17		7	10			0		31	265	79	186		60-64
65-69	80		121		36			38		7		21	15			16		33	252	115	137		65-69
70-74	84		51			15		47	38			51	20			40		62	193	215		22	70-74
FEMALES																							FEMALES
30-34		6		1		1		13		2		0	2			4		14	2	41		39	30-34
35-39		6		2		2		12		4		1	1			2		12	1	41		40	35-39
40-44		8		1		5		10		6		1	3			2		10	3	42		39	40-44
45-49		25		1		3		9		7		2	2			3		13	2	63		61	45-49
50-54		40		17		9		11		11		1	6			2		8	6	100		94	50-54
55-59		60		29		11		18		14		1	5			5		18	5	156		151	55-59
60-64		123		46		22		25		25	2		3			7		28	5	275		270	60-64
65-69		229		92		44		38		29	0		15			25		50	15	507		492	65-69
70-74		356		123		115		41		16	11		24			19		49	35	718		683	70-74

Table 5

PERCENT CHANGE IN MORTALITY BY CAUSE OF DEATH
by sex and age

Netherlands 1950/1952 — 1959/1961

age	C V D		neo-plasms		respir. system		tubercu-losis		digest. system		gen.-ur. system		accidents		ill-defined		other diseases		remain-der		age
	+	—	+	—	+	—	+	—	+	—	+	—	+	—	+	—	+	—	+	—	
MALES																					MALES
30-34		4		3		32		93		58	—		16			26		29		17	30-34
35-39	34			—		17		87		47	89		11			26		20		9	35-39
40-44	27		2			29		86		30	36		16			28		30		6	40-44
45-49	24		5			13		77		37	—		—			10		26		3	45-49
50-54	16		14		—	—		76		19		23	6			15		39	1		50-54
55-59	23		18		37			74		8		—	20			8		25	12		55-59
60-64	16		21		49			65		19		24	11			—		24	11		60-64
65-69	6		16		22			72		6		29	17			13		18	5		65-69
70-74	4		4			5		73	26			31	15			21		22		0	70-74
FEMALES																					FEMALES
30-34		41		2		29		93		41		40	32			70		48		29	30-34
35-39		28		4		35		85		47		31	13			57		35		27	35-39
40-44		20		2		54		80		49		18	30			33		28		18	40-44
45-49		33		1		23		77		38		33	12			40		34		18	45-49
50-54		29		7		45		87		38		17	28			17		17		18	50-54
55-59		23		9		33		87		30		6	20			27		24		19	55-59
60-64		23		10		37		85		34	16		11			19		23		20	60-64
65-69		20		14		35		84		26	—		37			39		24		20	65-69
70-74		16		13		41		79		10	36		38			17		14		16	70-74

Table 6

MORTALITY FROM CARDIOVASCULAR DISEASES BY SUB-GROUPS

by sex and age

Netherlands — per 100 000 — 1950/1952 & 1959/1961

sub-group	MALES									FEMALES								
	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69	70-74	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69	70-74
1950/1952																		
ischaemic heart disease	4	7	24	55	130	210	380	650	1160	1	3	7	16	38	86	210	480	1010
hypertensive diseases	8	9	15	29	60	120	210	460	800	6	10	18	39	75	140	260	520	990
other cardiovascular diseases	7	9	15	19	26	43	69	130	240	8	10	12	19	27	38	70	120	260
all cardiovasc.(-renal) dis.	19	25	54	100	220	370	660	1240	2200	15	22	37	74	140	260	540	1120	2260
1959/1961																		
ischaemic heart disease	6	16	45	87	180	310	520	810	1290	1	2	6	14	30	85	180	400	860
hypertensive diseases	7	10	12	23	41	86	170	360	710	4	7	13	21	46	80	160	350	770
other cardiovascular diseases	5	8	11	17	31	53	78	150	290	4	7	11	15	23	38	70	130	280
all cardiovasc.(-renal) dis.	18	34	69	130	250	450	770	1320	2290	9	16	30	49	99	200	420	890	1910

detailed list numbers:

ischaemic heart disease = 420-422
cerebrovascular and hypertensive diseases = 330-334, 440-447 & 592-594
other cardiovascular diseases = 400-416, 430-434 & 450-468

rates above 100 rounded off in tens

Table 7

MORTALITY FROM MALIGNANT NEOPLASMS
by sex and age

Netherlands — per 100 000 — 1950-1961

period	35-39	40-44	45-49	50-54	55-59	60-64	65-69	70-74	period
MALES									MALES
1950/1952	37	64	112	205	332	505	757	1,123	1950/1952
1953/1955	35	63	122	211	357	538	758	1,107	1953/1955
1956/1958	33	64	120	215	368	580	776	1,118	1956/1958
1959/1961	36	66	118	237	397	609	876	1,170	1959/1961
FEMALES									FEMALES
1950/1952	49	83	140	218	314	446	644	897	1950/1952
1953/1955	51	82	142	209	303	426	595	860	1953/1955
1956/1958	49	89	141	196	295	404	583	817	1956/1958
1959/1961	47	84	141	203	288	399	553	776	1959/1961

Table 8

TOTAL MORTALITY IN SPECIFIED COUNTRIES
by sex and age

per 100 000 — 1958/1960

countries	MALES				FEMALES			
	35-44	45-54	55-64	65-74	35-44	45-54	55-64	65-74
U.S.A.	380	970	2310	5230	230	520	1190	3100
non-white	750	1530	3250	6900	560	1140	2460	5010
white	330	910	2210	5050	190	450	1080	2970
U.K.	250	740	2200	5400	180	450	1100	3090
Scotland	310	910	2520	5950	230	530	1350	3680
Engl. & W.	240	730	2170	5350	180	440	1080	3030
Denmark	220	580	1550	3920	180	420	1020	2940
Sweden	210	500	1400	3800	150	370	930	2850
Norway	220	530	1450	3560	130	320	830	2560
Netherlands	190	540	1510	3620	150	350	880	2700

Sources: Epidem. vital Statist. Rep. 1963, 16, no. 2
Annual epidemiological and vital statistics 1958, 1959
Demographic yearbook 1960, 1961
Vital Statist. spec. Rep. 1960, 52, no. 4) U.S.A. white and non-white: 1958/1959
" " " " 1961, 54, no. 5

Table 9.1

MORTALITY FROM CARDIOVASCULAR DISEASES IN SPECIFIED COUNTRIES
by sex and age

per 100 000 — 1958/1960

countries	MALES				FEMALES			
	35-44	45-54	55-64	65-74	35-44	45-54	55-64	65-74
U.S.A.	139	494	1313	3241	62	191	599	1943
non-white	250	720	1780	4149	211	585	1473	3367
white	124	465	1257	3136	43	150	519	1851
U.K.	84	315	999	2806	46	143	491	1797
Scotland	106	396	1217	3284	67	193	660	2242
Engl. & W.	82	307	978	2763	43	137	472	1753
Denmark	47	219	723	2113	24	88	355	1539
Sweden	42	184	692	2126	25	101	376	1618
Norway	50	203	688	1962	19	79	334	1418
Netherlands	48	176	588	1728	20	74	304	1368

sources as in table 7

Table 9.2

MORTALITY FROM CARDIOVASCULAR DISEASES IN SPECIFIED COUNTRIES
by sex and age

percentages [1] 1958/1960

countries	MALES				FEMALES			
	35-44	45-54	55-64	65-74	35-44	45-54	55-64	65-74
U.S.A.	37	51	57	62	27	37	50	63
non-white	33	47	55	62	38	51	60	67
white	37	51	57	62	23	33	48	62
U.K.	34	42	45	52	25	32	45	58
Scotland	35	44	48	55	29	36	49	61
Engl. & W.	34	42	45	52	24	31	44	58
Denmark	22	38	47	54	14	21	35	52
Sweden	20	36	49	56	16	27	40	57
Norway	23	38	47	55	14	25	40	55
Netherlands	25	33	39	48	14	21	35	51

sources as in table 7

[1] percentages on all deaths in each age group

Table 10.1

MORTALITY FROM ARTERIOSCLEROTIC AND DEGENERATIVE HEART DISEASE IN SPECIFIED COUNTRIES
by sex and age

per 100 000 B 26 1958/1960

countries	MALES				FEMALES			
	35-44	45-54	55-64	65-74	35-44	45-54	55-64	65-74
U.S.A.	90	354	928	2129	18	79	314	1082
non-white	101	329	843	1919	56	197	553	1308
white	89	354	932	2121	14	68	291	1063
U.K.	49	210	641	1617	8	40	201	820
Scotland	70	287	838	2010	18	66	313	1105
Engl. & W.	47	202	621	1580	7	37	189	792
Denmark	28	139	464	1239	6	28	155	723
Sweden	20	109	445	1256	5	26	152	733
Norway	28	140	457	1125	4	24	128	590
Netherlands	28	122	386	980	4	22	133	616

sources as in table 7

Table 10.2

MORTALITY FROM ARTERIOSCLEROTIC AND DEGENERATIVE HEART DISEASE IN SPECIFIED COUNTRIES
by sex and age

percentages [1] B 26 1958/1960

countries	MALES				FEMALES			
	35-44	45-54	55-64	65-74	35-44	45-54	55-64	65-74
U.S.A.	65	72	71	66	30	42	52	56
non-white	40	46	47	47	26	34	38	39
white	72	76	74	68	33	45	56	57
U.K.	59	67	64	58	19	28	41	46
Scotland	66	72	69	61	26	34	48	49
Engl. & W.	58	66	64	57	17	27	40	45
Denmark	61	64	64	59	25	32	44	47
Sweden	47	59	64	59	21	25	40	45
Norway	55	69	66	57	20	30	38	42
Netherlands	58	69	66	57	20	29	44	45

sources as in table 7

[1] percentages on deaths from all cardiovascular diseases in each age group

Table 11.1

MORTALITY FROM HYPERTENSIVE AND CEREBROVASCULAR DISEASES IN SPECIFIED COUNTRIES
by sex and age

per 100 000 B 22, 28, 29 1958/1960

countries	MALES				FEMALES			
	35-44	45-54	55-64	65-74	35-44	45-54	55-64	65-74
U.S.A.	25	85	258	815	25	75	213	691
non-white	111	307	762	1801	122	326	789	1772
white	16	64	216	754	14	50	166	634
U.K.	17	67	254	875	16	59	203	741
Scotland	18	75	288	1028	20	81	265	933
Engl. & W.	17	67	251	861	15	57	196	722
Denmark	5	28	131	551	7	31	116	549
Sweden	12	44	160	619	10	46	156	661
Norway	11	32	152	650	8	34	146	649
Netherlands	8	24	117	504	6	28	112	537

sources as in table 7

Table 11.2

MORTALITY FROM HYPERTENSIVE AND CEREBROVASCULAR DISEASES IN SPECIFIED COUNTRIES
by sex and age

percentages [1] B 22, 28, 29 1958/1960

countries	MALES				FEMALES			
	35-44	45-54	55-64	65-74	35-44	45-54	55-64	65-74
U.S.A.	18	17	20	25	40	39	36	36
non-white	44	43	43	43	58	56	54	53
white	13	14	17	24	33	33	32	34
U.K.	20	21	25	31	35	42	41	41
Scotland	17	19	24	31	31	42	40	42
Engl. & W.	21	22	26	31	35	42	42	41
Denmark	11	13	18	26	28	35	33	36
Sweden	27	24	23	29	40	46	42	41
Norway	21	16	22	33	41	42	44	46
Netherlands	16	14	20	29	31	38	37	39

sources as in table 7

[1] percentages on deaths from all cardiovascular diseases in each age group

Table 12

MORTALITY FROM OTHER CARDIOVASCULAR DISEASES IN SPECIFIED COUNTRIES
by sex and age

per 100 000 1958/1960

countries	MALES				FEMALES			
	35-44	45-54	55-64	65-74	35-44	45-54	55-64	65-74
U.S.A.	23	55	127	297	18	37	72	170
non-white	38	84	175	413	33	62	131	288
white	19	47	109	261	15	32	62	154
U.K.	18	38	104	314	22	44	87	236
Scotland	18	34	91	247	29	46	82	204
Engl. & W.	17	38	105	321	21	43	87	239
Denmark	13	52	129	323	11	29	83	266
Sweden	11	31	87	251	10	29	68	225
Norway	12	31	78	187	8	22	59	180
Netherlands	12	30	86	244	10	24	59	214

sources as in table 7

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