

Traditional Risk Factors for Stroke in East Asia

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Stroke is one of the leading causes of death and morbidity worldwide. The occurrence of stroke is strongly dependent on well-known vascular risk factors. After rapid modernization, urbanization, and mechanization, East Asian countries have experienced growth in their aged populations, as well as changes in lifestyle and diet. This phenomenon has increased the prevalence of vascular risk factors among Asian populations, which are susceptible to developing cardiovascular risk factors. However, differing patterns of stroke risk factor profiles have been noted in East Asian countries over the past decades. Even though the prevalence of vascular risk factors has changed, hypertension is still prevalent and the burden of diabetes and hypercholesterolemia will continue to increase. Asia remains a high tobacco-consuming area. Although indicators of awareness and management of vascular risk factors have increased in many East Asian countries, their rates still remain low. Here we review the burdens of traditional risk factors, such as hypertension, diabetes, hypercholesterolemia, and smoking in East Asia. We will also discuss the different associations between these vascular risk factors and stroke in Asian and non-Asian populations.

Keywords Stroke; Epidemiology; Risk factors; Asia

Introduction

Cerebrovascular disease is one of the leading causes of death and morbidity worldwide.¹ The World Health Organization (WHO) estimates that there were 6.7 million stroke-related deaths in 2012. This comprised 11.9% of all deaths which was the second highest cause of death worldwide.² While age-standardized stroke mortality has decreased over the past two decades, particularly in high-income countries, the burden of stroke remains high worldwide. Indeed, the absolute number of stroke and stroke-related disability-adjusted life years (DALYs) loss has increased.^{3,4}

The burden of cerebrovascular disease in Asia is high. Distinct features, such as a higher burden of stroke than coronary heart disease, as well as a higher incidence of hemorrhagic stroke, have been noted in this region.⁵ In 2002, 60% of the world's to-

tal mortality due to stroke occurred in East Asia.⁶ In addition, Asia has a higher burden of vascular risk factors overall. Previously, high-carbohydrate diets with high salt and low fat, economic status, and underlying genetic factors were shown to be possible determinants for the epidemic of vascular risk factors in Asian countries.^{5,7-11} Following rapid modernization, urbanization, and mechanization, East Asian countries have experienced growth in their aged populations, as well as changes in lifestyle and diet. Together, these changes have exacerbated vascular risk factor profiles in Asian populations.¹²⁻¹⁵ As a result, the prevalence of vascular risk factors and their impact on cardiovascular disease has changed along with the varying patterns seen in each country.^{5,16}

The objective of this article was to review the burden of traditional vascular risk factors and changes in these burdens over several decades in Asian countries. Because there is considerable

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heterogeneity in ethnicity, as well as epidemiologic differences in Asia,¹⁷ we mainly focused on data from five East Asian countries: China, Japan, the Republic of Korea, Mongolia, and Taiwan. We concentrated our efforts on four risk factors carrying a high population attributable risk for stroke or stroke-related DALYs. These risk factors were hypertension, diabetes, hypercholesterolemia, and smoking (Tables 1 and 2). These factors are also recognized

as major culprits of atherosclerotic stroke in the Asia Pacific Cohort Studies Collaboration (APCSC), a collaborative project that pooled data regarding cardiovascular disease in the Asia Pacific region from 44 existing longitudinal cohort studies. In addition to data from nationwide studies in each country, we also investigated trends in the burden of risk factors using the published data on estimated trends between 1990 and 2008. These data included mean systolic blood pressure,¹⁸ fasting blood glucose,¹⁹ serum total cholesterol,²⁰ and prevalence of daily smoking.²¹ All

Table 1. Population-attributable risks of ischemic stroke⁸⁸

Risk factors	Population-attributable risk	
Hypertension		
Age (year)	Men	Women
20–34	99	98
35–44	99	106
45–54	100	103
55–64	100	102
65–74	100	101
75+	100	101
Diabetes	27–5	
High total cholesterol	9.1 (5.7–13.8)	
Cigarette smoking	14–12*	

*This value is for stroke deaths, not ischemic stroke incidence.

Table 2. Population-attributable fractions of stroke-related disability-adjusted life-years⁷²

Country	High systolic blood pressure	High fasting plasma glucose	High total cholesterol	Smoking
China	72.9	11.7	2.3	25
Japan	51.5	9.2	3.8	17.3
Mongolia	76.2	14	2.3	29.2
Republic of Korea	53.4	10.2	4.6	20.2
Taiwan	58.8	10.3	4.1	21.3
United Kingdom	47.7	9.4	5.4	14.7
United States	47.8	14.2	7.1	16.4

Table 3. Data sources and standardization methods used in previous studies estimating the trends of risk factors

Data	Data sources used for estimation	Standardization method
Mean systolic blood pressure ¹⁸	Data from published and unpublished health examination surveys and epidemiological studies (786 country-years and 5.4 million participants)	Age-standardized to the WHO reference population.
Mean fasting plasma glucose ¹⁹	Data from published and unpublished health examination surveys and epidemiological studies (370 country-years and 2.7 million participants)	
Mean serum total cholesterol ²⁰	Data from published and unpublished health examination surveys and epidemiological studies (321 country-years and 3.0 million participants)	
Smoking prevalence ²¹	Data from major multicountry survey programs, national multiyear survey programs, and 3 large databases (the WHO Global Infobase, the International Smoking Statistics, and the Global Health Data Exchange) (2,102 country-years of data for a total of 38,315 country-year-age-sex data points from 181 countries)	
Stroke incidence ^{4,65}	Data from the Global Burden of Diseases, Injuries, and Risk Factors study 2010	

WHO, World Health Organization.

Table 4. Commonly used definitions for traditional vascular risk factors

Risk factors	Definition
Hypertension	Systolic blood pressure \geq 140 mmhg and/or diastolic blood pressure \geq 90 mmhg or use of anti-hypertensive medication
Diabetes mellitus	Fasting glucose level \geq 7 mmol/L (126 mg/dL) or A1c \geq 6.5% or 2-hour plasma glucose in one 75-g oral glucose tolerance test \geq 11.1 mmol/L (200 mg/dL) or random plasma glucose \geq 11.1 mmol/L (200 mg/dL)
Hypercholesterolemia	Fasting total cholesterol \geq 6.2 mmol/L (240 mg/dL) or taking cholesterol lowering medication or serum high-density lipoprotein-cholesterol $<$ 1 mmol/L (40 mg/dL) or serum triglyceride \geq 2.3 mmol/L (200 mg/dL) or serum low-density lipoprotein-cholesterol \geq 4.1 mmol/L (160 mg/dL)
Current smoker	Currently smokes either every day or some days (\pm within 1, or 3, or 6 months) or smoked greater than 100 cigarettes in a lifetime and now smokes every day or some days

these estimated data were systematically standardized and validated, which enabled us to compare the burden of risk factors across countries (Table 3).

There are diagnostic criteria for these risk factors that have been used in other clinical reports (Table 4). In this study, the definitions of risk factors were as follows: hypertension was defined as having a systolic blood pressure of ≥ 140 mmHg, and/or a diastolic blood pressure of ≥ 90 mmHg, and/or use of antihypertensive agents; diabetes was defined as having a fasting glucose level of ≥ 7 mmol/L (126 mg/dL) or taking hypoglycemic agents; hypercholesterolemia was defined as having a total cholesterol level of ≥ 6.2 mmol/L (240 mg/dL). However, because there are wide variations in the definition of hypercholesterolemia between studies, we mainly used total cholesterol levels for this review.

Burdens of traditional risk factors for stroke in East Asia

Elevated blood pressure and prevalence of hypertension

Previously, populations in many East Asian countries, except Japan, were reported to have a lower prevalence of hypertension or mean systolic blood pressure lower than or similar to that of Western countries.²²⁻²⁴ Analyses of reports published between 1980 and the early 2000s indicated that the age-standardized prevalence of hypertension ranged between 19% and 28% in East Asian countries (China, the Republic of Korea, and Taiwan), while Japan had a higher prevalence of hypertension (38.3%).^{22,24} The age-standardized average systolic blood pressure in the Western Pacific region, which included China, the Republic of Korea, and Taiwan, had the lowest average (124 mmHg) among

the 14 world regions defined by the WHO.²³

However, the prevalence of hypertension has notably changed in different manners among East Asian countries. In Japan, there has been a decrease in mean systolic blood pressure in all age groups, as well as in both men and women since around 1965.^{25,26} Likewise, the prevalence of hypertension decreased in almost all age groups, except men aged > 50 years.²⁶ In the Republic of Korea, a national survey indicated that the age-adjusted prevalence of hypertension decreased from 29.9% in 1998 to 25.5% in 2014, although the prevalence fluctuated to some extent, with a slight increase to 29.0% between 2007 and 2012.²⁷ In Taiwan, nationwide surveys such as the Nutrition and Health Survey in Taiwan (NAHSIT), which was carried out between 1993 and 1996, and the Taiwanese Survey on Hypertension, Hyperglycemia, and Hyperlipidemia (TwSHHH), which was carried out in 2002, revealed that the age-standardized prevalence of hypertension decreased from 26.8% in NAHSIT (1993–1996) to 23.5% in TwSHHH (2002).²⁸ Unlike Japan, the Republic of Korea, and Taiwan, China seemed to experience a rise in the prevalence of hypertension. In China, the age-standardized prevalence of hypertension was 11.3% in 1991, 18.0% in 2002, and 26.6% in 2007–2008.²⁹⁻³¹ In Mongolia, two nationwide cross-sectional surveys conducted by STEPS (STEPwise Approach to Surveillance) indicated that the prevalence of hypertension was similar in 2005 (28.1%) and 2009 (27.3%).^{32,33} Figure 1 shows that the mean systolic blood pressure has increased since 1990 in China and Mongolia, while there was a decreasing trend for systolic blood pressure in other countries.

Within the East Asian population, blood pressure and the prevalence of hypertension has been reported to be higher in older aged men, those with high salt consumption, and populations in urbanized and medium-sized cities.^{5-7,24,31,34-38}

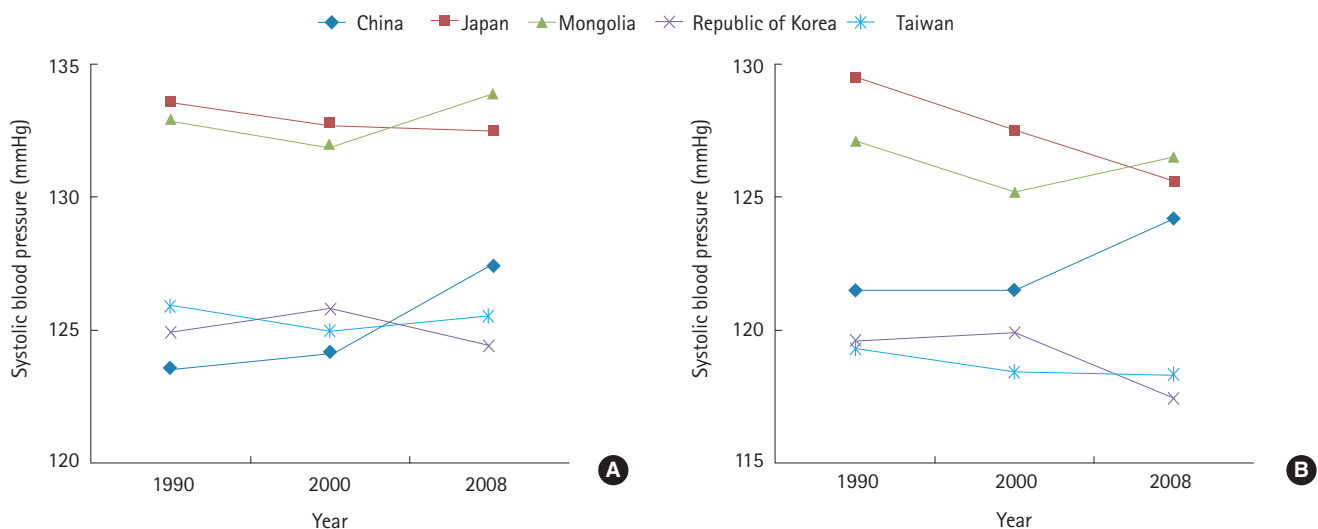


Figure 1. Trends in age-standardized mean systolic blood pressure (mmHg) for men (A) and women (B).

Diabetes

Globally, the number of diabetic adults has more than doubled over the last 30 years.¹⁹ In Asia, the pattern of increasing diabetes prevalence has been different from that found in other regions in that the increase has occurred over a much shorter time period. For example, the prevalence of diabetes in the United States has doubled over the past 40 years,³⁹ while the prevalence of diabetes in many Asian countries has increased 3–5-fold during the past 30 years.¹³ In China, the prevalence of diabetes has increased rapidly from 1% in 1980 to 9.7% in 2007–2008, and to 11.6% (including cases with HbA1c \geq 6.5) in 2010.^{40,41} Japan and the Republic of Korea have also experienced marked increases in the prevalence of diabetes.^{15,19,37} Likewise, the prevalence of diabetes has increased in Taiwan (3.15% in 2000 to 4.22% in 2008)⁴² and in Mongolia (2.9% in 1999 to 6.5% in 2009).^{32,43}

Global estimates of diabetes prevalence for 2013, provided by the International Diabetes Federation, showed that the prevalence of diabetes in East Asian countries (5.1% in Japan, 9.0% in China, 7.5% in the Republic of Korea, 8.3% in Taiwan) was similar to that in the United States (9.2%) and Canada (7.9%), and higher than that in the United Kingdom (4.9%). In fact, more than 40% of diabetic patients globally live in East Asia.⁴⁴ Mean fasting glucose has increased in China, Japan, and Mongolia, and decreased in the Republic of Korea and Taiwan between 1990 and 2008 (Figure 2).

The prevalence of diabetes and impaired glucose tolerance is expected to further increase in Asia at a rapid rate.⁴⁴ Because Asians have a greater risk of diabetes, even at earlier ages and lower BMI levels,^{12,13,15,45} rapid socioeconomic development, increases in westernized diet, and changes in lifestyle can aggra-

vate this phenomenon. Diabetes in East Asia was also related to older age, obesity, smoking, urban living, living in economically developed regions, and a family history of diabetes.^{41,46}

Hypercholesterolemia

East Asian populations had generally lower levels of serum total cholesterol than those of Western countries.⁵ Available reports indicate that Japan was one of the countries with the lowest values of total cholesterol in the world. However, total cholesterol levels in the Japanese population increased dramatically between 1958 and 1986.⁴⁷ The Republic of Korea and China also had increased mean total cholesterol levels in the 1970s and 1990s.⁴⁸ During this period, the incidence of ischemic heart disease in this region was reported to increase along with increased total cholesterol levels.^{49–51}

Although the trends for increased total cholesterol levels in East Asian adults and children prevail, mean age-standardized total cholesterol levels are still lower in most East Asian countries than in Western countries, including the United States and the United Kingdom.²⁰ However, in Japan, total cholesterol levels in males and females have increased by 0.13–0.15 mmol/L per decade, which has resulted in higher total cholesterol levels than those in the United States and Canada. In fact, total cholesterol levels in the Japanese population have approached levels found in Western Europe.²⁰ Figure 3 shows that there was a rise in serum total cholesterol levels in Japan, China, and the Republic of Korea. However, decreasing trends for serum total cholesterol levels were noted in Mongolia and Taiwan, although previous reports suggest that there is a trend for an increase in dyslipidemia in these two countries.^{52,53}

These trends for increasing total cholesterol levels in many

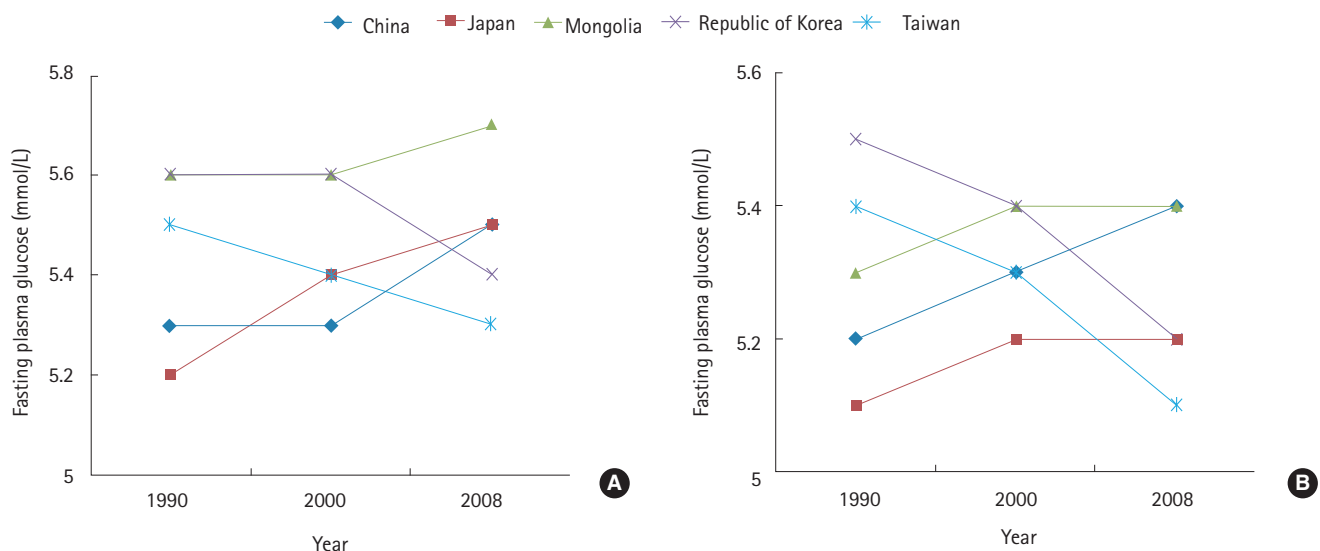


Figure 2. Trends in age-standardized mean fasting blood glucose (mmol/L) for men (A) and women (B).

East Asian countries were associated with increasingly older populations, changes in dietary patterns, and rapid urbanization.^{32,33,54} As mentioned earlier, because of the epidemic transition over the past decades in East Asia, westernized diet patterns of total and saturated fat consumption, foods from animal sources, and processed foods, together with low levels of physical activity, have become more common.^{20,55,56} The incidence of obesity has also increased over the past decades, even among Asian young adults and children.⁵⁷⁻⁶⁰ These changes have played a role in the increase in average cholesterol levels in East Asia.

Smoking

Asia is the world's largest tobacco consuming region, with seven Asian countries in the top ten countries ranked as having the highest tobacco consumption levels. China was ranked num-

ber one with 301 million current smokers, which composed 28.1% of adults in 2010.⁶¹ Other countries in East Asia also had similar rates of current smokers (the Republic of Korea [24.2% in 2014]²⁷ and Mongolia [27.7% in 2009]³²).

Historically, there has been an imbalance in smoking prevalence between men and women in East Asia. Approximately 40–50% of men in East Asia are current smokers, which is a proportion higher than those found in the United States and the United Kingdom.^{5,62} The prevalence of smoking (current or former smokers) reaches 70–80% among men aged 50–59 in China, Japan, and the Republic of Korea.⁶² However, the prevalence of smoking in women is low. Thus, the ratios of prevalence between male and female smokers is about 22:1 in China,⁶¹ 3:1 in Japan,³⁷ 7:1 in the Republic of Korea,³⁶ and 7:1 in Mongolia.³²

In China, Japan, the Republic of Korea, and Taiwan, the preva-

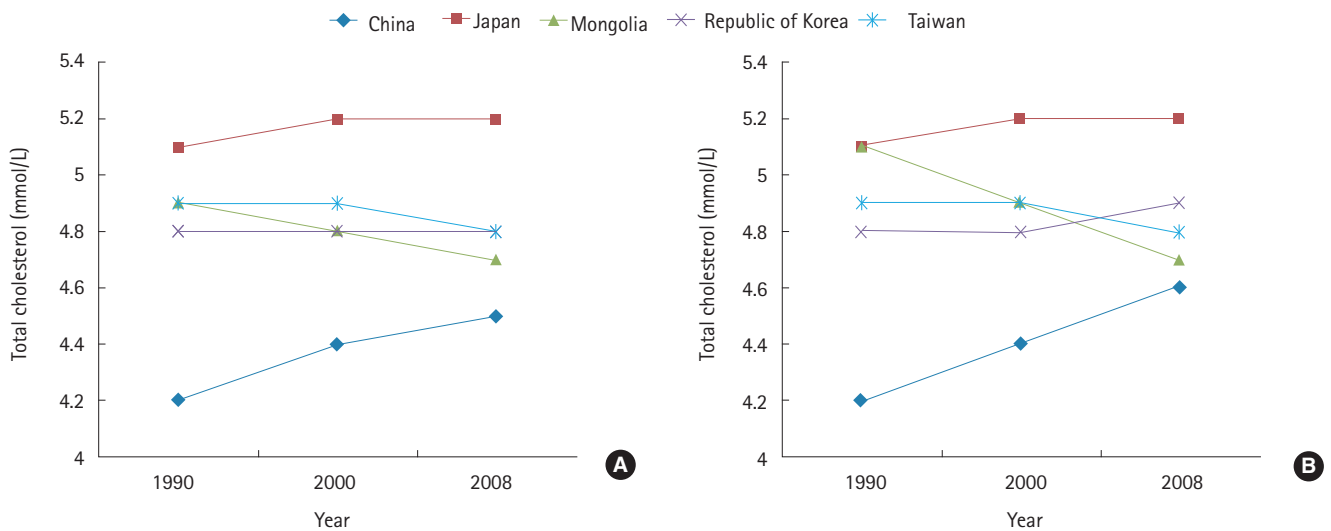


Figure 3. Trends in age-standardized mean total cholesterol (mmol/L) for men (A) and women (B).

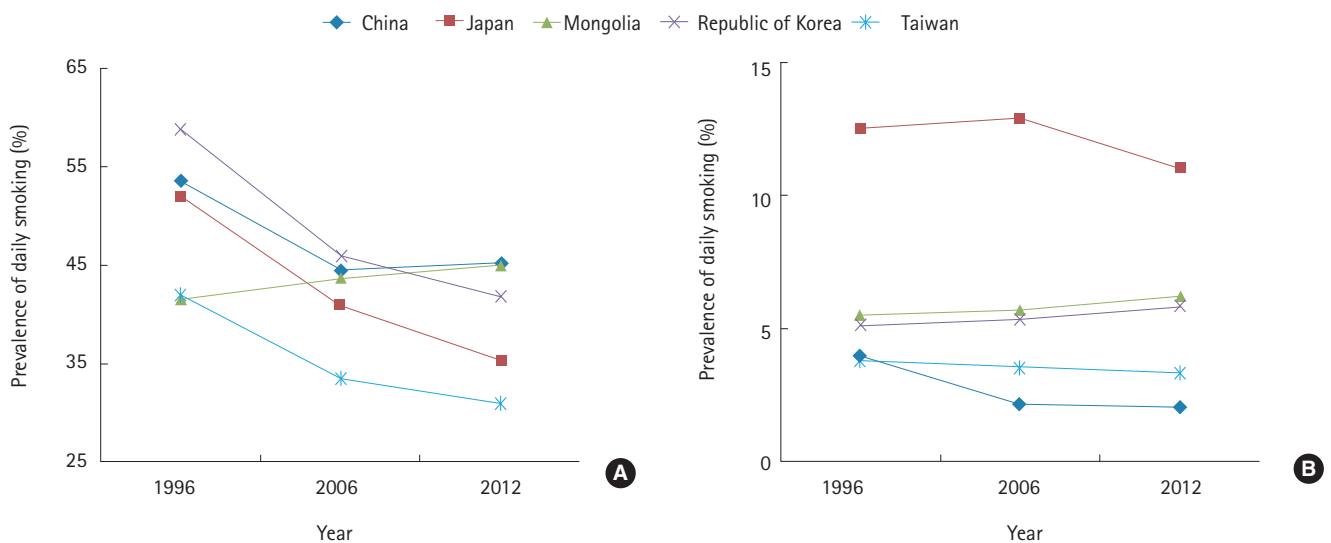


Figure 4. Trends in age-standardized prevalence (%) of daily tobacco smoking for men (A) and women (B).

lence of current smoking in men has decreased over the past decades,^{37,63} although it is still high. In contrast, the prevalence of current smoking has increased in Mongolia (Figure 4).⁵² Moreover, there seems to be an increase in smoking among women and younger aged groups in some East Asian countries, such as China,⁶⁴ the Republic of Korea,²⁷ and Mongolia.^{32,33}

Impact of vascular risk factors on stroke among Asian populations

Trends of stroke incidence in East Asian countries

To compare stroke incidence between countries, we extracted data regarding stroke incidence in 5 countries from the Global Burden of Diseases, Injuries, and Risk factors study (GBD 2010) (Table 3).^{4,65} Data from the United States and the United Kingdom were also used for comparison. In 1990, age-standardized stroke incidences (per 100,000 person-years) in East Asian countries were 247.53–347.78, which was higher than those found in the United States (220.66) and the United Kingdom (141.97). Since 1990, stroke (either ischemic or hemorrhagic) incidence has increased in China, Mongolia, and Taiwan, while there was a

decrease in stroke incidence in Japan and the Republic of Korea (Figure 5). In Taiwan, the increase in total stroke incidence was due to an increase in hemorrhagic stroke incidence. In 2010, all East Asian countries, except for the Republic of Korea, still had higher stroke incidences compared to the United States and the United Kingdom (Figure 5).

Relationships between risk factors and stroke incidence in East Asia

As shown earlier, in China and Mongolia, there was an increase in stroke incidence between 1990 and 2010, along with an increase in mean systolic blood pressure and the prevalence of hypertension. In contrast, there were decreases in stroke incidence in Japan and the Republic of Korea, with decreasing mean systolic blood pressures and a decreasing prevalence of hypertension. High blood pressure had the highest effect on stroke in the East Asia and Pacific region, with population-attributable fractions of 50% of stroke mortality.³⁷ Elevated systolic blood pressure had a stronger relationship with stroke (in particular, hemorrhagic stroke) in Asians than in non-Asian populations.⁶⁶⁻⁷⁰ A recent meta-analysis using population-based cohort studies of

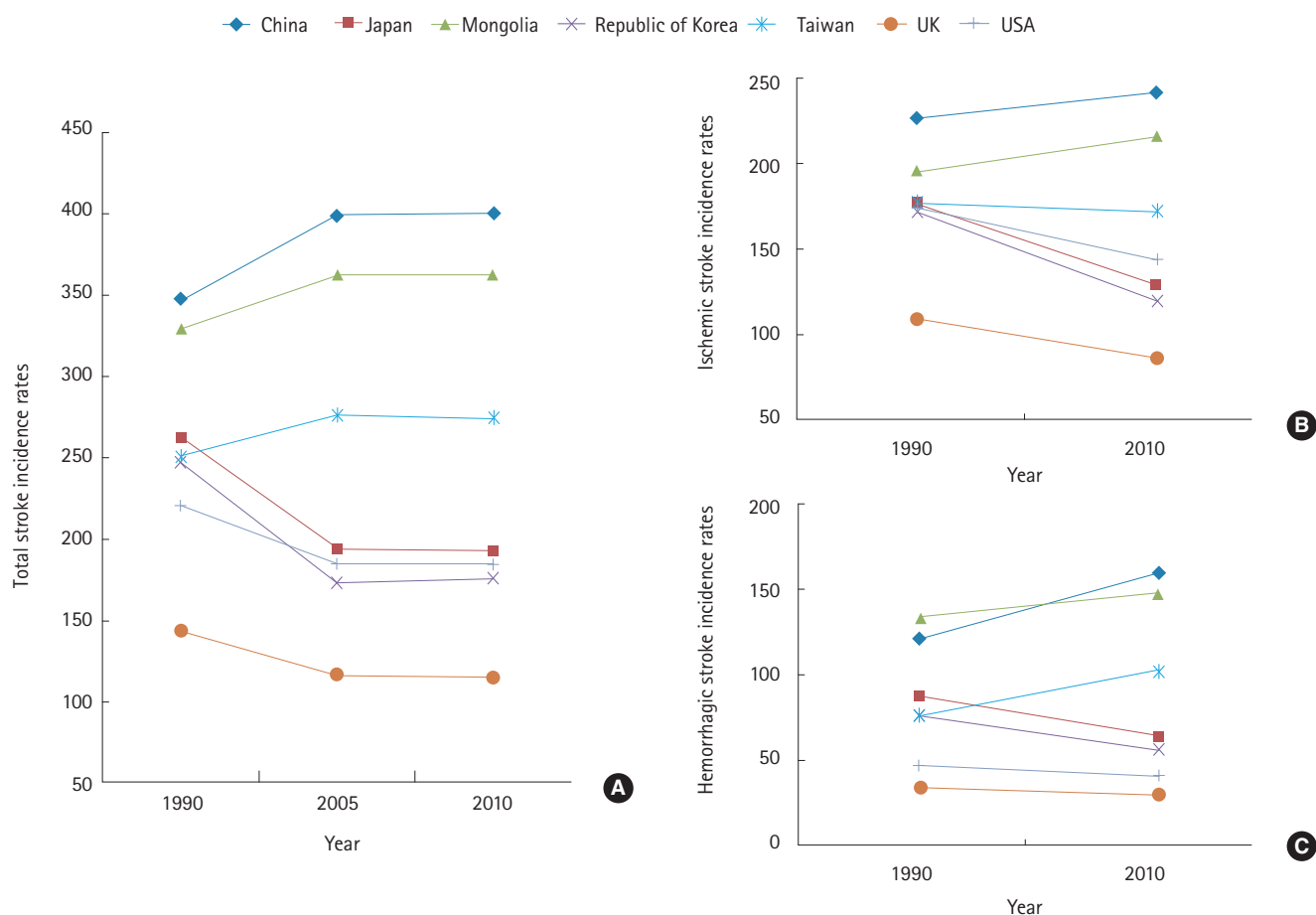


Figure 5. Trends in age-standardized incidence rate (per 100,000 people) of total stroke (A), ischemic stroke (B), and hemorrhagic stroke (C).

11 Western countries and 11 Asian countries (mainly China, Japan, and the Republic of Korea), also demonstrated that the risk of stroke associated with elevated blood pressure was greater among Asians than Western populations. This is indicated by the fact that the hazard ratio (HR) for systolic blood pressure ≥ 140 mmHg and the presence of hypertension were 6.22 and 2.84, respectively, in Asians, compared to 2.39 and 1.79 in Western populations.⁷¹ The Global Burden of Disease Study 2013 indicated

that high systolic blood pressure had the largest effect on the burden of stroke in East Asian countries, accounting for a population-attributable fraction of 52–73% of stroke-related DALYs. This is higher than the burden reported in the United Kingdom (48%) and the United States (48%) (Table 2).⁷² Recently, the INTERSTROKE study also showed that the population-attributable risk of stroke due to hypertension was higher in Asian populations than in those of other ethnicities or regions.⁷³ These results

Table 5. Awareness, treatment, and control rate (%) of risk factors over the decades

Risk factor	Item	China	Japan	Mongolia	Republic of Korea	Taiwan
Hypertension	Awareness	44.7 in 2000–2001, ³⁸ 24 in 2002, ³⁰ 45 in 2007–2008 ³¹	54 in 2000, ⁸⁹ 65.7 in men and 72.7 in women in 2000–2001 ⁹⁰		33.5 in 2001, 63.2 in 2010–2012 ²⁷	22–22.5 in men and 39–39.3 in women in 1993–1996, ^{28,91} 55.8 in men and 73.6 in women in 2002 ²⁸
	Treatment	28.2 in 2000–2001, ³⁸ 20 in 2002, ³⁰ 36.2 in 2007–2008 ³¹	46.1 in 2000, ⁹² 33.2–53.5 in men and 34.3–62 in women in 2000, ²⁶ 16.4–61.1 in men and 33.3–57.1 in women in 2000–2001, ⁹⁰ 54.4 in 2008, ⁸⁹ 29.6 in 2009, ⁹³ 43.4–64.6 in men and 31.2–68.8 in women in 2010 ²⁶	74.2 in 2006, ³³ 38.9 in 2009 ³²	31.9 in 2001, 57.6 in 2010–2012 ²⁷	13–13.4 in men and 27.6–28 in women in 1993–1996, ^{28,91} 44.3 in men and 59.4 in women in 2002 ²⁸
	Control	8.1 in 2000–2001, ³⁸ 5 in 2002, ³⁰ 11.1 in 2007–2008 ³¹	15.2–23.4 in men and 21.6–27.8 in women in 2000, ²⁶ 11.9 or 41.5 in 2000, ^{89,92} 27 in 2008, ⁸⁹ 23.7 or 24.8 in 2009, ^{89,93} 29.9–33.3 in men and 40.5–44.1 in women in 2010 ²⁶	13.3 in 2009 ³²	12.1 in 2001, 40.5 in 2010–2012 ²⁷	2–2.4 in men and 5–5.1 in women in 1993–1996, ^{28,91} 21 in men and 28.5 in women in 2002 ²⁸
Diabetes	Awareness	23.7 in 2000–2001, ⁹⁴ 30.1 in 2010 ⁸²			71.3 in 2010–2012 ²⁷	70 in men and 63 in women in 1993–1996 ⁹⁵
	Treatment	20.3 in 2000–2001, ⁹⁴ 25.8 in 2010 ⁸²		37.4% with drugs, 13.7% with insulin in 2006, ³³ 16.7% with drugs, 9.9% with insulin in 2009 ³²	62.3 in 2010–2012 ²⁷	
	Control	8.3 in 2000–2001, ⁹⁴ 39.7 (among patients treated) in 2010 ⁸²	34 in 2000–2002, ⁹⁶ 36.2–43.1 in 2006–2008 ⁹⁷		28.2 in 2010–2012 ²⁷	27 in 1998, ⁹⁸ 11.2 (among patients with insulin therapy) in 2005–2006, ⁹⁹ 11.7 (among patients with insulin therapy) in 2010–2012 ¹⁰⁰
Hypercholesterolemia	Awareness	24.4 in 2003–2013 ¹⁰¹	55.7 in men and 58.6 in women in 2000–2001 ⁹⁰		45.2 in 2010–2012 ²⁷	
	Treatment	8.8 in 2003–2013 ¹⁰¹	13.3–52.2 in men and 16.7–52.5 in women in 2000–2001, ⁹⁰		35 in 2010–2012 ²⁷	
	Control	4.3 in 2003–2013 ¹⁰¹	72.3 (44.5 for secondary prevention) in 2009 ¹⁰²		28.1 in 2010–2012 ²⁷	64.9 in 2002–2003, ¹⁰³ 65.9 (among patients with lipid lowering therapy) in 2006–2007 ¹⁰⁴

imply that stroke or stroke burden can be effectively prevented by better hypertension management in Asia. In fact, improvements in hypertension control were related to decreases in systolic blood pressure and the risk of stroke or stroke burden in Japan and the Republic of Korea. Although the impact of hypertension on stroke has declined during the past several decades owing to improved management of hypertension, hypertension is still the strongest risk factor for stroke in East Asia.^{74,75}

The trends for diabetes or hypercholesterolemia have not always been comparable to changes in stroke incidence in different countries. This may be due to relatively smaller effects of diabetes or hypercholesterolemia compared to hypertension on the incidence of stroke. However, as the impact of hypertension on stroke occurrence decreases, the contributions of diabetes or hypercholesterolemia will become greater. In fact, in Japan, a rapid increase in the prevalence of metabolic disorders such as glucose intolerance, hypercholesterolemia, and obesity, has offset the impacts of improvements in hypertension control on stroke occurrence.⁷⁴ Furthermore, considering that many Asian countries have experienced increasing burdens of atherosclerosis in intra- and extra-cranial cerebral arterial beds, which can be affected by hypercholesterolemia and metabolic syndrome,^{76–80} the increasing trends for diabetes and hypercholesterolemia may have greater effects on stroke risk in the future.

Awareness, treatment, and control rates of risk factors

Table 5 summarizes previous reports regarding awareness, treatment, and control rates of traditional risk factors for stroke. Although it is difficult to compare these rates directly because of difference in study populations and methodologies, awareness, treatment, and control rates of traditional risk factors for stroke seemed to have increased in many East Asian countries (Table 5). For example, rising trends for awareness rates for hypertension have been observed in the Republic of Korea (34% in 2001 and 63.2% in 2010–2012),²⁷ and Taiwan (about 23–39% in 1993–1996 and 56–74% in 2002).²⁸ There has also been an increase in the control rates for hypertension in Japan, the Republic of Korea, Taiwan, and China (Table 5).

In Asia, the awareness and treatment rates of vascular risk factors are higher in older populations, women, and patients living in urban areas.^{26,27,30,38,81,82} Increases in education level, preventive measures implemented by health professionals and the government, and campaigns and advertisements may have contributed to these improvements in awareness, treatment, and control rate of risk factors.⁸³ However, despite the improvements, these rates, particularly the control rate, still remain low. Most

regions have lower than approximately 50% control rates. These rates are lower than those in Western countries. For example, in the United States, the awareness, treatment, and control rates of hypertension were 81%, 74%, and 53%, respectively.⁸⁴ This implies that proper public health strategies and optimal treatment approaches should be adopted to further reduce stroke and cardiovascular risks. For example, innovative initiatives targeting children have shown some success. A meta-analysis of 58 studies evaluating interventions in children to increase stroke awareness indicated a 70% improvement compared to baseline.⁸⁵

Many East Asian countries have had weak national legislation prohibiting passive smoking or restricting the activities of the tobacco industry.⁶² In fact, the percentage of those planning to stop smoking is low (<20%) among current Asian smokers. Support for the cessation of drug use is not enough. For example, only 5–14% of smokers use nicotine replacement drugs in East Asia. Considering the benefits of implementing multi-component quitting assistance systems on smoking cessation,^{62,86} more aggressive multidisciplinary tobacco control policies are needed in many East Asian countries.

Limitations

There are some limitations in this review. First, we did not include other risk factors, such as atrial fibrillation (AF), whose incidence is expected to increase in Asia.⁸⁷ Second, the associations between traditional risk factors and stroke subtypes or stroke mechanisms were not reviewed in detail. In addition, other Asian regions, such as South and Southeast Asia, were not included in this review.

Conclusions

Over the past decades, Asia has experienced rapid epidemiologic transitions. Along with economic and nutritional changes, the burden of vascular risk factors and their impact on cardiovascular disease has changed in East Asian countries. Although there are some variations between countries, hypertension is still prevalent and a significant risk factor for stroke in many Asian countries. The burdens of diabetes and hypercholesterolemia will continue to increase. Asia also remains a high tobacco consuming area. Although awareness of patients' diagnoses and risk factors has improved compared to the past decades, these rates remain low. Treatment and control rates are even lower in East Asia. The incidence or burden of stroke has differentially changed in response to the burdens of risk factors in Asian countries. These imply that further efforts will be required to determine the exact epidemiologic statuses and to plan interventional ap-

proaches for reducing the burdens of risk factors and stroke in East Asia.

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