

Secular Trends in Death Rates from Ischemic Heart Diseases and Cerebrovascular Diseases in Selected Countries

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The aim of this report is to describe age-adjusted death rates from ischemic heart diseases (IHD) and cerebrovascular diseases (CVD) in recent years and secular trends in the selected countries. World Health Statistics Annuals by the World Health Organization were used for data sources. From 1994 annual statistics, among males, the countries with the highest age-adjusted death rates were as follows in decreasing order: Hungary, former Czechoslovakia, the United Kingdom, Ireland and Finland for IHD; Bulgaria, Hungary, Portugal, former Czechoslovakia and Poland for CVD. On the other hand, the countries with the lowest rates were as follows in increasing order: Japan, France, Spain, Portugal and Italy for IHD; Switzerland, Canada, the United States, France and Australia for CVD. The trends of age-adjusted death rates both in IHD and CVD for 1970-1994 decreased in the United States, Australia, Western and Southern Europe and Japan, while both IHD and CVD rates tended to increase in Eastern Europe. Decreasing trends seen in the countries that already showed marked decrease in 1970s through the mid 1980s, seemed to be blunted in recent years. Some countries whose death rates were relatively high showed decreasing trends that lagged behind the other countries: Spain, Poland and Greece for IHD; and Hungary for CVD. *J Epidemiol*, 1996 ; 6 : S189-S196.

ischemic heart diseases, cerebrovascular diseases, death rate, secular trend, international comparisons

Cardiovascular diseases, mainly ischemic heart diseases (IHD) and cerebrovascular diseases (CVD), are the chief killers throughout the world, especially in the developed countries. When non-fatal, they are also major contributors to disability in middle-aged and elderly people. Although decreasing death rates have been seen in many developed countries for these last three decades, these diseases are still on the list of leading cause of death in these countries. It is equally true that cardiovascular diseases are on the rise in some countries even in recent years.

The aim of this report is to describe the crude and age-adjusted death rates in recent years and secular trends in age-adjusted rates from IHD and CVD in some selected countries.

MATERIALS AND METHODS

Data sources were World Health Statistics Annuals published by the World Health Organization (WHO)¹⁾. Raw data for generating age-adjusted death rates were provided by the WHO data bank for IHD and CVD for a period from 1970 to the latest available year (reported in 1994 annual statistics) by sex for the selected countries. The age groups that were used for calculating age-adjusted death rates ranged from 35 to 74 years. The selected countries are believed to provide accurate population estimates, complete death registration, and comparable cause of death coding. Rates have been age-adjusted to Segi's European population²⁻⁴⁾.

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RESULTS

Because death rates from IHD and CVD among males were two to three-fold of that for females, the cases for male are primarily considered in ranking the countries. For the latest 1994 annual report, the correlation coefficients of age-adjusted death rates between male and female was 0.97 for IHD and 0.98 for CVD, respectively. Thus, consideration based on the data for males appears to have a valid basis

From 1994 annual statistics, crude death rates per 100,000

for IHD for males, was lowest for China (selected areas) (22.8) and Latvia was the highest (522.9); for females, China was the lowest (21.3) and Estonia was the highest (502.3). The rates for CVD ranged from 22.7 (Mexico) to 294.9 (Bulgaria) for males and from 25.6 (Mexico) to 329.8 (Russia) for females. Crude death rates for IHD for males, for China was the lowest, 22.8, and Latvia was the highest, 522.9; for females, China was the lowest, 21.3, and Estonia was the highest, 502.3.

Concurrent age-adjusted death rates from IHD is shown in

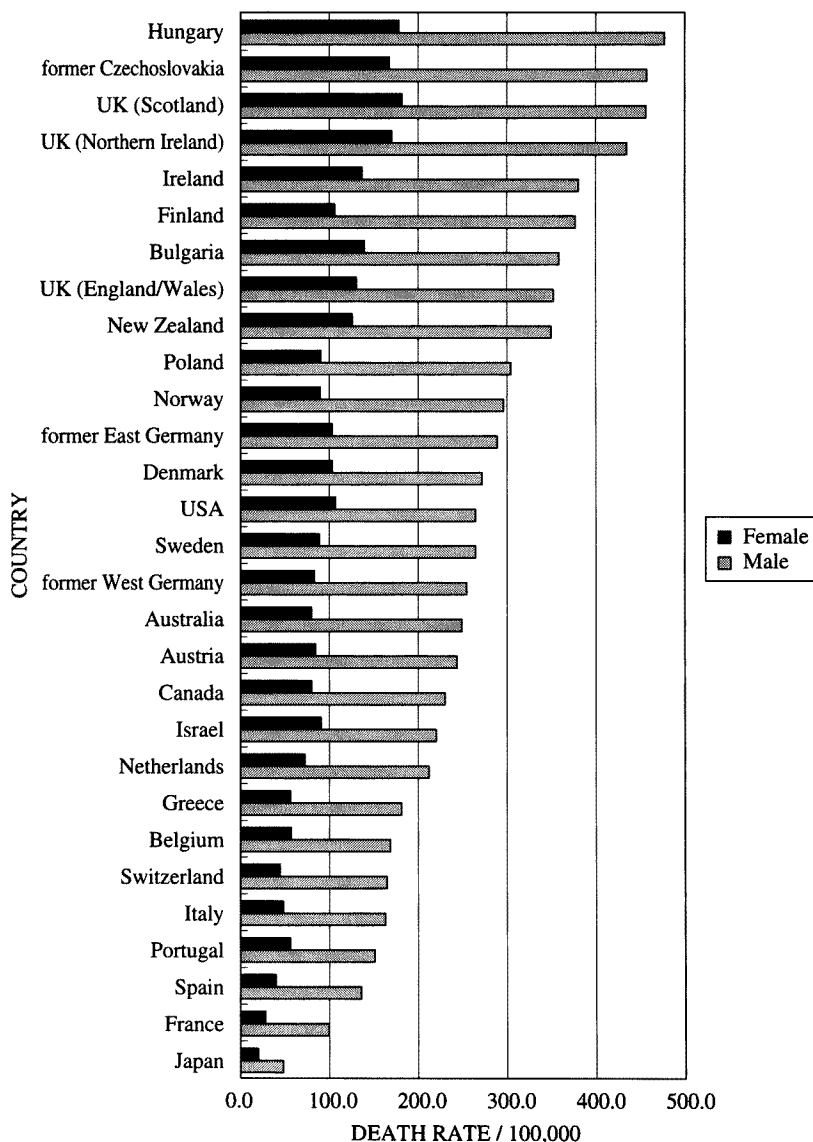


Figure 1. Age-adjusted death rates from ischemic heart diseases in selected countries, 35-74 years old, 1994. (If data were not available for the indicated year, those in the nearest year were adopted.) UK, the United Kingdom ; USA, the United States of America.

Figure 1. The countries that showed the highest age-adjusted male death rates for IHD were Hungary, former Czechoslovakia, the United Kingdom (Scotland, Northern Ireland), Ireland and Finland, with rates of about 400 deaths per 100,000 persons annually. The countries that showed the lowest age-adjusted male death rates for IHD were Japan, France, Spain, Portugal and Italy. Among them, an exceptionally low rate was seen in Japan of 44.5 deaths per 100,000 persons.

On the other hand, the countries that showed the highest age-

adjusted death rates of males for CVD were Bulgaria, Hungary, Portugal, former Czechoslovakia and Poland (Figure 2). The rates in these countries had a wider range than seen for IHD, ranging from approximately 120 up to 320 deaths per 100,000 persons annually. The countries that showed the lowest age-adjusted death rates of male from CVD were Switzerland, Canada, the United States, France and Australia, whose rates ranged from 36 to 49 deaths per 100,000 persons.

Secular trends in age-adjusted death rates were analyzed by two methods: long-term (1970-1994) and short-term (1987-

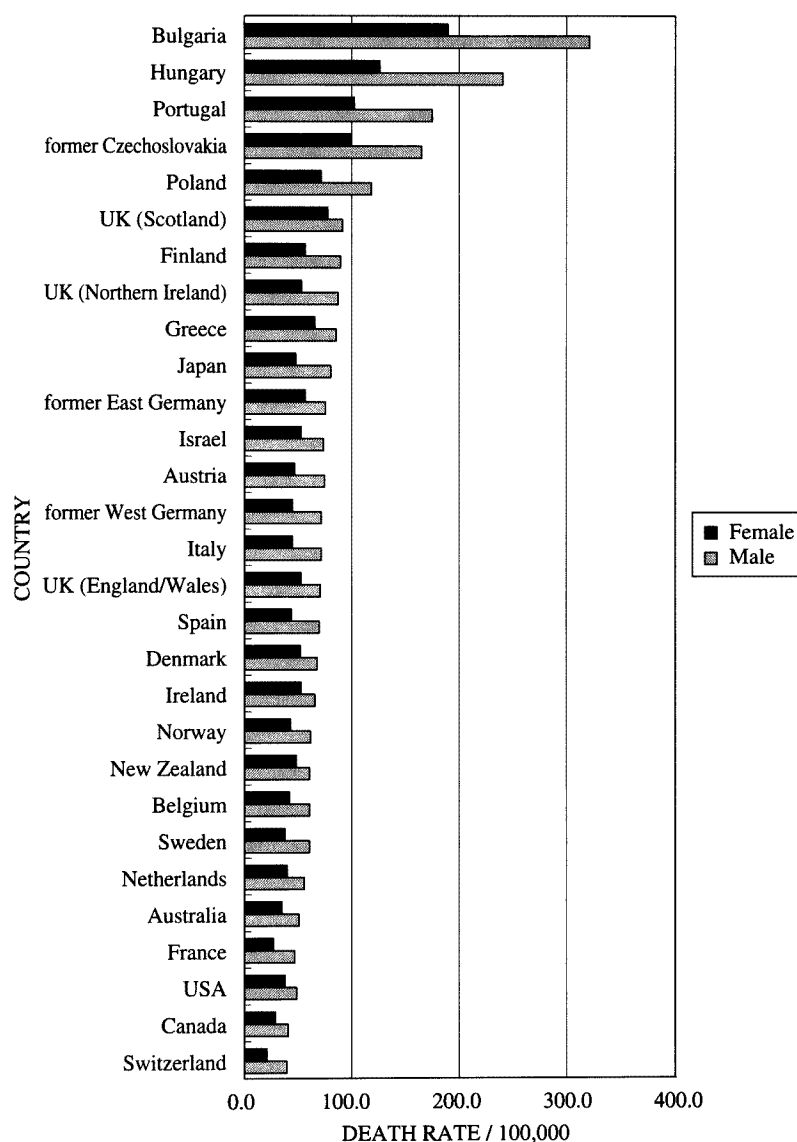


Figure 2. Age-adjusted death rates from Cerebrovascular diseases in selected countries, 35-74 years old, 1994. (If data were not available for the indicated year, those in the nearest year were adopted.)
UK, the United Kingdom ; USA, the United States of America.

Table 1. Age-adjusted death rates from ischemic heart diseases and their percent change in the selected countries.

Countries	Male					Female				
	1970	1987	1994	1970-1994	1987-1994	1970	1987	1994	1970-1994	1987-1994
Australia	652.3	333.1	248.2	-62.0	-34.2	255.5	126.2	77.0	-69.9	-63.9
USA	651.5	306.6	263.4	-59.6	-16.4	252.2	122.1	104.8	-58.4	-16.5
Canada	549.2	309.2	228.0	-58.5	-35.6*	195.5	104.3	77.0	-60.6	-35.5
Israel	475.7	305.2	218.5	-54.1	-39.7*	254.1	140.5	88.7	-65.1	-58.5
Belgium	350.8	221.1	165.7	-52.8	-33.5	120.8	71.9	55.6	-54.0	-29.4
Japan	93.5	52.2	44.5	-52.4	-17.3	46.9	21.4	16.7	-64.4	-28.1
Netherlands	400.4	284.2	210.0	-47.6	-35.3*	124.6	85.0	69.6	-44.1	-22.1
Finland	701.7	506.6	377.1	-46.3	-34.3	193.0	153.0	104.9	-45.6	-45.9
New Zealand	608.9	446.7	348.1	-42.8	-28.3	222.6	165.2	123.9	-44.3	-33.3
Denmark	429.7	372.8	270.9	-37.0	-37.6*	157.0	116.3	101.5	-35.4	-14.6
Sweden	396.9	352.6	263.0	-33.7	-34.1	146.9	98.6	85.3	-41.9	-15.6
Norway	444.6	401.9	297.2	-33.2	-35.2*	133.6	105.2	87.4	-34.6	-20.4
France	148.7	127.1	100.5	-32.4	-26.5	50.2	34.0	25.5	-49.3	-33.5
UK (Northern Ireland)	646.0	540.7	437.4	-32.3	-23.6	246.4	200.0	167.8	-31.9	-19.2
UK (England/Wales)	509.3	439.9	353.1	-30.7	-24.6	164.5	154.8	128.4	-21.9	-20.6
Italy	226.2	191.0	160.7	-29.0	-18.9	87.4	55.8	44.6	-49.0	-25.1
UK (Scotland)	634.2	566.3	457.7	-27.8	-23.7	239.6	226.2	181.5	-24.2	-24.6
Switzerland	224.0	201.8	162.9	-27.3	-23.9	66.3	50.1	42.8	-35.4	-17.1
Austria	334.1	282.6	243.1	-27.2	-16.2	116.9	88.8	82.4	-29.5	-7.8
Ireland	490.7	482.4	379.8	-22.6	-27.0	198.8	171.9	135.8	-31.7	-26.6
former West Germany	326.5	289.5	253.2	-22.4	-14.3	100.3	90.3	80.1	-20.1	-12.7
Portugal	184.9	144.0	147.5	-20.2	2.4	80.8	52.4	52.6	-34.9	0.4
former Czechoslovakia	455.4	484.8	459.6	0.9	-5.5	183.4	176.9	166.0	-9.5	-6.6
former East Germany	229.1	270.9	289.4	26.3	6.4	80.4	94.1	96.8	20.4	2.8
Spain	103.2	149.1	133.5	29.4	-11.7	33.5	41.1	37.0	10.4	-11.1
Greece	135.0	180.4	178.0	31.8	-1.4	47.4	52.4	52.4	10.6	0.0
Hungary	348.9	444.4	479.5	37.4	7.3	161.0	164.3	178.1	10.6	7.7
Bulgaria	234.9	309.2	359.1	52.9	13.9	150.3	124.4	137.2	-8.7	9.3
Poland	177.4	316.6	304.2	71.5	-4.1	54.9	87.6	89.0	62.0	1.5

Source : World Health Statistics Annual, WHO. Rates are age-adjusted to Segi's European population.

If data were not available for the indicated year, those in the nearest were adopted.

The order is sorted by percent change in age-adjusted death rates (male) observed between 1970 and 1994.

* : Top five countries that showed the highest percent decrease in age-adjusted death rates, 1987-1994.

USA, the United States of America ; UK, the United Kingdom.

1994) trends. Long term trends for IHD (Table 1) for most of the examined countries showed decreasing trends, especially Australia, the United States, Canada, Israel and Belgium. However, beginning with an extremely high increasing rate seen in Poland (72%), Bulgaria, Hungary, Greece, Spain and former East Germany showed increasing trends in excess of 25%. In short-term trends for IHD, the countries that showed the most marked decreases were Israel, Denmark, Canada, Netherlands and Norway. While these countries showed over 35% decrease for this short-term, increasing trends were seen in Portugal, former East Germany, Hungary and Bulgaria for the same period. Spain, Greece and Poland showed very high increasing trends in long-term analysis, but slightly decreasing trends in short-term analysis. However, the rates seen in former East Germany, Hungary and Bulgaria kept increasing even in

recent years.

Long-term trends for CVD (Table 2) in most of the examined countries showed decreasing trends: Japan, Australia, France, Switzerland and the United States showed more than a 60% decreasing trends. However, the trends seen in Poland, Bulgaria, Hungary and former East Germany were isolatedly increasing highly. For short-term trends of CVD, the countries that showed the most marked decreasing trends were Italy, Austria, New Zealand, Spain and France. While these countries showed around a 40% decrease, increasing trends were seen in Bulgaria, Poland, former East Germany, Denmark and Sweden for this period. Although Hungary showed a highly increasing trend in long-term analysis, its recent trend is somewhat decreasing.

Briefly, the trends for both IHD and CVD for 1970-1994

Table 2. Age-adjusted death rates from cerebrovascular diseases and their percent change in the selected countries.

Countries	Male					Female				
	1970	1987	1994	1970-1994	1987-1994	1970	1987	1994	1970-1994	1987-1994
Japan	385.3	104.0	79.8	-79.3	-30.3	225.1	62.3	46.2	-79.5	-34.9
Australia	157.4	66.3	48.7	-69.1	-36.1	142.3	46.2	34.6	-75.7	-33.5
France	138.3	64.4	46.7	-66.2	-37.9*	83.6	32.8	24.9	-70.3	-32.0
Switzerland	95.3	46.4	35.8	-62.4	-29.6	68.3	26.6	20.1	-70.6	-32.3
USA	119.8	50.3	45.9	-61.7	-9.6	90.1	39.9	34.9	-61.3	-14.3
Canada	95.3	47.2	38.4	-59.7	-22.9	72.1	32.0	26.8	-62.8	-19.4
Ireland	158.0	83.9	64.8	-59.0	-29.5	143.9	60.1	52.6	-63.4	-14.3
Belgium	143.6	74.9	60.3	-58.0	-24.2	105.3	54.3	40.1	-61.9	-35.5
Austria	173.0	105.4	73.0	-57.8	-44.4*	119.0	66.4	45.0	-62.2	-47.6
former West Germany	156.8	81.4	70.1	-55.3	-16.1	106.1	49.1	43.9	-58.6	-11.9
Italy	154.3	101.6	70.1	-54.6	-44.9*	107.5	64.2	43.4	-59.6	-47.9
New Zealand	130.5	85.6	60.3	-53.8	-42.0*	118.4	67.3	46.9	-60.4	-43.5
UK (England/Wales)	141.2	84.4	68.7	-51.3	-22.9	112.7	65.5	53.1	-52.9	-23.4
Finland	179.5	107.8	87.6	-51.2	-23.1	143.9	71.9	55.4	-61.5	-29.8
Norway	126.2	73.7	61.8	-51.0	-19.3	91.9	46.2	41.8	-54.5	-10.5
Spain	137.6	96.6	68.5	-50.2	-41.0*	100.6	62.9	42.8	-57.5	-47.0
UK (Scotland)	180.2	114.2	90.6	-49.7	-26.0	158.5	86.7	76.9	-51.5	-12.7
Israel	140.7	80.2	74.2	-47.3	-8.1	149.4	67.5	51.9	-65.3	-30.1
UK (Northern Ireland)	165.4	94.1	87.3	-47.2	-7.8	138.5	69.9	52.4	-62.2	-33.4
Netherlands	97.5	56.1	54.3	-44.3	-3.3	80.5	37.5	38.3	-52.4	2.1
Portugal	279.8	195.8	173.6	-38.0	-12.8	200.8	124.8	101.2	-49.6	-23.3
Sweden	82.2	58.4	59.7	-27.4	2.2	66.6	37.9	36.4	-45.3	-4.1
Denmark	89.4	64.0	65.6	-26.6	2.4	72.1	44.6	51.4	-28.7	13.2
former Czechoslovakia	224.1	205.8	164.7	-26.5	-25.0	147.0	131.2	100.1	-31.9	-31.1
Greece	104.3	101.3	83.3	-20.1	-21.6	103.8	88.6	64.7	-37.6	-36.9
former East Germany	58.1	72.4	74.6	28.4	3.0	44.8	52.5	55.3	23.3	5.0
Hungary	185.7	242.6	239.3	28.9	-1.4	145.0	147.9	125.2	-13.7	-18.1
Bulgaria	234.0	281.0	320.0	36.8	12.2	224.5	198.7	188.8	-15.9	-5.2
Poland	65.3	107.4	118.6	81.7	9.5	54.6	75.2	70.7	29.5	-6.3

Source : World Health Statistics Annual, WHO. Rates are age-adjusted to Segi's European population.

If data were not available for the indicated year, those in the nearest were adopted.

The order is sorted by percent change in age-adjusted death rates (male) observed between 1970 and 1994.

*: Top five countries that showed the highest percent decrease in age-adjusted death rates, 1987-1994.

USA, the United States of America ; UK, the United Kingdom.

decreased in the United States, Australia, Western and Southern Europe, and Japan. Conversely, both IHD and CVD rates tended to increase in Eastern European countries. Decreasing trends seen in the countries that already showed marked decrease in the 1970s through the mid 1980s, seemed to be blunted in recent years. Some countries whose death rates were relatively high showed decreasing trends that lagged behind the other countries: Spain, Poland and Greece for IHD; Hungary for CVD. Principally, the countries whose death rates were relatively high in 1970 showed marked decreasing trends: for example, the United States, the United Kingdom, Australia and New Zealand for IHD; Japan, Portugal and former Czechoslovakia for CVD.

DISCUSSION

Death rate is determined mainly by incidence rate and fatality rate of the disease. Incidence rate is influenced by various etiologic factors such as environmental, lifestyle and genetic factors. Fatality rate is related to usual or most common therapy and the severity and complications of the incident cases. Other than these factors, death rates are subject to some artifacts such as coding revisions of the International Classification of Diseases (ICD) and diagnostic preference of the doctors in the countries⁵. As a rule, ICD has been revised almost every 10 years. The steep decline of death rates from IHD seen in Japan, Italy and former West Germany between 1967 and 1968 was due to the change of ICD coding, that is from ICD7 to ICD8. In this revision, "degenerative heart dis-

eases" was separated from "ischemic heart diseases", which caused artificial declines of death rates from IHD in these countries. As for diagnostic preference, it is indicated that not a few cases of deaths from cardiovascular causes are likely to be diagnosed as ill-defined death. This tendency is especially observed in the case of elderly people who show slow-progressing course, and in the case of sudden death^{6,7}. For the former, they were, for example in Japan, often diagnosed as simple "aging" or "senility". A higher autopsy rate can reduce the proportion of such misclassified cases, but is very difficult and often is not feasible. An analysis that is limited to middle-aged and younger elderly people, for example adopting 35-74 years old as is used in this report, can be an option to reduce the bias from the former. When the international comparisons using WHO official data is used to search for true etiologic factors, these potential artifacts should be kept in mind.

Decrease of death rates both from IHD and CVD observed in most developed countries was likely attributable to improvement of antihypertensive therapy⁸⁻¹¹. Some recent reports, however, do not confirm this relationship. They indicated the possibility that changes of lifestyle factors such as smoking, alcohol drinking, unfavorable diet and physical inactivity have been related with these declining trends¹²⁻¹⁴. For addressing therapy, not only antihypertensive therapy but also acute phase therapy of progressing IHD and CVD should be taken into account in further studies. While antihypertensive therapy may affect mainly the incidence rate of IHD and CVD, the latter may be related with the fatality rate of these diseases. Although, determination to what extent these therapies and lifestyle factors contributed to the decline of death rates from IHD and CVD is a very important subject, its qualitative definition needs much attention and very prudent consideration. Ecological comparisons and trend analyses were helpful to some extent, however, these types of studies are inevitably subject to various confounding factors such as races and socioeconomic backgrounds.

It should be also kept in mind that subtypes of cardiovascular diseases, especially CVD, were different among countries. Subsequently, it is possible to assume that the principal contributors for declining trends may not be completely the same¹⁵. Japan is, for example, often regarded as an exceptionally successful case, whose age-adjusted death rate from CVD that once showed very high in the world decreased outstandingly^{6,16} and that from IHD, though once being extremely low among the industrialized countries, decreased further to still lower levels³. Cerebral hemorrhage and cerebral infarction are main subtypes of CVD, and their relative frequencies were different across countries, especially in 1960s. Contrasting to low death rates from cerebral hemorrhage seen in western countries and the United States, that seen in Japan was extremely high¹⁷⁻¹⁹. While some reports from western European countries^{20, 21} and the United States²² observed positive relationship between

serum cholesterol level and risk of cerebral infarction or overall CVD, several epidemiological studies in Japan showed inverse relationship between serum cholesterol level and cerebral hemorrhage in 1960s and in early 1970s²³⁻²⁵. At that time, the average levels of serum cholesterol in some community residents were very low and there were a number of hypocholesterolaemic people^{24, 26}. This situation might result from the traditional Japanese diet (high carbohydrate and salt intake, very low intake of fat and animal protein) and heavy physical labor like unmechanized farming¹⁵. Considerable portion of the marked decline of CVD rates seen in Japan from 1960s could be attributed to the outstanding decrease in cerebral hemorrhage, which was observed especially during the high economic growth period (1960-1975)²⁷⁻²⁹. During this period, dietary and working patterns in Japanese changed toward western styles^{30, 31} and simultaneously serum cholesterol levels increased^{32, 33}. However, increasing tendencies of both incidence and mortality of IHD has not been apparently observed yet^{26, 34}. The Japanese situation above mentioned is much different from those in the other developed countries.

These epidemiological findings imply that the contributing factors to the declines in death rates from cardiovascular diseases were different among countries and, thus, their peculiar background should not be overlooked³⁴⁻³⁶.

Increasing trends for both IHD and CVD seen in Eastern European countries is another point that should be explored. Some data suggest that risk-factor levels in these countries are worsening^{37, 38}. In the case of Poland, whose death rates from both IHD and CVD were very high and kept increasing until recently, the findings from WHO MONICA project (the POLMONICA Warsaw Project) and the relating study are available³⁹. They showed elevations of serum cholesterol, systolic and diastolic blood pressure and Quetelet Index among males. Simultaneously, increase in total energy and fat intakes were also reported. Environmental factors and practices of diagnosis and certification among physicians may also be related with them, however, further study is needed to determine true causalities.

The last point that should be mentioned is the present situations of developing countries. Representative population surveys have not been established in most Asian and African countries, thus, reliable data on cardiovascular diseases in these countries are very rare at present. Secondary to this, data from hospital-based surveys should be utilized for evaluating IHD and CVD trends. For example in Bangladesh, National Institute of Cardiovascular Diseases was established in 1978 and a large number of patients have been admitted to this hospital mainly for circulatory problems. An increasing trend in hospital admission of number of cardiovascular diseases was observed here⁴⁰. A number of developing countries are well into the so called "epidemiological transition"⁴¹, changing from mortality patterns dominated by infectious diseases to

those predominantly caused by chronic diseases such as cardiovascular diseases⁴². CVD may emerge as a more frequent cause of death than IHD after infection and malnutritional diseases are overcome, as predicted according to secular trends in the leading causes of death over a long period of time in the United States and Western European countries⁴³.

Advantages of WHO official data are their availability, by age and sex; the large numbers in their numerators and denominators; their representativeness; the long time periods for which they are available; and the wide range of rates observed. Although international comparisons of death rates and their trends in IHD and CVD using WHO database are inevitably subject to various methodological issues, cautious interpretation of them may make routine vital statistics adequately useful.

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