Thematic Article

Cardiovascular epidemiology in the Asia–Pacific region

Geok Lin Khor PhD

Department of Nutrition and Health Sciences, Faculty of Medicine and Health Sciences, Universiti Putra Malaysia, Serdang, Malaysia

By 2020, non-communicable diseases including cardiovascular diseases (CVD) are expected to account for seven out of every 10 deaths in the developing countries compared with less than half this value today. As a proportion of total deaths from all-causes, CVD in the Asia–Pacific region ranges from less than 20% in countries such as Thailand, Philippines and Indonesia to 20–30% in urban China, Hong Kong, Japan, Korea and Malaysia. Countries such as New Zealand, Australia and Singapore have relatively high rates that exceed 30–35%. The latter countries also rank high for coronary heart disease (CHD) mortality rate (more than 150 deaths per 100 000). In contrast, death from cerebrovascular disease is higher among East Asian countries including Japan, China and Taiwan (more than 100 per 100 000). It is worth noting that a number of countries in the region with high proportions of deaths from CVD have undergone marked declining rates in recent decades. For example, in Australia, between 1986 and 1996, mortality from CHD in men and women aged 30–69 years declined by 46 and 51%, respectively. In Japan, stroke mortality dropped from a high level of 150 per 100 000 during the 1920s–1940s to the present level of approximately 100 per 100 000. Nonetheless, CVD mortality rate is reportedly on the rise in several countries in the region, including urban China, Malaysia, Korea and Taiwan. In China, CVD mortality increased as a proportion of total deaths from 12.8% in 1957 to 35.8% in 1990. The region is undergoing a rapid pace of urbanization, industrialization and major technological and lifestyle changes. Thus, monitoring the impact of these changes on cardiovascular risks is essential to enable the implementation of appropriate strategies towards countering the rise of CVD mortality.

Key words: Asia–Pacific region, cardiovascular disease mortality rates and trends.

Introduction

A comprehensive assessment of the cardiovascular disease (CVD) situation in the Asia–Pacific region including its nutrition implications has been previously reported.[1] This article takes another look at the region's CVD epidemiology, with focus on updating the overall status, rates and trends. Description of cardiovascular risk factors is included but this topic is addressed in greater detail in the articles following on.

The Asia–Pacific region referred to here includes countries in East Asia, South-east Asia, Australia, New Zealand and the Pacific Islands. Countries in this region have a wide diversity of sociocultural background and are at different levels of economic and technological development. It is thus a formidable challenge to delineate the cardiovascular epidemiology of all the countries in the Asia–Pacific region. This article would only highlight major aspects related to the CVD situation in selected countries in the region.

By 2020, non-communicable diseases are expected to account for seven out of every 10 deaths in the developing countries compared with less than half this value today.[2] Aging of the population is the major contributing factor for the rapid projected increase in the burden of non-communicable diseases worldwide. Non-communicable diseases that are influenced by lifestyles include CVD, diabetes mellitus, hyperlipidemia and hypertension. Among these, CVD and diabetes are major causes of premature deaths, morbidity and disability in most countries.

It is estimated that coronary heart disease (CHD) and stroke would be the first and second leading causes of death

globally by 2020.[2] The same report predicted that the prevalence of diabetes in adults, aged 20 years and over, is expected to rise from 4.0% in 1995 to 5.5% in 2025 globally. Among the 37 countries in the Western Pacific Region of WHO, CVD is one of the leading causes of death in 32 of these countries, accounting for no less than 3 million deaths each year. The leading cause of mortality in developing, as well as developed countries in the region was CVD (Table 1).

Rates for CVD mortality

As a proportion of total deaths from all-causes, the mortality rates of the countries may be ranked according to three categories. They are termed high, intermediate and low CVD mortality rates. Countries in the 'high mortality' category include New Zealand, Australia, Singapore, some Pacific Islands and urban areas of China. They exceed 30–35% of total deaths due to CVD (Fig. 1). The 'intermediate mortality' category consists of rural China, Hong Kong, Japan, Korea and Malaysia with 20–30% of total deaths from CVD. The 'low mortality' category of countries including Thailand, the Philippines and Indonesia has levels less than 20% of total deaths from CVD. In the case of Thailand, its low

Table 1. Leading causes of mortality

Indonesia 1997	Philippines 1995	Thailand 1998	Malaysia 1997	Japan 1997	Australia 1997
Conditions in perinatal period (13.6%)	Heart diseases (14.8%)	Heart diseases (22.3%)	Heart diseases (19.5%)	Malignant neoplasms (31.0%)	Malignant neoplasms (26.5%)
Heart diseases (10.1%)	Influenza and pneumonia (11.1%)	Malignant neoplasms (16.7%)	Malignant neoplasms (10.6%)	Heart diseases (15.7%)	Ischaernic heart disease (22.5%)
Cerebro-vascular disease (9.2%)	Malignant neoplasms (9.2%)	Transport accidents (4.6%)	Cerebro-vascular disease (8.%)	Cerebro-vascular disease (15.6%)	Cerebrovascular disease (9.4%)
Influenza and pneumonia (5.5%)	Tuberculosis (8.0%)	Septicemia (3.3%)	Transport accidents (7.4%)	Influenza and pneumonia (9.0%)	Chronic pulmonary disease (5.0%)

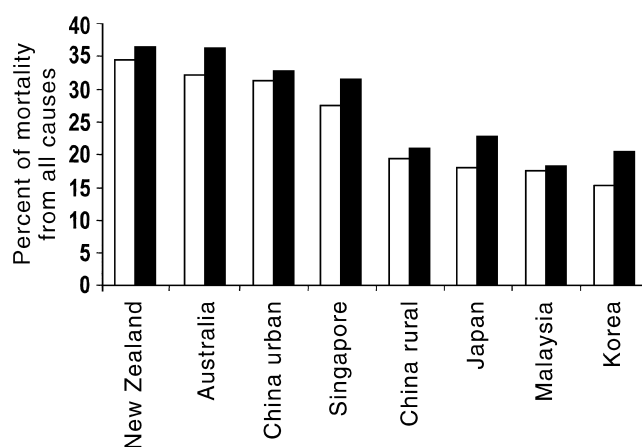SEAMIC Health Statistics, 1999; Australian Bureau of Statistics, 2000.

Figure 1. Cardiovascular disease mortality as percent of mortality from all-causes (1995–1996). (□), male; (■), female.

Figure 2. Coronary heart disease mortality rates in the Asia–Pacific region. (□), male; (■), female.
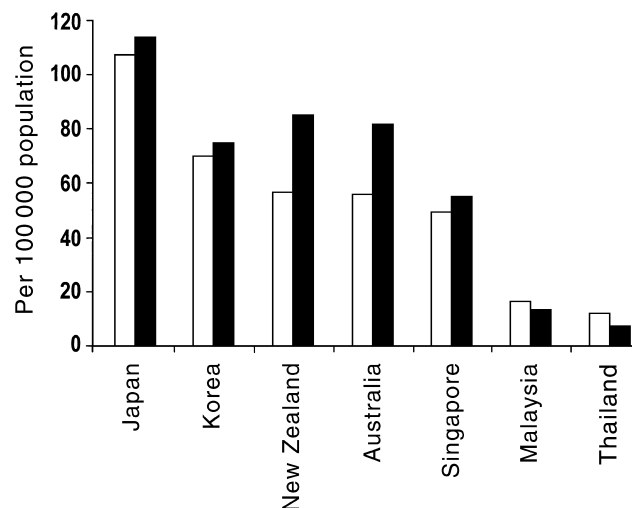
Figure 3. Cerebrovascular disease mortality rates in the Asia–Pacific region. (□), male; (■), female.

level of CHD mortality rates are attributed to a low prevalence of several CVD risk factors, including hypercholesterolemia (≥ 6.2 mmol/L) in 12.4% men and 16.7% women, diabetes mellitus in 2.4% men and 3.6% women, while hypertension in 6.3% men and 7.7% women.[3]

Nonetheless, lack of epidemiological data and underreporting of CVD death cases may account partly for the low levels in some of these countries. For example, it is likely that CVD deaths in Malaysia may be underestimated, as less than half of the total deaths are medically certified and examined.

When CVD mortality is assessed as CHD and cerebrovascular disease separately, it is noted that the countries of New Zealand, Australia and Singapore (high mortality category) also lead in CHD mortality rates (more than 150 deaths per 100 000). By comparison, countries in East Asia and South-east Asia (with the exception of Singapore) in general have lower CHD mortality rates of less than 100 per 100 000 (Fig. 2).

In contrast, death from stroke ranks higher in East Asian countries including Japan, China and Taiwan (more than 100 per 100 000) than New Zealand and Australia (50–80 per 100 000) (Fig. 3).[4] However, the mortality rate associated with stroke remains low in South-east Asian countries
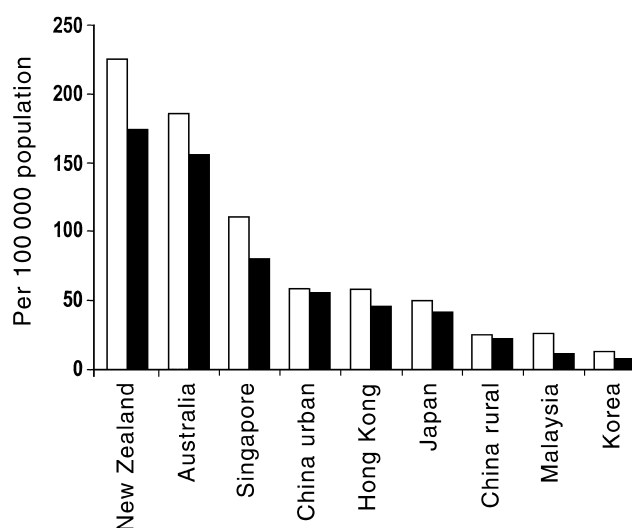
including Thailand, Malaysia, Indonesia and the Philippines (below 20 per 100 000).

Trends in CVD mortality

It is useful to examine the past trends for CHD and stroke mortality, as increasing or declining trends have different implications for interventions. It is worthy to note that countries in the high CVD mortality rate category have undergone marked declining rates in recent decades. In Australia, between 1986 and 1996, mortality from CHD in men and women aged 30–69 years declined by 46% and 51%, respectively.[5] This decline has commenced in the early 1970s with substantial drops reported between 1970 and 1989 for both men and women, as reviewed by Khor.[1] A similar pattern for CHD mortality decline prevails in New Zealand, although the quantum drop during the same period was smaller than that for Australia.

Meanwhile, countries in the region with high mortality rates for cerebrovascular disease such as Japan and Singapore have also undergone rapid decreases. In Japan, between 1960 and 1990, age-adjusted mortality from stroke declined 70% (while that from CHD by 20%).[6] The stroke mortality rate in Japan plummeted from a high level exceeding 150 per 100 000 in the 1920s–1940s to the present level of about 100 per 100 000 (Fig. 4). The remarkable decrease in stroke incidence and mortality in the past decades has been attributed mainly to hypertension control leading to a substantial decline in the mean value of systolic blood pressure. Nonetheless, it is noted that the rate of decline in stroke appears to have slowed down in mid-1990s, with the level rising from about 85 per 100 000 in 1994 to just above 100 per 100 000 in 1997 (Fig. 5). According to Morimoto and Takeshita, while cerebral haemorrhage has declined, death from cerebral infarction is on the rise.[7] These authors attributed the onset of stroke in Japanese to current lifestyle practices including smoking (odds ratio (OR) = 1.4–1.9), heavy drinking (OR = 1.7–8.9), obesity (OR = 2.0), lack of exercise (OR = 1.8–3.5) and stress (OR = 1.7).

As for Singapore, standardized death rates for cerebrovascular disease mortality showed a fall from 99 per 100 000 in 1976 to 59 per 100 000 in 1994.[8] Figure 6 shows a 3–5% decline in cerebrovascular mortality rate annually in general. Stroke risk factors implicated in the mortality decline in Singapore include decrease in the prevalence of previously undetected hypertension from 8.7% in 1974 to 3.5% in 1992; and a fall in hyperlipidemia prevalence from 27% in 1984 to 19% in 1992.

However, CVD mortality rate is reportedly on the rise in several countries in the region including Malaysia, China, Korea and Taiwan.[4,9] These countries are at different stages
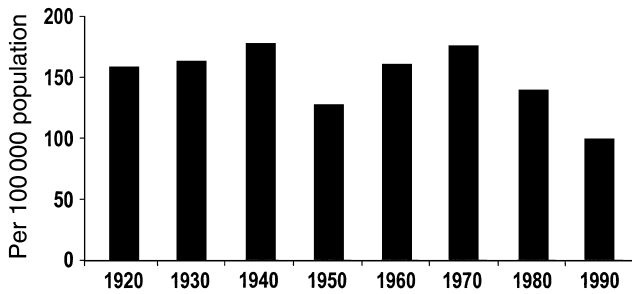

Figure 4. Trend in cerebrovascular mortality in Japan 1920–1990. Data taken from SEAMIC Health Statistics for males and females.
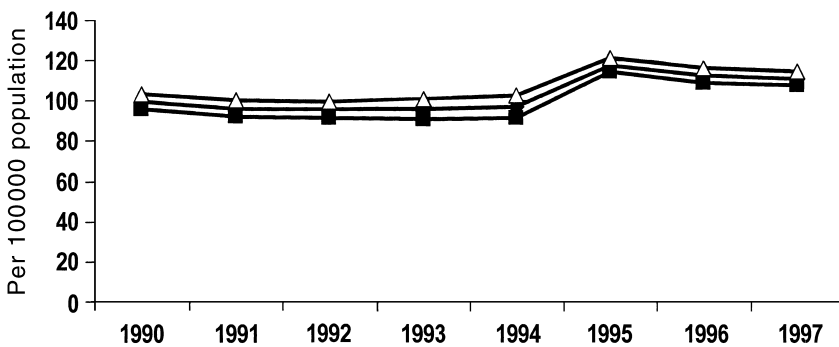

Figure 5. Trend in cerebrovascular mortality by sex in Japan 1990–1997. (◆), total; (■), male; (△), female. Data taken from SEAMIC Health Statistics.
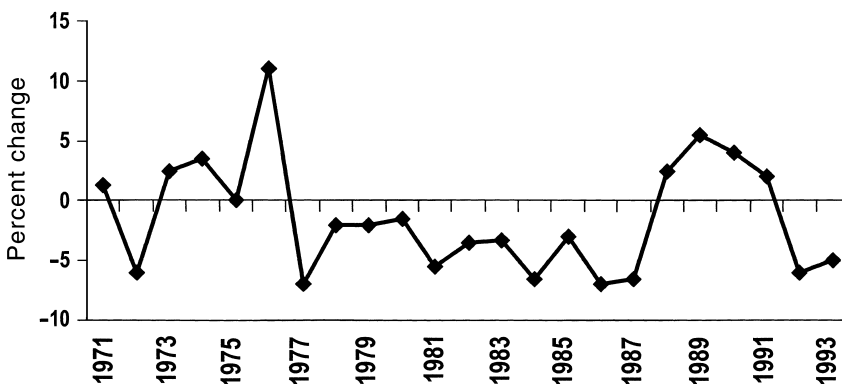

Figure 6. Percent per annum decline in mortality rates from cerebrovascular disease in Singapore 1970–1994. Data taken from Venketasubramanian, 1998.

of epidemiological transition accompanied by rapid changes in dietary practices and other lifestyles. Examples in this context are drawn from China and Western Samoa.

Cardiovascular disease mortality in China increased as a proportion of total deaths from 12.8% in 1957 to 35.8% in 1990.[10] The figures reported by WHO in 1998 for the CVD proportion of total deaths in urban China is 37% for men and 41% for women, while the figures for rural men and women are 29% and 32%, respectively.[11] Rapid pace of economic development and industrialization in the past two decades has brought about rapid changes in lifestyles including a shift towards westernization of dietary patterns, especially in urban areas.[12] Their study showed that in a period of 5 years between 1989 and 1993, consumption of coarse grains (corn, millet and sorghum) and potatoes decreased, while intake of total fat (edible oils, red meat, lard and butter) increased. As a result, the proportion of overweight adults aged 20–45 years (BMI $\geq$ 25.0 kg/m²) increased from 9.7% to 14.9% between 1982 and 1992 in urban areas.[13]

Another major contributing factor to the increasing burden of CVD mortality and morbidity in the Chinese population is the marked increase in cigarette smoking. Cigarette consumption tripled during the 1980s and by the early 1990s, 60–70% of Chinese men were current smokers.[14] A third important CVD risk factor for the increasing CVD trend in China is the upsurge in hypertension prevalence. The rate of hypertension rose by 25% between 1979 and 1980 and in 1991 to 7.5%.[15] Translated into number of people, the total number of hypertensives in China in 1990 was 89.5 million.

In the case of the Polynesian Western Samoa, lifestyle changes concomitant with socioeconomic development has witnessed increased prevalence of obesity and diabetes mellitus type II. The current levels of dyslipidemia are similar to those observed in developed Western populations and are increasing rapidly.[16] Between 1978 and 1991 the age-standardized prevalence of hypercholesterolemia ($\geq$ 5.5 mmol/L) increased from 18 to 36%, while the prevalence of hypertriglyceridemia ($\geq$ 2.0 mmol/L) rose from 9 to 15%. Dietary changes are believed to have led to the unhealthy lipid profiles especially in urban areas. Urban Polynesians tend to consume more imported fats (margarine, butter and dripping) and refined carbohydrates (sugar, white rice, bread, pasta and noodles) than the rural population, who are more likely to consume local foodstuffs including complex carbohydrates (taro, breadfruit, yams).

Socioeconomic inequalities in CVD mortality rates and trends

As the CHD prevalence increases in industrialized and developing countries, it impinges on the more affluent
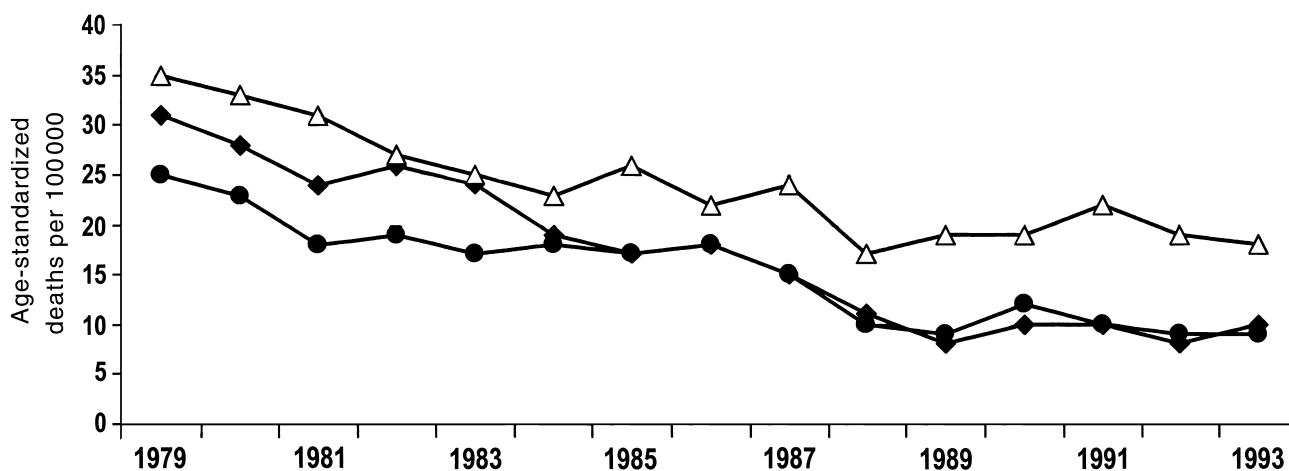

Figure 7. Death rates from cerebrovascular disease, Australian men aged 25–64 by occupation group. ($\bullet$), professional; ($\blacklozenge$), clerical/sales; ($\triangle$), manual. Data taken from Bennet 1996.
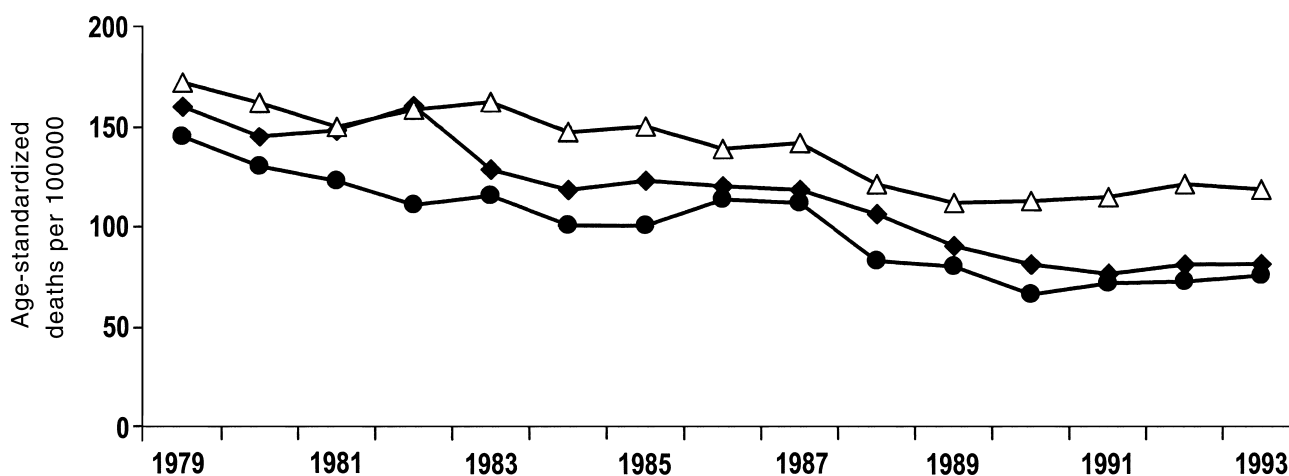
Figure 8. Death rates from coronary heart disease, Australian men aged 25–64 by occupation group. ($\bullet$), professional; ($\blacklozenge$), clerical/sales; ($\triangle$), manual. Data taken from Bennet 1996.

classes initially and then percolates through the social classes.[17] Thus, in countries like the USA and Britain that are presumably in the more advance stage of the CVD epidemic, there is an inverse relationship between socioeconomic status and CVD mortality rates.[18,19] In developing countries, this phenomenon is at the growing stage, and there is a higher CVD prevalence associated mainly with the higher income groups, as reported for India and Hong Kong.[20,21]

However, a study in Korea involving about 760 000 males aged 30–64 found no relationship between socioeconomic status and mortality from CHD.[22] The reason for this finding was attributed to lack of significant differences for the cardiovascular risk factors examined (cholesterol, blood pressure, overweight and smoking) between the higher and lower socioeconomic groups. It would seem that the 'CVD epidemic percolation' postulation might not be evident as clearly in countries, such as in Korea and Japan, that do not have distinctly large economic differentials in the population.

As the CVD epidemic progresses, declines in CVD mortality can be expected to occur at a faster rate in the more affluent classes, presumably as they have better access to choices on nutrition and health care. In Britain, Marmot reported that between 1971 and 1981, CHD mortality decreased by 15% among men in the non-manual class at the same time as it increased by 1% among the manual.[17] In Australia between 1979 and 1993, men aged 25–64 years in the professional category showed the highest rate of decline in CHD deaths than those in the manual and clerical/sales occupations (Figs 7,8).[23] This report found decreases in blood pressure and smoking prevalence contributed most to the socioeconomic inequalities in the risk of mortality from CHD. It was also suggested that differences in work stress might also contribute to the mortality differentials.

Conclusion

A survey of the cardiovascular epidemiology in the Asia–Pacific region shows a wide spectrum of the prevalence of cardiovascular risk factors and mortality rates. Impressive declines have been recorded by countries with high levels of CHD (e.g., Australia and New Zealand) and stroke (Japan and Singapore) mortality rates. Nonetheless, the current CVD mortality level remains high. For example, Japan has two times higher mortality from stroke than the USA. The CHD mortality burden (in terms of rate per 100 000) of Australia and New Zealand is higher than that for the USA for either men or women. However, countries with comparatively lower CVD mortality levels (e.g., Malaysia, Thailand, Hong Kong, Korea, Taiwan) are showing an upward trend. There is a need to take corrective action before the incidence and mortality of CVD in these countries continue to increase rapidly during the next decades. This region is undergoing rapid urbanization, industrialization, major technological and lifestyle changes. In order to monitor the impact of these changes on cardiovascular risks, and to assist in the planning and implementation of culturally appropriate strategies towards the alleviation of CVD, it is imperative for countries to improve data collection and maintain reliable epidemiological datasets.

References

1. Khor GL. Nutrition and cardiovascular disease: an Asia Pacific perspective. Asia Pac J Clin Nutr 1997; 6: 122–142.
2. Murray CJL, Lopez AD. The global burden of disease. Boston: Harvard School of Public Health, 1996.
3. Tatsanavivat P, Klungboonkrong V, Chirawatkul A, Bhuripanyo K, Manmontri A, Chitanondh H, Yipintsoi T. Prevalence of coronary heart disease and major cardiovascular risk factors in Thailand. Int J Epidemiol 1998; 27: 405–409.
4. Eastern Stroke and Coronary Heart Disease Collaborative Research Group. Blood pressure, cholesterol, and stroke in eastern Asia. Lancet 1998; 352: 1801–1807.
5. Sexton PT, Sexton TH. Excess coronary mortality among Australian men and women living outside the capital city statistical divisions. Med J Aust 2000; 172: 370–374.
6. Iso H, Shimamoto T, Kitamura A, Minoru I, Komachi Y. Trends of cardiovascular risk factors and diseases in Japan: implications for primordial prevention. Prev Med 1999; 29: S102–S105.
7. Morimoto K, Takeshita T. Relations between lifestyles and lifestyle-related diseases. Asian Med J 2000; 43: 460–469.
8. Venketasubramanian N. Trends in cerebrovascular disease mortality in Singapore. Int J Epidemiol 1998; 27: 15–19.
9. Sekikawa A, Kuller LH, Ueshima H, Park JE, Suh I, Jee SH, Lee HK, Pan WH. Coronary heart disease mortality trends in men in the post World War II birth cohorts aged 35–44 in Japan, South Korea and Taiwan compared with the United States. Int J Epidemiol 1999; 28: 1044–1049.
10. Yao C, Wu Z, Wu J. The changing pattern of cardiovascular diseases in China. World Health Stat Q 1993; 46: 11–118.
11. World Health Organization. WHO Statistics Annual. Geneva: WHO, 1998.
12. Guo X, Popkin BM, Zhai F. Pattern of change in food consumption and dietary fat intake in Chinese adults, 1989–1993. Food Nutr Bull 1999; 20: 344–353.
13. Ge K. Body mass index of young Chinese adults. Asia Pac J Clin Nutr 1997; 6: 175–179.
14. Anonymous. World Health Organization trying to slow tobacco-related deaths in developing countries. J Natl Cancer Inst 1992; 84: 1689.
15. Tao S, Zhou B. Epidemiology of hypertension in China. Chinese Med J 1999; 112: 1–7.
16. Hodge AM, Dowse GK, Toelupe P, Collins VR, Zimmet PZ. The association of modernization with dyslipidaemia and changes in lipid levels in the Polynesian population of Western Samoa. Int J Epidemiol 1997; 26: 297–306.
17. Marmot M. Socioeconomic determinants of CHD mortality. Int J Epidemiol 1989; 18: S196–S202.
18. Wannamethee SG, Shaper AG. Socioeconomic status within social class and mortality: a prospective study in middle-aged British men. Int J Epidemiol 1997; 26: 532–541.
19. Backlund E, Sorlie PD, Johnson NJ. The shape of the relationship between income and mortality in the United States: evidence from the National longitudinal mortality study. Ann Epidemiol 1996; 6: 12–20.
20. Singh RB, Sharma JP, Rastogi V, Niaz MA, Ghosh S, Beegom R, Janus ED. Social class and coronary disease in a rural population of north India. Eur Heart J 1997; 18: 588–595.
21. Wong SI, Donnan SP. Influence of socioeconomic status on cardiovascular diseases in Hong Kong. J Epidemiol Community Health 1992; 46: 148–150.
22. Song Y, Byeon JJ. Excess mortality from avoidable and non-avoidable causes in men of low socioeconomic status: a prospective study in Korea. J Epidemiol Community Health 2000; 54: 166–172.
23. Bennet S. Socioeconomic inequalities in coronary heart disease and stroke mortality among Australian men, 1979–93. Int J Epidemiol 1996; 25: 266–274.