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by


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# CADENZA: A Jockey Club Initiative for Seniors

CADENZA: A Jockey Club Initiative for Seniors is launched and funded by The Hong Kong Jockey Club Charities Trust in light of the rapidly ageing population. It is a HK$380 million project in partnership with the Faculty of Social Sciences of The University of Hong Kong and the Faculty of Medicine of The Chinese University of Hong Kong. The project aims at creating an elder-friendly environment in Hong Kong to foster positive community attitude towards ageing and continuously improve the quality of care and quality of life of older people.

CADENZA is an acronym for "**C**elebrate their **A**ccomplishments; **D**iscover their **E**ffervescence and **N**ever-ending **Z**est as they **A**ge." In classical music, a "Cadenza" is an extended virtuosic section, usually near the end of a movement in a concerto. The word is used figuratively to describe the apex of one's life and the celebration of a lifetime's accomplishments.

CADENZA has 4 major components:

1. ***Public Education*** is to promote positive ageing and highlight important issues pertaining to the elderly population, covering 6 themes: (i) health promotion and maintenance, (ii) health and social services in Hong Kong, (iii) living environment, (iv) financial and legal issues, (v) quality of life and quality of dying, and (vi) age disparities.

2. ***Community Projects*** are innovative and sustainable service models designed to cope with the changing needs of seniors. One of the innovative projects is the establishment of The Jockey Club CADENZA Hub in Tai Po, which is an integrated primary health and social care centre for the old and the soon-to-be-old.

3. ***Training*** programme offers on-line courses, workshops and public seminars to train different levels of health and social care professionals, front line workers, carers and the general public.

4. ***Leadership Training Programme and Research*** is to nurture academic leadership in gerontology, conduct research to advance gerontological knowledge and evaluate the outcomes of CADENZA programmes.

The findings covered by this report are part of the series "Challenges of population ageing on disease trends and burden" carried out by CADENZA in collaboration with the Department of Community Medicine, the School of Public Health of The University of Hong Kong. This series utilises existing data to estimate the effect of the ageing population on the impact of various chronic diseases on individuals and society as a whole. The current volume of the series focuses on stroke. This report is made available to the public with the compliments of The Hong Kong Jockey Club Charities Trust.

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# Contents

# Preface

As with many other non-communicable diseases, age is a strong risk factor for stroke occurrence. With population ageing, the number of people with stroke is expected to increase. Worldwide stroke is the second most common cause of mortality after ischemic heart disease (Strong *et al.*, 2007). In Hong Kong, it is the forth most common cause of mortality (Department of Health of Hong Kong Special Administrative Region, 2009). Stroke is also among the leading causes of Hong Kong's bed-day use in hospitals run by the Hospital Authority and accounts for between 30 and 50% of admissions to long term residential care homes (Chan *et al.*, 2008; Woo *et al.*, 1998a; Woo *et al.*, 2008). Approximately half of all strokes result in disability, physical dependency and dementia; hence, stroke is a disease with significant impact on the individual, the individual's family, as well as society (Leys *et al.*, 2005; Young and Forster, 2007). The World Health Organization (WHO) has three classifications of post stroke sequelae: impairment, functioning (or disability) and participation (or handicap) (WHO, 2001). The effect of stroke on the psychosocial well being of survivors, in particular depression and poor health-related quality, has been documented. In Hong Kong, depression occurs in 17.2% of stroke survivors (Tang *et al.*, 2002), while quality of life is reported to deteriorate steadily over the 12-month period following stroke occurrence in spite of some recovery in physical function, accompanied by an increased level of handicap (Chau *et al.*, 2007; Kwok *et al.*, 2007). In view of the significant human and economic burden of stroke, a review of trends in incidence, prevalence, mortality and case-fatality will provide information for future service planning as well as provide an indicator of the effectiveness of health promotion efforts in stroke prevention and treatment of the disease, with population ageing taken into account. An estimate of economic burden will also be made.

# Executive Summary

# Executive Summary

Although a decreasing trend in mortality of stroke has been observed in recent decades, stroke is among the leading causes of death worldwide. In Hong Kong, the number of people aged 65 and above is rapidly increasing and it is projected that there will be 2.3 million people aged 65 and above in 2036. Hence, the prevalence of stroke is expected to increase significantly, and the impact of stroke as well as the costs of hospitalization and long term health and social care will be substantial. An examination of the trend in prevalence, incidence, mortality and case-fatality over the years therefore facilitates an accurate estimation of the current and future burden of stroke and better stroke recovery services in Hong Kong.

## Prevalence

Based on self-reported data from population-based household surveys, there was an increasing trend in the prevalence rates of stroke among older people in Hong Kong between 1998 and 2008, with the rate among the community-dwelling population aged 65 and above being 2.8% in 1998/2001, 5.5% in 2003/2004, 4.2% in 2004 and 4.9% in 2008. Males and females have different trends in stroke prevalence. While the prevalence rates of stroke followed an increasing trend in women between 1998 and 2008, the rate of men increased slightly from 1998 to 2004 and remained stable between 2004 and 2008. The prevalence rates of stroke increased with age for both genders and males tended to have a higher prevalence rate of stroke than females. People with stroke also represent a large proportion of those living in institutions. According to self-reported estimates, the prevalence rate of stroke among the institutional older people aged 65 and above was 30.9% in 2008. We projected that the number of people aged 65 and above with stroke would be more than double from 0.06 million in 2010 to 0.16 million in 2036. Compared with other countries, the prevalence rates of self-reported stroke reported in the population-based household survey in Hong Kong in 2003/2004 were higher than those reported in Australia but lower than those reported in the United States and the United Kingdom.

There was an increasing trend in the prevalence rates of stroke among older people in Hong Kong between 1998 and 2008.

The number of people aged 65 and above who have stroke was projected to increase from 0.06 million in 2010 to 0.16 million in 2036, based on the effect of the demographic changes only.

## Incidence

Based on hospital admission data, the annual age-adjusted incidence rates of first-ever stroke among people aged 65 and above decreased slightly from 14.1 per 1,000 population in 2000-2001 to 10.5 per 1,000 population in 2006-2007 in Hong Kong. Trends of hemorrhagic and ischemic stroke incidence were different, with decreasing trend in ischemic stroke but non-decreasing trend in hemorrhagic stroke. Standardized to the WHO World Standard Population, the age-adjusted ischemic stroke incidence rates for both males and females in Hong Kong were much higher than those in Japan and Australia. As for hemorrhagic stroke, the age-adjusted rates were also much higher than those of males and females in Australia as well as males in Japan.

The annual age-adjusted incidence rates of first-ever stroke amongst those aged 65 and above in Hong Kong were decreasing from 14.1 per 1,000 population in 2000-2001 to 10.5 per 1,000 population in 2006-2007.

## Mortality

Stroke is the fourth leading cause of death in Hong Kong. In 2009, there were 3,443 deaths from stroke, accounting for 8.4% of all deaths. Although the age-adjusted stroke mortality rate among people aged 65 and above decreased between 2001 (438.5 per 100,000) and 2009 (331.5 per 100,000), the number of deaths from stroke increased gradually among those aged 65 and above during the same period, probably attributed by the ageing population. The mortality rates increased sharply with age. In 2009, the age-adjusted mortality rates from stroke among those aged 65 and above (331.5 per 100,000) was over 40 times higher than those aged below 65 (7.9 per 100,000). Males had higher mortality rates than females. Standardized to the WHO World Standard Population, the age-adjusted mortality rates for stroke in Hong Kong were higher than the United States, the United Kingdom, Australia, Japan and Singapore but much lower than China.

The age-adjusted stroke mortality rate among people aged 65 and above decreased slightly between 2001 (438.5 per 100,000) and 2009 (331.5 per 100,000).

## Case-fatality

In Hong Kong, a slow decrease in stroke case-fatality rate was observed between 1999 and 2007. Based on hospital admission data, the 30-day case-fatality rates for stroke (ICD-9: 430-434, 436-437) among stroke patients aged 65 and above have decreased from 14.0% in 1999 to 12.8% in 2007. Case-fatality rates of stroke increased steeply with age, and females aged 85 and above tended to have a higher case-fatality rate of stroke than males. A higher case-fatality rate of hemorrhagic stroke was also noted during the same period.

Based on hospital admission data, the 30-day case fatality rates for stroke among stroke patients aged 65 and above decreased from 14.0% in 1999 to 12.8% in 2007.

## Physical, psychological and social consequence

Stroke not only has its greatest impact on physical and cognitive function, but also affects the survivor's psychological well-being, social roles, and relationships with family members and friends. Cognitive impairment, dementia and depression are common among stroke survivors and evidence suggests that they are the main causes of dependency. Depression after stroke can also affect the survivor's emotional functioning, functional and cognitive abilities, and quality of life. Changes in social roles associated with stroke may also increase the stress of family relationships, lower self-esteem and cause depression in stroke survivors. Evidence suggests that loss of self-esteem following stroke contributes to functional disability and societal participation restriction. Given that physical, psychological and social impacts of stroke are interrelated, they should be integrated in stroke recovery.

Physical, psychological and social impacts of stroke are interrelated and therefore should be integrated in stroke recovery.

## Disability burden

Stroke is the leading cause of functional disability in older people. In 2006, nearly 119,000 Disability-Adjusted Life Years (DALYs) were lost due to stroke among people aged 65 and above in Hong Kong. Most of the burden was due to disability, with about 106,000 Years Lost due to Disability (YLDs) making up nearly 90% of DALYs. The remaining 10% of the burden was due to the estimated premature mortality of 13,000 Years of Life Lost (YLLs) due to stroke.

In 2006, nearly 119,000 DALYs were lost due to stroke among older people in Hong Kong.

## Economic burden

Hospitalization, out-patient care, rehabilitation service and community allied health service were the major components of direct medical costs of stroke. In 2006, over HK$ 1,332 million was spent on these services alone, of which hospitalization was the largest, accounting for over 80% of the cost. By 2036, direct medical cost is expected to increase to around HK$ 3,979 million per year. The cost of institutional care is substantial and is projected to increase by 1.8 times to HK$ 4,529 million per year as the prevalence of people with stroke living in institutions grows. The indirect cost resulting from premature death from stroke and lost productivity are also huge. The intangible costs due to stroke range from 133,000 to 283,000 Quality Adjusted Life Years (QALYs).

By 2036, it is projected that approximately HK$3,979 million will be spent on hospitalization, out-patient care, rehabilitation service and community allied health service among stroke patients aged 65 and above in Hong Kong per year.

It is projected that approximately HK$4,529 million will be spent on institutional care among people aged 65 and above with stroke in Hong Kong in 2036.

## Implications and Recommendations

Although the incidence of ischemic stroke is following a declining trend, the incidence is still high, while the rate of hemorrhagic stroke has remained fairly stable, suggesting the need for better preventive efforts towards effective stroke prevention, in particular better control of hypertension. The slower rate of decline in case-fatality compared with the decline in incidence suggests that public awareness of symptoms of onset of stroke could be improved. Hence, raising public awareness of symptoms of acute stroke may reduce delay in arrival at hospitals, enabling appropriate early treatment that may reduce mortality and disability. Moreover, provision of rehabilitation services for longer periods at appropriate institutional or community settings is needed in order to maximize recovery potential. Community centres may also incorporate maintenance stroke rehabilitation exercises as part of their regular programme of activities.

# Chapter 1

# Introduction

# Chapter 1

# Introduction

## 1.1 Overview

A stroke is caused by the interruption of blood flow to the brain, usually because a blood vessel bursts or is blocked by a clot. This cuts off the supply of oxygen and nutrients, causing damage to brain tissue (WHO, 2010). The major risk factors for stroke are similar to those for coronary heart disease. Ageing is one of the risk factors for stroke. Other common risk factors for stroke are: high blood pressure, abnormal blood lipids, tobacco use, physical inactivity and obesity, unhealthy diets, chronic stress, alcohol use, drug abuse, use of oral contraceptives, hormone replacement and anti-blood coagulation therapy, family history, and medical conditions that include diabetes mellitus, congenital brain arterial aneurysms and abnormalities, heart and blood vessel diseases and also history of stroke (Department of Health of Hong Kong Special Administrative Region, 2010; WHO, 2010). With the global ageing trend, the prevalence of stroke is increasing worldwide in both developed and developing countries.

The most common symptoms of stroke are sudden weakness of the face, arm and/or leg, and most often on one side of the body. Other symptoms include sudden onset of numbness of face, arm, and/or leg especially on one side of the body, slurring or loss of speech, difficulty seeing with one or both eyes, unsteadiness or falls, dizziness, severe headache with unknown cause, confusion or unconsciousness (Department of Health of Hong Kong Special Administrative Region, 2010; WHO, 2010). In hospitals, computer tomography (CT) scan is an important neuroimaging technique to assist prompt diagnosis and to differentiate the stroke-related cause of bleeding or infarction in the brain. However, a CT scan is found to be insensitive to detect the small areas of infarction especially in most cases of early infarction. Hence, clinicians order magnetic resonance imaging (MRI) when a diagnosis cannot be confirmed. MRI is useful in picking up very small strokes that cause minimal neurologic deficits whilst radiological angiographies are beneficial in screening for extracranial and intracranial vessels blockage or narrowing (Silverman and Rymer, 2009). The National Institute of Health Stroke Scale (NIHSS) is widely used to evaluate and document the severity of cerebral infarction in stroke patients (Brott *et al.*, 1989; National Institute of Neurological Disorders and Stroke, 2010). The context of the scale is to quantify the stroke-related neurologic deficits of the patient based on a 15-item neurologic examination. The NIHSS score is proven to be sensitive in helping predict both short-term and long-term outcomes from stroke. It is commonly used by neurologists to assist decision making on treatment modalities for acute ischemic strokes (Silverman and Rymer, 2009).

Stroke carries a high risk of death. Other adverse consequences of stroke vary from mild limb weakness to long term physical disability or combined physical and mental disabilities (WHO, 2010). Complications like limb weakness and loss of speech particularly affect activities of daily living; whilst impaired swallowing increases risk of aspiration pneumonia that may cause death. Nevertheless, most of the major risk factors for stroke are preventable by modifying lifestyle choices as well as controlling blood pressure, blood lipids and existing medical conditions. To date, some stroke survivors can continue living with a relatively good quality of life with improved mobility and self care ability after receiving prompt medical treatment and undergoing rehabilitative programmes.

## 1.2 Types of stroke

According to the American Stroke Association, there are three common types of stroke: ischemic, hemorrhage and transient ischemic attack (American Stroke Association, 2010).

- Ischemic stroke accounts for about 87% of all strokes. It occurs as a result of an obstruction within a blood vessel supplying blood to particular parts of the brain. The underlying condition for the type of obstruction is the development of fatty deposits lining the vessel walls. The condition is called atherosclerosis. These fatty deposits can cause two types of obstruction: cerebral thrombosis and cerebral embolism.
  - Cerebral thrombosis refers to a thrombus (blood clot) that develops at the dogged part of the atherosclerotic vessel.
  - Cerebral embolism refers generally to a blood clot (embolus) that forms at another location in the circulatory system, usually the heart and large arteries of the upper chest and neck. The loosened blood clot enters the blood stream, travels through the brain's blood vessels, reaches vessels which are too small for it to pass and causes blockage of blood flow in the vessels.
- Hemorrhagic stroke accounts for about 15-30% of all strokes. Hemorrhagic stroke results from a weakened vessel that ruptures and bleeds into the surrounding brain tissue. This possibly causes an increase of intracranial pressure that restricts the supply of oxygen and nutrients to brain cells. The weakened vessels can be an aneurysm or arteriovenous malformation. Two common subtypes of hemorrhagic stroke are intracerebral hemorrhage or subarachnoid hemorrhage.
- Transient ischemic attack is a minor or warning sign of a major stroke. The symptoms of stroke last less than 24 hours. A transient ischemic attack is caused by an obstruction (blood clot) in a blood vessel of the brain which resolves itself through normal mechanisms within a short time.

## 1.3 Diagnosis of stroke

When stroke is suspected, prompt and accurate diagnosis is necessary to minimize brain tissue damage. Diagnosis includes a medical history, a physical examination, a neurological examination, blood tests, imaging tests, electrical tests, Doppler ultrasound and angiography.

- Physical examination includes assessing the airway, breathing, circulation and vital signs. The head and extremities are also examined to help determine the cause of the stroke and rule out other conditions that produce similar symptoms.
- The neurological examination is a series of simple questions and tests that provide crucial information about the nervous system. It is divided into several components, each focusing on a different part of the nervous system: mental status, cranial nerves, motor system, sensory system, the deep tendon reflexes, coordination and the cerebellum, and gait. The examination requires skill, patience, and intelligence on the part of the physician, and cooperation from the patient.
- Blood tests (e.g., complete blood count and lipid profiles) help the physician look for diseases known to increase the risk of stroke.
- Imaging tests help the physician determine the type of stroke and rule out other conditions, such as infection and brain tumour. The most common tests are a CT scan and an MRI which produce a 3-dimensional image of the brain and show the location and extent of a brain injury. The image produced by an MRI is sharper and more detailed than a CT scan; hence, it is often used to diagnose small and deep injuries.
- Electrical tests show the brain's electrical activity. There are two basic tests: electroencephalogram (EEG) and evoked response. In an EEG, small metal discs (electrodes) are placed on a person's scalp to pick up electrical impulses. These electrical signals are printed out as brain waves. An evoked response test measures how the brain handles different sensory information. Electrodes record electrical impulses related to hearing, body sensation or vision.
- Doppler ultrasound uses high-frequency sound waves to produce images of blood flow through the arteries and to determine the size and location of arterial blockages in the vessels that bring blood to the brain. A carotid Doppler is used to measure blood flow in the carotid arteries while a transcranial Doppler is used to measure blood flow in the large arteries in the brain. There is also another ultrasound test, leg ultrasound, which looks for blood clots in the deep veins of the legs.

- Angiography is a medical procedure which involves injecting a contrast agent (dye) into the bloodstream and taking a series of x-rays of blood vessels. This test is used to identify the size and location of arterial blockage and to detect aneurysms and malformations.

## 1.4 International Classification of Diseases (ICD)

The International Classification of Diseases (ICD) is published by the WHO for the international standard diagnostic classification of disease. The ICD is commonly used to classify diseases and other health problems on records including death certificates and hospital discharge records. The ICD codes for strokes are:

- ICD 9$^{th}$ version (ICD-9): 430-438
- ICD 10$^{th}$ version (ICD-10): I60-I69

## 1.5 Data quoted in this report

This report examines all types of stroke together unless a specific type of stroke is explicitly stated. For mortality statistics, the ICD is used for classifying stroke in Hong Kong. As the statistics quoted in this report were compiled from different sources, the conceptualization and compilation methods could vary considerably across studies. The comparisons presented in this report, therefore, can only be interpreted in a broad sense. It is recommended that readers consult the cited references for the meta-data of the studies.

Chapter 2

# Worldwide Trends and Burden of Stroke

# Chapter 2

# Worldwide Trends and Burden of Stroke

## 2.1 Prevalence worldwide

According to the latest Global Burden of Disease (GBD) report by the WHO published in 2008, 30.5 million people worldwide suffered a stroke and the corresponding prevalence rate of first-ever stroke was 0.5% (WHO, 2008c). The worldwide prevalence rate of first-ever stroke remained more or less the same between 2000 and 2001, whilst the rate decreased from 0.6% in 2001 to 0.5% in 2004 (Table 2.1) (WHO, 2002b, 2002d, 2008c).

**Table 2.1 Worldwide prevalence of first-ever stroke survivors, 2000-2004**

| | 2000 | 2001 | 2004 |
|---|---|---|---|
| **Prevalence rate** | 0.6% | 0.6% | 0.5% |
| **Number of first-ever stroke survivors** | 38.6 million | 39.5 million | 30.5 million |

*Data sources: WHO (2002b, 2002d, 2008c)*

In 2004, among WHO regions, Europe had the highest prevalence of stroke (9.6 million), followed by Western Pacific (9.1 million) and the Americas (4.8 million) (WHO, 2008c). The number of stroke events in Europe is estimated to increase from 1.1 million per year in 2000 to more than 1.5 million per year in 2025 (Truelsen *et al.*, 2006b).

## 2.2 Incidence worldwide

According to WHO estimates, there were 3.8 million new cases for first-ever stroke in 2000 and the number of new cases increased dramatically to 15.3 million in 2002 (Table 2.2) (WHO, 2002a, 2002c, 2004c). Strong *et al.* (2007) estimated that there were 16 million first-ever strokes in 2005, and without intervention, the number of new cases for first-ever stroke would increase to 18 million in 2015 and to 23 million in 2030.

**Table 2.2 Worldwide incidence of first-ever stroke, 2000-2030**

| | 2000 | 2001 | 2002 | 2015 | 2030 |
|---|---|---|---|---|---|
| **Number of cases** | 3.8 million | 3.9 million | 15.3 million | 18 million | 23 million |
| **Incidence rate (per 1,000)** | 0.6 | 0.6 | 2.5 | -- | -- |

*Data sources: Strong et al. (2007) and WHO (2002a, 2002c, 2004c)*

In 2004, among WHO regions, Western Pacific had the highest annual incidence of first-ever stroke (3.3 million), followed by Europe (2.0 million) and South-East Asia (1.8 million) (WHO, 2008a).

Recently, Feigin *et al.* (2009) carried out a systematic review of incidence rates of stroke based on 56 population-based studies from 28 countries published from 1970 to 2008. According to the WHO criteria for definite stroke, there was a divergent, statistically significant trend in stroke incidence rates over the past four decades, with a 42% decrease in stroke incidence in high-income countries (age-adjusted annual incidence rate of total stroke decreased from 1.6 per 1,000 population in 1970-1979 to 0.9 per 1,000 population in 2000-2008) and a greater than 100% increase in stroke incidence in low to middle income countries (age-adjusted annual incidence rate of total stroke increased from 0.5 per 1,000 population in 1970-1979 to 1.2 per 1,000 population in 2000-2008).

## 2.3 Mortality worldwide

According to WHO estimates, stroke was the second leading cause of death and there were approximately 5.7 million people who died from stroke worldwide in 2004 (WHO, 2008b). The proportion of death due to stroke worldwide was around 9.5% in 2000 and 9.7% in 2004 (WHO, 2003, 2004b, 2008d). It was projected that the number of deaths due to stroke would increase to 6.6 million in 2015 and to 8.2 million in 2030 (Table 2.3) (Hong Kong Hospital Authority, 2006-2007; Post *et al.*, 2001).

**Table 2.3 Worldwide number of deaths from stroke for years 2000 to 2004 and projection for 2015 and 2030**

| | 2000 | 2002 | 2004 | 2015 | 2030 | % change (2000-2030) |
|---|---|---|---|---|---|---|
| Number of deaths due to stroke | 5.3 million | 5.5 million | 5.7 million | 6.6 million | 8.2 million | +54.7% |
| Proportion of deaths due to stroke among all deaths | 9.5% | 9.7% | 9.7% | 10.8% | 12.1% | +27.4% |
| Mortality rate (per 100,000) | 87.1 | 88.5 | 88.7 | 91.3 | 101.0 | +16.0% |

*Data sources: Hong Kong Hospital Authority (2006-2007), Post et al. (2001) and WHO (2003, 2004b, 2008d)*

The worldwide mortality rate for stroke increased sharply with age for both genders, with the rate among males aged 60 to 69 being 375.9 per 100,000 and among those aged 80 and above being 2,183.0 per 100,000 in 2002. The corresponding figures for females were 272.9 per 100,000 and 2,350.9 per 100,000. Females aged 80 and above tended to have a higher mortality rate for stroke than their male counterparts (Table 2.4) (WHO, 2002e, 2003, 2004b).

**Table 2.4 Worldwide mortality rates for stroke (per 100,000), by age group and sex, 2000-2002**

| | 2000 | | 2001 | | 2002 | |
|---|---|---|---|---|---|---|
| Age group | Male | Female | Male | Female | Male | Female |
| 60-69 | 379.4 | 274.7 | 379.8 | 280.3 | 375.9 | 272.9 |
| 70-79 | 977.1 | 845.9 | 1,012.4 | 880.3 | 976.3 | 847.2 |
| 80+ | 2,243.6 | 2,407.4 | 2,372.5 | 2,543.3 | 2,183.0 | 2,350.9 |
| Whole population | 80.2 | 94.1 | 82.0 | 98.5 | 81.4 | 95.6 |

*Data sources: WHO (2002e, 2003, 2004b)*

## 2.4 Case-fatality worldwide

According to the WHO Monitoring Trends and Determinants in Cardiovascular Disease (MONICA) study, the average case-fatality rate at 28 days was 30%, ranging from 15% to 49% among males and from 18% to 57% among females in different age groups. Case-fatality rates varied three-fold between populations, with the lowest reported from populations in Germany and the Nordic countries, and the highest in most of the Eastern European populations and in Italy (Thorvaldsen *et al.*, 1995). Recently, Feigin *et al.* (2009) carried out a systematic review of case-fatality rates of stroke based on 56 population-based studies from 28 countries published from 1970 to 2008. According to the WHO criteria for definite stroke, early (21 days to 1 month) stroke case-fatality ranged from 17% to 30% (13-23% for ischemic stroke, 25-35% for primary intracerebral hemorrhage and 25-35% for subarachnoid hemorrhage) in high-income countries and from 18% to 35% (13-19% for ischemic stroke, 30-48% for primary intracerebral hemorrhage and 40-48% for subarachnoid hemorrhage) in low- and middle-income countries in 2000-2008. There was a decreasing trend in early stroke case-fatality in both high-income and low- and middle-income countries.

## 2.5 Disability-Adjusted Life Years (DALYs) worldwide

According to the latest GBD report by the WHO, stroke caused more than 46.6 million Disability-Adjusted Life Years (DALYs) worldwide in 2004. It was projected that DALYs lost to stroke would be nearly 58.2 million in 2030 (WHO, 2008b).

In 2004, DALYs lost to stroke in low-income and middle-income countries (41.8 million) was almost nine times those lost in high-income countries (4.8 million). Among WHO regions, Western Pacific Region had the highest DALYs lost to stroke (15.8 million), followed by South-East Asia Region (9.6 million) and European Region (9.5 million) (Table 2.5) (WHO, 2008b).

**Table 2.5 Worldwide estimates of DALYs lost to stroke, by WHO region, 2004**

| WHO Region | DALYs |
|---|---|
| Africa | 4.9 million |
| The Americas | 4.0 million |
| Eastern Mediterranean | 2.7 million |
| Europe | 9.5 million |
| South-East Asia | 9.6 million |
| Western Pacific | 15.8 million |

*Data source: WHO (2008b)*

## 2.6 Summary

Although a decreasing trend in mortality of stroke has been observed in recent decades, stroke is among the leading causes of death worldwide, accounting for around 5.5 million deaths every year. The prevalence rate of stroke was decreasing from 2000 to 2004 worldwide. However, as populations are growing older, and that stroke incidences increases with age, it was projected that the number of new cases for first-ever stroke would increase to 23 million in 2030. The greatest risk of death for patients with stroke occurs in the first 30 days. According to a recent review of worldwide stroke incidence and case-fatality rates reported in 56 population-based studies, early stroke case-fatality ranged from 17% to 30% in high-income countries and from 18% to 35% in low to middle income countries. In 2004, stroke caused more than 46 million DALYs worldwide and it was projected that DALYs lost to stroke would be 58 million in 2030. Among WHO regions, Western Pacific Region had the highest DALYs lost to stroke (15.8 million).

Chapter 3

# Trends in Stroke Prevalence in Hong Kong

# Chapter 3

# Trends in Stroke Prevalence in Hong Kong

Hong Kong has a rapidly ageing population. The population aged 65 and above nearly doubled during the past two decades, from 0.5 million in 1988 to 0.9 million in 2008. It is projected that in 2036, there will be 2.3 million people aged 65 and above in Hong Kong (Census and Statistics Department of Hong Kong Special Administrative Region, 2007c and 2009a). With the ageing population, the number of people with stroke will be expected to increase. This chapter reviews the trends in stroke prevalence and calculates current estimates and future projections of the number of people with stroke in Hong Kong. Prevalence rates reported in previous studies in Hong Kong are also compared with those of other countries.

## 3.1 Previous estimates of stroke prevalence

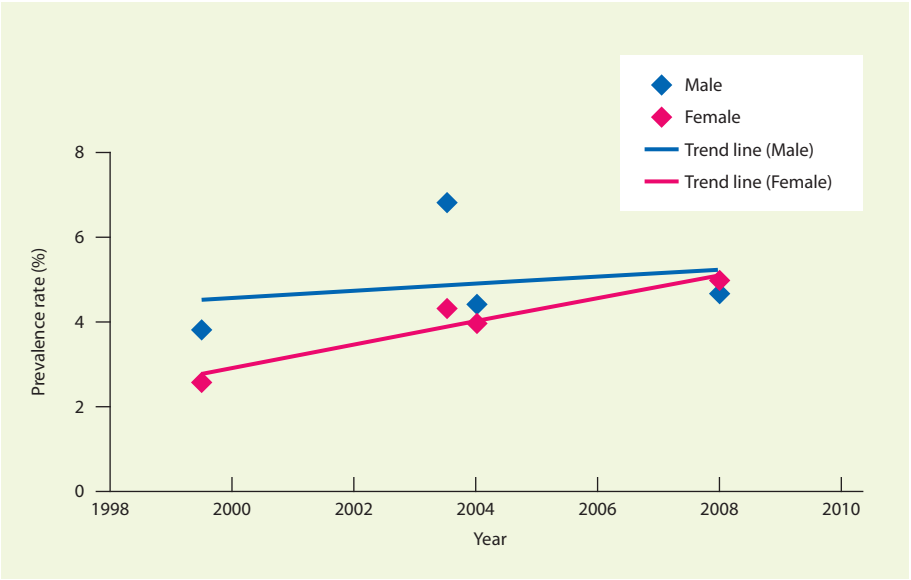
A number of individual epidemiological studies have investigated the prevalence rates of stroke in older people in Hong Kong. Data from these studies were mainly derived from questionnaires applied to community population samples and therefore prevalence estimates were mostly self-reported data for any type of stroke. Prevalence estimates based on self-reported data among community population samples, however, were likely to be underestimated because a high proportion of stroke survivors live in institutions. Hence, these data need to be interpreted with caution. In this report, prevalence estimates are presented for community and institutional populations separately.

### *3.1.1 Prevalence of stroke among community population*

Data were collected from previous population-based household surveys, which asked whether the respondent had had a doctor-diagnosed stroke. According to self-reported estimates, there was an increasing trend in the prevalence rate of stroke among older people in Hong Kong from 1998 to 2008, with the rate among the community-dwelling population aged 65 and above being 2.8% in 1998/2001, 5.5% in 2003/2004, 4.2% in 2004, and 4.9% in 2008. Males and females have different trends in stroke prevalence. While the prevalence rates of stroke followed an increasing trend in women between 1998 and 2008, the rate of men increased slightly from 1998 to 2004 and remained stable between 2004 and 2008 (Figure 3.1)

(Census and Statistics Department of Hong Kong Special Administrative Region, 2005 and 2009b; Department of Health of Hong Kong Special Administrative Region, n.d.; Department of Health of Hong Kong Special Administrative Region and Department of Community Medicine of the University of Hong Kong, 2005).

**Figure 3.1 Prevalence of self-reported stroke among people aged 65 and above living in the community, by gender, Hong Kong, 1998-2008**




*Data sources: Census and Statistics Department of Hong Kong Special Administrative Region (2005, 2009b), Department of Health of Hong Kong Special Administrative Region (n.d.), Department of Health of Hong Kong Special Administrative Region and Department of Community Medicine of the University of Hong Kong (2005) and authors' calculations*

The prevalence rates of stroke increased with age for both genders. According to the Population Health Survey (PHS) 2003/2004, the prevalence rates of stroke among those aged 65 and above (5.5%) were 14 times those of 15 to 64 year olds (0.4%) (Department of Health of Hong Kong Special Administrative Region and Department of Community Medicine of the University of Hong Kong, 2005).

Males tended to have a higher prevalence rate of stroke than females. Based on self-reported data from an elderly cohort established between 1998 and 2001, the prevalence rates of stroke among those aged 65 and above were 3.8 per 1,000 population for males and 2.6 per 1,000 population for females; whilst in the PHS 2003/2004, the corresponding figures were 6.8 per 1,000 population and 4.3 per 1,000 population (Table 3.1) (Department of Health of Hong Kong Special Administrative Region, n.d.; Department of Health of Hong Kong Special Administrative Region and Department of Community Medicine of the University of Hong Kong, 2005).

**Table 3.1 Prevalence rates of self-reported stroke among people aged 65 and above in Hong Kong, by age group and sex, 1998-2001 and 2003-2004**

| | 1998-2001[1] | | | 2003-2004[2] | | |
|---|---|---|---|---|---|---|
| **Age group** | **Male** | **Female** | **Total** | **Male** | **Female** | **Total** |
| **65-74** | 3.3% | 2.2% | 2.6% | 5.8% | 4.2% | 5.1% |
| **75+** | 5.1% | 3.3% | 3.9% | 9.2% | 4.4% | 6.4% |
| **65+** | 3.8% | 2.6% | 3.0% | 6.8% | 4.3% | 5.5% |

*Data sources:*

*1. Elderly cohort from Elderly Health Centre, Department of Health of Hong Kong Special Administrative Region, 1998-2001. Question used "Active Disease – cerebrovascular accident"*

*2. PHS 2003/2004. Question used "Have you ever been told by a doctor (western medical practitioner) that you had the following chronic health conditions – stroke?"*

Further estimates of the prevalence rates of stroke based on self-report of previous doctor diagnoses are shown in Table 3.2. However, these estimates are not directly comparable with the previous estimates due to specific sample selection criteria.

**Table 3.2 Further estimates of prevalence rates of self-reported stroke in older people in Hong Kong, 1988-2003**

| Year | Age | Sample Characteristics | Prevalence rate | Source |
|---|---|---|---|---|
| **1988** | 55+ | Older people living in the community | 2.7% | Chi and Lee (1989) |
| **1991-1992** | 70+ | Older people receiving allowance from the government | 8.0% | Ho *et al.* (1994) |
| **1997** | 65+ | Older people living in Central and Western District – including both community-dwelling and institutional population | 6.4% | Chu *et al.* (1998) |
| **1998-1999** | 65+ | Ambulatory older people | 6.3% | Chu *et al.* (2005) |
| **2001-2003** | 60+ | Older people attending a mobile clinic in Sham Shui Po for screening | 3.4% | McGhee *et al.* (2007) |
| **2001-2003** | 65+ | Community-dwelling older people who attended a health check | 4.4% | Lee *et al.* (2006) |

### *3.1.2 Prevalence of stroke among institutional population*

According to self-reported estimates, there was an increasing trend in the prevalence rates of stroke among older people living in institutions in Hong Kong from 2004 to 2008, with the rate among the institutional elderly aged 65 and above being 29.2% in 2004 and 30.9% in 2008 (Census and Statistics Department of Hong Kong Special Administrative Region, 2005 and 2009b).

## 3.2 Current and future estimates of stroke prevalence

Age-sex-specific prevalence of stroke was estimated for community and institutional populations separately. We estimated the total numbers of people with stroke in the community and in institutions in Hong Kong by multiplying the age-sex-specific prevalence rates of self-reported stroke obtained from the population-based household survey conducted in 2008 by the Census and Statistic Department of Hong Kong Special Administrative Region to the Hong Kong domestic population and the Hong Kong institutional population, respectively. The proportions of domestic population and institutional population in Hong Kong were assumed to be constant as those in 2008 (Census and Statistics Department of Hong Kong Special Administrative Region, 2009b).

Assuming the age-sex-specific prevalence rates of stroke among the community population remain unchanged, it was estimated that 0.04 million people aged 65 and above living in the community suffered a stroke in Hong Kong in 2010. Using the same methodology and assuming that the age-sex-specific prevalence rates among the community population and the age-sex-specific proportion of domestic population in Hong Kong remain unchanged until 2036, the number of people aged 65 and above living in the community with stroke would be expected to increase to 0.11 million in 2036 (Table 3.3).

**Table 3.3 Projected numbers of people with stroke living in the community in Hong Kong, 2010 and 2036**

| | 2010 | | | 2036 | | |
|---|---|---|---|---|---|---|
| **Age group** | **Male** | **Female** | **Total** | **Male** | **Female** | **Total** |
| **65-69** | 3,617 | 3,198 | 6,815 | 6,773 | 8,868 | 15,641 |
| **70-74** | 6,644 | 3,999 | 10,643 | 14,966 | 11,226 | 26,192 |
| **75-79** | 4,995 | 6,516 | 11,511 | 13,168 | 18,084 | 31,252 |
| **80-84** | 2,438 | 3,778 | 6,217 | 7,323 | 10,409 | 17,732 |
| **85+** | 1,321 | 5,532 | 6,853 | 4,579 | 15,181 | 19,760 |
| **65+** | 19,016 | 23,023 | 42,039 | 46,810 | 63,768 | 110,578 |

*Note: Individual cells may not sum to total due to rounding.*

*Data source: Authors' calculations*

For the institutional population, estimates were also based on the assumption that age-sex-specific prevalence rates of stroke remain unchanged until 2036. Applying the age-sex-specific prevalence rates of self-reported stroke among the institutional elderly obtained from the population-based household survey to the population in Hong Kong in 2010 and 2036, around 0.02 million people aged 65 and above living in institutions were estimated to have had a stroke in 2010. By 2036, it is projected that there will be around 0.05 million people aged 65 and above living in institutions with stroke (Table 3.4).

**Table 3.4 Projected numbers of people with stroke living in institutions in Hong Kong, 2010 and 2036**

| | 2010 | | | 2036 | | |
|---|---|---|---|---|---|---|
| Age group | Male | Female | Total | Male | Female | Total |
| 65-74 | 1,905 | 1,234 | 3,139 | 4,003 | 3,452 | 7,456 |
| 75-79 | 2,030 | 1,774 | 3,804 | 5,352 | 4,924 | 10,276 |
| 80-84 | 1,491 | 3,000 | 4,491 | 4,478 | 8,264 | 12,742 |
| 85+ | 1,734 | 5,707 | 7,441 | 6,010 | 15,662 | 21,673 |
| 65+ | 7,161 | 11,715 | 18,876 | 19,844 | 32,303 | 52,146 |

*Note: Individual cells may not sum to total due to rounding.*

*Data source: Authors' calculations*

Combining the community and institutional populations, the projected number of people aged 65 and above with stroke will increase from 0.06 million in 2010 to 0.16 million in 2036. This corresponds to an increase of 167%. Nevertheless, the above estimates assume the age-sex-specific prevalence rates of stroke remain unchanged until 2036, with changing demographic only. As the prevalence rates do seem to increase, the number of people with stroke would be larger than our estimates above.

## 3.3 Comparison of prevalence with other countries

International comparisons of stroke prevalence are fraught with difficulties due to the difference in population age structure, the proportion of people living in institutions, and the paucity of prevalence studies including people in the oldest age groups who are at higher risk of the disease. Hence, international comparisons can only be conducted in a broad sense. Selected stroke prevalence studies in Hong Kong, the United States, the United Kingdom, China, Japan and Singapore are briefly reviewed and described in the following sections; however, prevalence estimates based on modelling are excluded.

In general, the prevalence rates of stroke across countries were found to vary but all consistently showed a higher rate at older age. The prevalence rate of stroke among people aged 65 to 74 years in the PHS 2003/2004 in Hong Kong (5.1%) was lower than that reported in comparable age groups in the United States in 2007 (6.3%) and the United Kingdom in 2006 (5.6%), but higher than the rate reported in Australia in 2007-2008 (3.3%) (Department of Health of Hong Kong Special Administrative Region and Department of Community Medicine of the University of Hong Kong, 2005; Centers for Disease Control and Prevention, Department of Health and Human Services of United States, 2011; The NHS Information Centre of the United Kingdom, 2008; Australian Bureau of Statistics, 2009b).

Feigin *et al.* (2003) carried out a review of published population-based studies of the prevalence of stroke from 1990 onwards. Nine studies of stroke prevalence from eight countries, including New Zealand, the Netherlands, Bolivia, the United States, the United Kingdom, Papua New Guinea, China and Italy were reviewed and there was no significant difference in age-adjusted prevalence rates between selected populations in people aged 65 years and above, except in L'Aquila, Italy and Newcastle, the United Kingdom, which reported higher prevalence rates than the other studies.

### 3.3.1 United States

Using the 2000 United States standard population as the standard, the prevalence rate of stroke among the community-dwelling population aged 18 and above in the United States gradually increased from 1.7% in 1990 to 2.4% in 2005, and remained stable between 2005 and 2007. The prevalence rates increased with age. In 2007, the age-specific prevalence rates of stroke were 2.8% for those aged 45 to 64 and 10.6% for those aged 75 and above (Table 3.5) (Centers for Disease Control and Prevention, Department of Health and Human Services of United States, 2011).

**Table 3.5 Prevalence rates of self-reported stroke in the United States, by age group, 1990-2007**

| Age group | 1990 | 1995 | 2000 | 2005 | 2007 |
|---|---|---|---|---|---|
| 45-64 | 1.7% | 1.5% | 2.1% | 2.2% | 2.8% |
| 65-74 | 5.0% | 5.2% | 6.5% | 6.2% | 6.3% |
| 75+ | 8.4% | 9.9% | 10.4% | 12.5% | 10.6% |
| 18+ (age-adjusted*) | 1.7% | 1.8% | 2.2% | 2.4% | 2.4% |

** The age-adjusted prevalence rates used the 2000 US standard population as the standard.*

*Data source: Centers for Disease Control and Prevention, Department of Health and Human Services of United States (2011)*

### 3.3.2 United Kingdom

In the United Kingdom, the prevalence rate of stroke among the community-dwelling population aged 16 and above increased from 1.7% in 1994 to 2.3% in 2006. The prevalence rate of stroke increased with age. In 1994, the prevalence rates of stroke were 2.3% for those aged 55 to 64 and 7.9% for those aged 75 and above. The corresponding figures in 2006 were 2.6% and 11.6% (Table 3.6) (The NHS Information Centre of the United Kingdom, 2008).

**Table 3.6 Prevalence rates of self-reported past diagnosis of stroke by a doctor in the United Kingdom, by age group, 1994-2006**

| Age group | 1994 | 1998 | 2003 | 2006 |
|---|---|---|---|---|
| 55-64 | 2.3% | 2.7% | 2.3% | 2.6% |
| 65-74 | 4.8% | 5.5% | 6.4% | 5.6% |
| 75+ | 7.9% | 9.4% | 10.6% | 11.6% |
| 16+ | 1.7% | 2.2% | 2.3% | 2.3% |

*Data source: The NHS Information Centre of the United Kingdom (2008)*

### 3.3.3 Australia

In Australia, the age-adjusted prevalence rate of self-reported stroke among the community-dwelling population nearly tripled over three years from 0.4% in 2004-2005 to 1.1% in 2007-2008. The prevalence rate of stroke increased with age. In 2004-2005, the prevalence rates of stroke among those aged 55 to 64 was 0.9% and that among those aged 75 and above was 3.5%. The corresponding figures in 2007-2008 were 2.2% and 8.0% (Table 3.7) (Australian Bureau of Statistics, 2009b).

**Table 3.7 Prevalence rates of self-reported stroke in Australia, by age group, 2004-2005 and 2007-2008**

| Age group | 2004-2005 | 2007-2008 |
|---|---|---|
| 55-64 | 0.9% | 2.2% |
| 65-74 | 1.6% | 3.3% |
| 75+ | 3.5% | 8.0% |
| Whole population (age-adjusted*) | 0.4% | 1.1% |

** The age-adjusted prevalence rates used the 30 June 2000 Australian estimated resident population as the standard.*
*Data source: Australian Bureau of Statistics (2009b)*

### 3.3.4 China

In China, the prevalence rates of self-reported stroke among the community-dwelling population increased from 0.4% in 1993 to 1.0% in 2008. There were different trends of stroke prevalence between urban and rural China. While the prevalence rates for stroke in urban areas remained stable between 1998 and 2008, the rate in rural areas increased from 0.2% in 1993 to 0.8% in 2008 (Table 3.8) (Ministry of Health of the People's Republic of China, 2008).

**Table 3.8 Prevalence rates of self-reported stroke in urban and rural areas, China, 1993-2008**

| Area | 1993 | 1998 | 2003 | 2008 |
|---|---|---|---|---|
| Urban | 1.0% | 1.3% | 1.3% | 1.4% |
| Rural | 0.2% | 0.3% | 0.4% | 0.8% |
| Total | 0.4% | 0.6% | 0.7% | 1.0% |

*Data source: Ministry of Health of the People's Republic of China (2008)*

### 3.3.5 Singapore

A community-based study examining 14,906 Singaporeans aged 50 and above between 2001 and 2003 in Singapore found that the age-sex-adjusted prevalence rates of stroke, including institutional population, was 3.7% (95% Confidence Interval (CI): 3.4-4.0). The prevalence rates increased with age for both genders, with the rate being 0.7% for those aged 50 to 54 years and 14.9% for those aged 85 and above. The prevalence rates were also higher among males compared with females, with the rates being 4.5% for males and 2.9% for females (Table 3.9) (Venketasubramanian *et al*., 2005).

**Table 3.9 Prevalence rates of stroke in Singapore, by age group and sex, 2001-2003**

| Age group | Male | Female | Total |
|---|---|---|---|
| 50-54 | 1.2% | 0.3% | 0.7% |
| 55-59 | 2.8% | 1.4% | 2.0% |
| 60-64 | 3.7% | 2.1% | 2.8% |
| 65-69 | 6.1% | 3.4% | 4.8% |
| 70-74 | 8.0% | 6.1% | 6.9% |
| 75-79 | 9.4% | 7.7% | 8.6% |
| 80-84 | 11.8% | 13.0% | 12.4% |
| 85+ | 18.8% | 12.5% | 14.9% |
| 50+ (age-adjusted*) | 4.5% | 2.9% | 3.7% |

** The age-adjusted prevalence rates used the WHO world population as the standard.*

*Data source: Venketasubramanian et al. (2005)*

### 3.3.6 Japan

Based on self-reported data from the 2000 National Study on Cardiovascular Disease in Japan, the prevalence rate of self-reported stroke for people aged 30 and above was 3.0%. The prevalence rates increased with age for both genders, with the rate being 4.1% for those aged 60 to 69 and 8.9% for those aged 70 and above. The prevalence rates were also higher among males compared with females. These findings, however, need to be interpreted with caution because the study population were generally healthy and the prevalence rates may have been underestimated (Table 3.10) (Ministry of Health, Labour and Welfare of Japan, 2001).

**Table 3.10 Prevalence rates of self-reported stroke in Japan, 2000**

| Age group | Male | Female | Total |
|---|---|---|---|
| 60-69 | 5.7% | 2.5% | 4.1% |
| 70+ | 12.0% | 6.7% | 8.9% |
| 30+ | 4.0% | 2.2% | 3.0% |

*Data source: Ministry of Health, Labour and Welfare of Japan (2001)*

## 3.4 Summary

Based on self-reported data from several population-based household surveys, there was an increasing trend in the prevalence rates of stroke among older people in Hong Kong between 1998 and 2008, with the rate among the community-dwelling population aged 65 and above being 3.0% in 1998/2001, 5.5% in 2003/2004, 4.2% in 2004 and 4.9% in 2008. Males and females have different trends in stroke prevalence. While the prevalence rates of stroke followed an increasing trend in women between 1998 and 2008, the rate of men increased slightly from 1998 to 2004 and remained stable between 2004 and 2008. The prevalence rates of stroke increased with age for both genders and males tended to have a higher prevalence rate of stroke than females. People with stroke also represent a large proportion of those living in institutions. According to self-reported estimates, the prevalence rate of stroke among the institutional elderly aged 65 and above was 30.9% in 2008. Based on the prevalence rates of self-reported stroke, the number of community-dwelling people aged 65 and above with stroke was projected to more than double between 2010 and 2036 from 0.04 million in to 0.11 million, based on the effect of the demographic changes only. The number of people aged 65 and above living in institutions with stroke was also projected to increase from 0.02 million in 2010 to 0.05 million in 2036. Compared with other countries, the prevalence rates of self-reported stroke reported in the population-based household survey in Hong Kong in 2003/2004 was lower than those reported in the United States and the United Kingdom, but higher than those reported in Australia.

# Chapter 4

# Trends in Stroke Incidence in Hong Kong

# Chapter 4

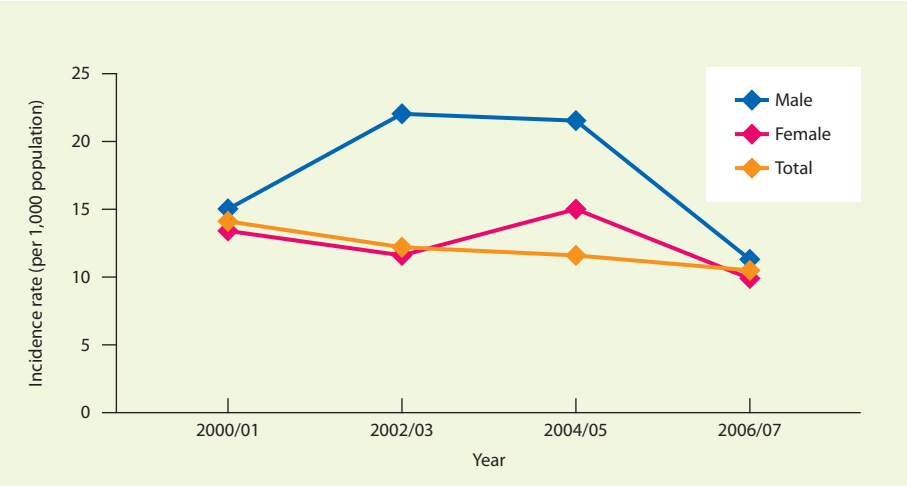
# Trends in Stroke Incidence in Hong Kong

Population-based stroke incidence studies provide accurate data on the occurrence of an individual's first stroke, which are important for risk estimates and for comparison between populations. This chapter reviews the trends in stroke incidence in Hong Kong. Incidence rates reported in previous studies in Hong Kong are also compared with those reported in other countries.

## 4.1 Previous estimates of stroke incidence

The incidence rate of stroke in Hong Kong was following a declining trend (Wu *et al.*, 2012). Based on hospital admission data, the incidence rates of stroke (ICD-9: 430-437) decreased slightly from 2000-2001 to 2006-2007, with the annual incidence rates of first-ever stroke among people aged 65 and above being 13.3 per 1,000 population in 2000-2001 and 10.6 per 1,000 population in 2006-2007. The corresponding age-adjusted rates were 14.1 per 1,000 population and 10.5 per 1,000 population for the two periods respectively (Figure 4.1). The incidence rates increased with age for both genders and males tended to have a higher rate than females (Table 4.1).

**Figure 4.1 Age-adjusted* incidence rates of first-ever stroke (per 1,000 population) among people aged 65 and above in Hong Kong, by gender, 2000-2007**




** The age-adjusted incidence rates used the Hong Kong population as of mid-2006 as the standard.*

*Data source: Authors' calculations*

**Table 4.1 Incidence rates of first-ever stroke (per 1,000 population) among people aged 65 and above in Hong Kong, by age group and sex, 2006-2007**

| Age group | Male | Female | Total |
|---|---|---|---|
| 65-74 | 8.5 | 5.8 | 7.2 |
| 75-84 | 14.6 | 12.3 | 13.3 |
| 85+ | 20.5 | 18.4 | 19.1 |
| 65+ (crude) | 11.4 | 9.9 | 10.6 |
| 65+ (age-adjusted*) | 11.3 | 9.9 | 10.5 |

** The age-adjusted incidence rates used the Hong Kong population as of mid-2006 as the standard.*

*Data source: Authors' calculations*

Trends of hemorrhagic and ischemic stroke incidence were different with decreasing trend in ischemic stroke but non-decreasing trend in hemorrhagic stroke (Chau *et al.*, 2011b). Based on the same dataset, the number of hemorrhagic stroke episodes for those aged 65 years and above increased over the years 1999 to 2007, whilst that of ischemic stroke decreased, resulting in an increasing proportion of hemorrhagic stroke over the years (Table 4.2).

**Table 4.2 Proportion of first-ever stroke subtypes among the Hong Kong population aged 65 and above, 1999-2007**

| Stroke type | 1999-2001 | 2002-2004 | 2005-2007 | Total |
|---|---|---|---|---|
| Hemorrhagic | 14.6% | 17.3% | 18.4% | 16.7% |
| Ischemic | 75.6% | 72.9% | 71.8% | 73.5% |

*Data sources: Chau et al. (2011b) and authors' calculations*

Based on self-reported data from the PHS 2003/2004, the incidence rate of stroke was 5.5 per 1,000 population for those aged 65 and above. Overall, the incidence rates increased with age, with the rate among those aged 65 and above 3 times higher than those aged 15 to 64. The data also suggested that the incidence rate of stroke varies between sex, and males tended to have a higher rate than females (Table 4.3) (Department of Health of Hong Kong Special Administrative Region and Department of Community Medicine of the University of Hong Kong, 2005).

**Table 4.3 Annual incidence rates of stroke (per 1,000 population) in Hong Kong, by age group and sex, 2003-2004**

| Age group | Male | Female | Total |
|---|---|---|---|
| 15-64 | 2.4 | 0.5 | 1.3 |
| 65+ | 7.2 | 3.9 | 5.5 |
| 15+ | 3.1 | 0.9 | 1.9 |

*Data source: Department of Health of Hong Kong Special Administrative Region and Department of Community Medicine of the University of Hong Kong (2005)*

A population-based elderly cohort study reporting on stroke incidence between 1991 and 1995 has also been published. A total of 2,032 Hong Kong Chinese subjects aged 70 years and above were followed-up for up to 36 months over 3 consecutive periods (1991-1992, 1993-1994, 1994-1995). It was found that the incidence rate of self-reported stroke was 30.1 per 1,000 population in the 36-month follow up period. This works out to an annual incidence of 10.0 per 1,000 population (Woo *et al.*, 2002).

Based on the same dataset, the incidence rates of stroke increased with age for both genders, with the rate at 18 months follow-up being 4 per 1,000 population for males aged 70 to 74 and 31 per 1,000 population for those aged 85 to 89. Females aged 70 to 84 tended to have a higher incidence rate of stroke than their male counterparts; however, the reverse was true for those aged 85 and above (Table 4.4) (Woo *et al.*, 1998b).

**Table 4.4 Incidence rates of stroke (per 1,000 population) in a 18-month follow-up period in Hong Kong, by age group and sex, 1991-1994**

| Age group | Male | Female |
|---|---|---|
| 70-74 | 4 | 8 |
| 75-79 | 12 | 16 |
| 80-84 | 8 | 40 |
| 85-89 | 31 | 18 |
| 90+ | 28 | 9 |

*Data Source: Woo et al. (1998b)*

## 4.2 Comparison of incidence with other countries

Comparisons of incidence of stroke across studies are difficult because estimates are often based on different time periods for different age groups and may use different methodologies. Hence, international comparisons can only be conducted in a broad sense. Nevertheless, the incidence rates of stroke across countries consistently showed a higher rate with increasing age. Details about stroke incidence in individual countries are presented in subsequent sections.

Sudlow and Warlow (1997) compared stroke rates from eleven studies in Europe, Russia, Australasia and the United States in 1995. Adjusted to the Segi's European population, age- and sex-adjusted annual incidence rates in people aged 45 to 84 years were similar (between approximately 300 per 100,000 and 500 per 100,000) in most places, with the exception of Dijon in France, where the rate was the lowest (238 per 100,000), and Novosibirsk in Russia, where the rate was the highest (627 per 100,000).

Feigin *et al.* (2009) reviewed stroke incidence rates from 56 population-based studies in 28 countries from 1970 to 2008. According to WHO criteria for definite stroke, total crude stroke incidence rates (per 1,000 person-years) among high-income countries ranged from 1.1 (Dijon, France) to 2.2 (Tartu, Estonia and Valley d'Aosta, Italy) in 2000-2008. Among low- and middle-income countries, crude rates of stroke incidence (per 1,000 person-years) ranged from 0.7 (Iquique, Chile) to 1.7 (Tbilisi, Georgia) in 2000-2008.

Chau *et al.* (2011b) also compared the rate of different stroke subtypes in Hong Kong and selected countries. Standardized to the WHO World Standard Population, the age-adjusted ischemic stroke incidence per 100,000 population for both males and females in Hong Kong was much higher than those in Japan and Australia. As for hemorrhagic stroke, the age-adjusted rates were also much higher than those of males and females in Australia, as well as males in Japan (Table 4.5).

**Table 4.5 International comparison of first-ever stroke subtypes and age-adjusted* incidence rates (per 100,000 population) among population aged 35 and above**

| | Hong Kong | Japan | Australia | Italy | Brazil |
|---|---|---|---|---|---|
| **Ischemic Stroke** | | | | | |
| **Male** | 270.7 | 182.8 | 189.6 | 223.6 | 319.4 |
| **Female** | 204.5 | 90.1 | 129.4 | 131.3 | 204.1 |
| **Hemorrhagic Stroke** | | | | | |
| **Male** | 80.5 | 56.1 | 40.4 | 31.6 | 52.2 |
| **Female** | 44.5 | 45.7 | 29.2 | 13.8 | 26.5 |

** The age-adjusted incidence rates used the WHO World Standard Population as the standard.*

*Data source: Chau et al. (2011b)*

### *4.2.1 United States*

A large number of population-based longitudinal cohort studies have provided the incidence rates of stroke in the United States. Kleindorfer *et al.* (2006) reported stable incidence of first-ever hospitalized stroke of all age groups between 1993-1994 and 1999 based on stroke-related ICD-9 codes (1993-1994: ICD-9 430-438, 1999: ICD-9 430-436), with the age-adjusted annual incidence rate of first-ever stroke being 1.8 (95% CI: 1.7-1.9) per 1,000 population in 1993-1994 and 2.1 (95% CI: 2.0-2.2) per 1,000 population in 1999. In the Minnesota Stroke Survey, Lakshminarayan *et al.* (2009) reported significant decline rates of hospitalized stroke among men aged 30 to 74 years from 1980 (age-adjusted incidence rate of stroke: 3.1 per 1,000 population) to 2000 (2.0 per 1,000 population) based on stroke-related ICD-9 codes (431, 432, 434, 436, or 437). Rates based on highly specific clinical criteria (i.e.: neuroimaging definition), however, remained stable among women.

Stroke incidences increased rapidly with increasing age and a greater incidence rate of stroke was found in males than in females. In the Cardiovascular Heart Study using prospectively collected data from 1989 to 2001 on cardiovascular events in older Americans aged 65 and above, stroke was more common in males and females aged 75 and older than in those younger than 75. The overall incidence rates of stroke were similar for males (14.7 per 1,000 person-years) and females (13.7 per 1,000 person-years) but the risk of stroke increased with age more rapidly in females (Arnold *et al.*, 2005).

In the Framingham Heart Study, based on data from 56 years of prospective follow-up in a community-based sample aged 45 and above, the incidence rates of stroke were 5.0 and 4.1 per 1,000 person-years for males and females, respectively. For the age group 45-84, stroke incidence was higher in males than in females but the gender effect reversed in the oldest group 85 to 94, with stroke incidence higher in females than in males (Table 4.6) (Petrea *et al.*, 2009).

**Table 4.6 Incidence rates of stroke (per 1,000 person-years) in the United States, by age group and sex, 1948-2005**

| Age group | Male | Female |
|---|---|---|
| 45-54 | 1.2 | 0.8 |
| 55-64 | 2.6 | 1.8 |
| 65-74 | 7.6 | 5.0 |
| 75-84 | 13.4 | 12.1 |
| 85-94 | 15.5 | 21.6 |
| 45+ | 4.6 | 4.4 |

*Data source: Petrea et al. (2009)*

### 4.2.2 United Kingdom

In the United Kingdom, a study of population-based registers covering inhabitants of all age groups in an inner area of South London reporting on trends in stroke incidence rates from 1995 to 2004 has recently been published. The age-adjusted annual incidence rate of first-ever stroke decreased in both sexes over the 10-year study period, from 1.6 to 1.3 per 1,000 population in males and 1.2 to 0.9 per 1,000 population in females (Table 4.7) (Heuschmann *et al.*, 2008).

**Table 4.7 Age-adjusted* annual incidence rates of first-ever stroke (per 1,000 population) in the South London Stroke Register, United Kingdom, by sex, 1995-2004**

| Sex | 1995-1996 | 1997-1998 | 1999-2000 | 2001-2002 | 2003-2004 |
|---|---|---|---|---|---|
| Male | 1.6 | 1.7 | 1.4 | 1.5 | 1.3 |
| Female | 1.2 | 1.2 | 1.0 | 1.1 | 0.9 |

** The age-adjusted incidence rates used the standard European population as the standard.*
*Data source: Heuschmann et al. (2008)*

Stroke incidences increased rapidly with age. Data from the same study showed that the age-specific incidence rates increased more than double from 9.3 per 1,000 in people aged 75-84 to 19.7 per 1,000 in people aged 85 and over between 1995 and 1998 (Wolfe *et al.*, 2002).

### 4.2.3 Australia

In Australia, the Perth Community Stroke Study reported a decline of incidence rate of diagnosed first-ever stroke from 1.9 per 1,000 population in 1989-1990 to 1.6 per 1,000 population in 1995-1996 and 1.3 per 1,000 population (of all age groups) in 2000-2001, corresponding to a 5.5% average annual decrease overall. Incidence rates of stroke increased with age for both genders. In 2000-2001, rates among people aged 85 and above were almost 4 times those of 65 to 74 year olds (Table 4.8) (Islam *et al.*, 2008).

**Table 4.8 Incidence rates of diagnosed first-ever stroke (per 1,000 population) in Perth, Australia, by age group, 1989-2001**

| Age group | 1989-1990 | 1995-1996 | 2000-2001 |
|---|---|---|---|
| ≤64 | 0.5 | 0.3 | 0.3 |
| 65-74 | 5.9 | 4.0 | 3.7 |
| 75-84 | 17.1 | 12.2 | 9.7 |
| 85+ | 25.3 | 26.0 | 14.4 |
| Whole population (crude) | 1.9 | 1.6 | 1.3 |
| Whole population (age-adjusted*) | 1.3 | 0.9 | 0.7 |

** The age-adjusted incidence rates used the WHO World Standard Population as the standard.*

*Data source: Islam et al. (2008)*

Another study conducted in Melbourne also showed consistent figures for the incidence rates of first-ever stroke in the late 1990's. At all ages, the incidence rate of first-ever stroke was 1.1 per 1,000 population for males and 0.9 per 1,000 population for females in 1996-1997 by adjusting age with the world population (Table 4.9) (Thrift *et al.*, 2001).

**Table 4.9 Annual incidence rates for first-ever-in-a-lifetime stroke (per 1,000 population) in Melbourne, Australia, by age group and sex, 1996-1997**

| Age group | Male | Female | Total |
|---|---|---|---|
| 65-74 | 5.7 | 5.1 | 5.4 |
| 75-84 | 14.7 | 11.8 | 12.9 |
| 85+ | 33.4 | 27.2 | 29.0 |
| Whole population (crude) | 2.0 | 2.2 | 2.1 |
| Whole population (age- and sex-adjusted*) | 1.1 | 0.9 | 1.0 |

** Age- and sex-adjusted incidence rates used the Segi world population as the standard.*

*Data source: Thrift et al. (2001).*

### 4.2.4 China

In China, the Sino-MONICA project in Beijing (the Sino-MONICA-Beijing project) reported an increasing trend in age-adjusted incidence rates of stroke for both males and females aged 25 to 74 from 1984 to 2004. The age-adjusted incidence rate of first-ever stroke for people aged 25 to 74 years increased from 1.3 per 1,000 population in 1984 to 1.8 per 1,000 population in 2004. The significant increase in the incidence rate of ischemic stroke (increased by 8.7% annually from 1984 to 2004) led to a significant increase in total stroke burden in spite of remarkable decline in hemorrhagic stroke (declined by 1.7% annually from 1984 to 2004). The incidence rates of stroke were consistently higher in males than in females over the years (Table 4.10) (Zhao *et al.*, 2008).

**Table 4.10 Age-adjusted* incidence rates of the first-ever stroke (per 1,000 population) in Sino-MONICA population aged 25-74 years in Beijing, China, by sex, 1984-2004**

| Sex | 1984 | 1990 | 1995 | 2000 | 2004 |
|---|---|---|---|---|---|
| Male | 1.4 | 1.5 | 2.0 | 2.2 | 2.1 |
| Female | 1.2 | 1.2 | 1.6 | 1.4 | 1.5 |
| Total | 1.3 | 1.4 | 1.8 | 1.8 | 1.8 |

** Age-adjusted incidence rates used the China national census in 2000 as the standard.*

*Data source: Zhao et al. (2008)*

### 4.2.5 Singapore

Incidence data from Singapore is scanty. The Singapore Cardiovascular Cohort Study used national registry data to identify new cases of stroke in 1999 from a cohort of 5,920 persons. The incidence rate of stroke was 1.8 per 1,000 person-years, with higher rates in Malay females compared to Chinese females after adjustment for age (Heng *et al.*, 2000).

### 4.2.6 Japan

There have been a number of studies of the incidence of stroke conducted in Japan in the last few decades. Most of the studies were based on self-reported surveys, and accompanied with health examination with the use of the WHO standard definition of stroke. The Akita-Osaka study of stroke and coronary heart disease incidence reported a decreasing trend of age-adjusted incidence rates for both males and females aged 40 to 69 living in urban and rural communities in Japan. The age-adjusted incidence rate (per 1,000 person-years) among those living in urban communities decreased from 2.4 during 1980-1987 to 1.2 during 1996-2003 for males and from 1.6 during 1980-1987 to 0.8 during 1996-2003 for females (Table 4.11) (Kitamura *et al.*, 2008).

**Table 4.11 Age-adjusted* annual incidence rates of stroke (per 1,000 population) among population aged 40 to 69 in urban and rural communities of Osaka, Japan, by sex, 1980-2003**

| | 1980-1987 | | 1988-1995 | | 1996-2003 | |
|---|---|---|---|---|---|---|
| **Area** | **Male** | **Female** | **Male** | **Female** | **Male** | **Female** |
| **Urban** | 2.4 | 1.6 | 2.3 | 0.8 | 1.2 | 0.8 |
| **Rural** | 3.3 | 1.6 | 2.6 | 1.9 | 2.3 | 1.1 |

** The age-adjusted incidence rates used the 1985 national model population in Japan as the standard.*

*Data source: Kitamura et al. (2008)*

The Hisayama study of cardiovascular disease incidence in a suburban community in southern Japan also showed a declining trend in stroke incidence. The age-adjusted incidence rate (per 1,000 person-years) among those aged 40 and above decreased from 6.3 during 1974-1986 to 5.3 during 1988-2000 for males and from 4.5 during 1974-1986 to 3.9 during 1988-2000 for females (Kubo *et al.*, 2003).

Stroke incidence increased rapidly with increasing age and a greater incidence rate of stroke was found in males than in females. In the Jichi Medical School cohort study, the incidence rate of stroke was the highest in the group of subjects aged 70 and above (Table 4.12) (Ishikawa *et al.*, 2008).

**Table 4.12 Incidence rates of stroke (per 1,000 person-years) in Japan, by age group and sex, 1992-2005**

| Age group | Male | Female |
|---|---|---|
| ≤39 | 0.2 | 0.1 |
| 40-49 | 1.3 | 0.4 |
| 50-59 | 2.7 | 1.8 |
| 60-69 | 7.7 | 4.2 |
| 70+ | 13.8 | 12.3 |
| Total (age-adjusted*) | 3.1 | 2.2 |

** The age-adjusted incidence rates used the 1985 Japanese population in Japan as the standard.*
*Data source: Ishikawa et al. (2008)*

## 4.3 Summary

Based on hospital admission data, the annual age-adjusted incidence rates of first-ever stroke among people aged 65 and above decreased slightly from 14.1 per 1,000 population in 2000-2001 to 10.5 per 1,000 population in 2006-2007 in Hong Kong. Trends of hemorrhagic and ischemic stroke incidence were different, with decreasing trend in ischemic stroke but non-decreasing trend in hemorrhagic stroke. Comparing stroke incidence in different countries is difficult as estimates are often based on different time periods, different age groups and/or different methodologies. Nevertheless, stroke incidence rates reported in Hong Kong and those reported in the United States, the United Kingdom, Australia, China, Singapore and Japan consistently showed a higher rate with increasing age. Based on the estimates by Chau *et al.*(2011b), the age-adjusted ischemic stroke incidence for both males and females in Hong Kong was much higher than those in Japan, Australia and Italy. As for hemorrhagic stroke, the age-adjusted rates were also much higher than those of males and females in Australia, Italy and Brazil, as well as males in Japan.

Chapter 5

# Trends in Stroke Mortality in Hong Kong

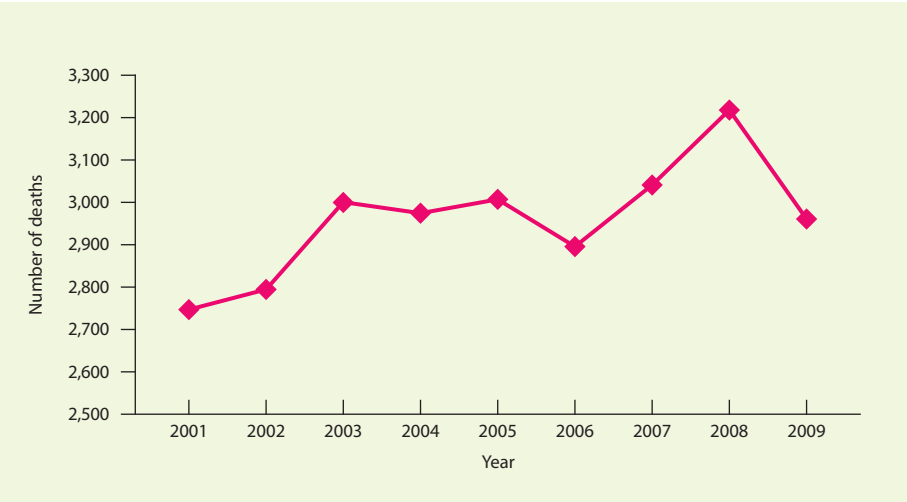
# Chapter 5

# Trends in Stroke Mortality in Hong Kong

## 5.1 Mortality trends of stroke

Stroke (ICD-10: I60-I69) is the fourth leading cause of death in Hong Kong. In 2009, there were 3,443 deaths from stroke, accounting for 8.4% of all deaths. Among those aged 65 and above, the number of deaths from stroke increased from 2,745 in 2001 to 2,962 in 2009 (Figure 5.1) (Department of Health of Hong Kong Special Administrative Region, 2011).

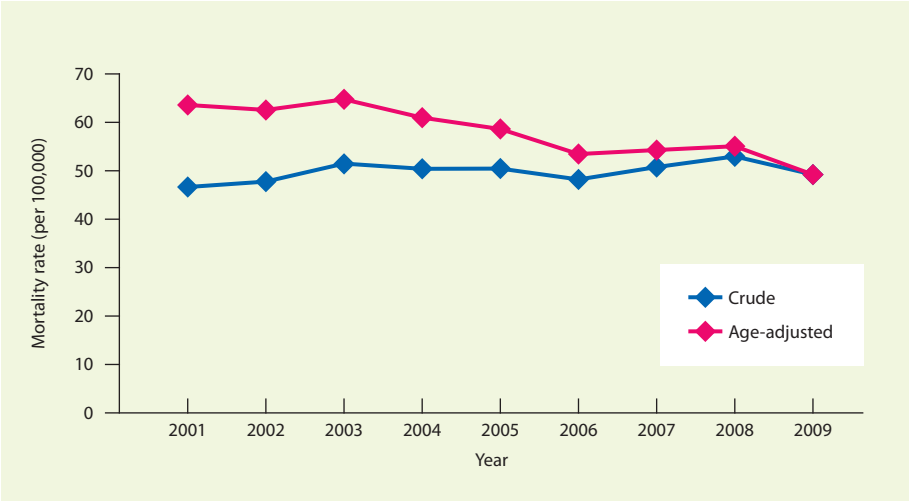
**Figure 5.1 Number of deaths due to stroke among people aged 65 and above in Hong Kong, 2001-2009**




*Data source: Department of Health of Hong Kong Special Administrative Region (2011)*

The crude mortality rate from stroke remained stable between 2001 (46.6 per 100,000) and 2009 (49.2 per 100,000). The age-adjusted mortality rates from stroke decreased from 63.5 per 100,000 in 2001 to 49.2 per 100,000 in 2009 (Figure 5.2) (Department of Health of Hong Kong Special Administrative Region, 2011).

**Figure 5.2 Crude and age-adjusted* mortality rates (per 100,000) for stroke in Hong Kong, 2001-2009**




** The age-adjusted mortality rates used the Hong Kong population as of mid-2009 as the standard.*

*Data source: Department of Health of Hong Kong Special Administrative Region (2011)*

The mortality rates increased sharply with age (Table 5.1) (Figure 5.3). In 2009, the age-adjusted mortality rates from stroke among those aged below 65 was 7.9 per 100,000 and that among those aged 65 and above was 331.5 per 100,000 (Department of Health of Hong Kong Special Administrative Region, 2011).

**Table 5.1 Age-adjusted* mortality rates for stroke# (per 100,000) in Hong Kong, by age group, 2001-2009**

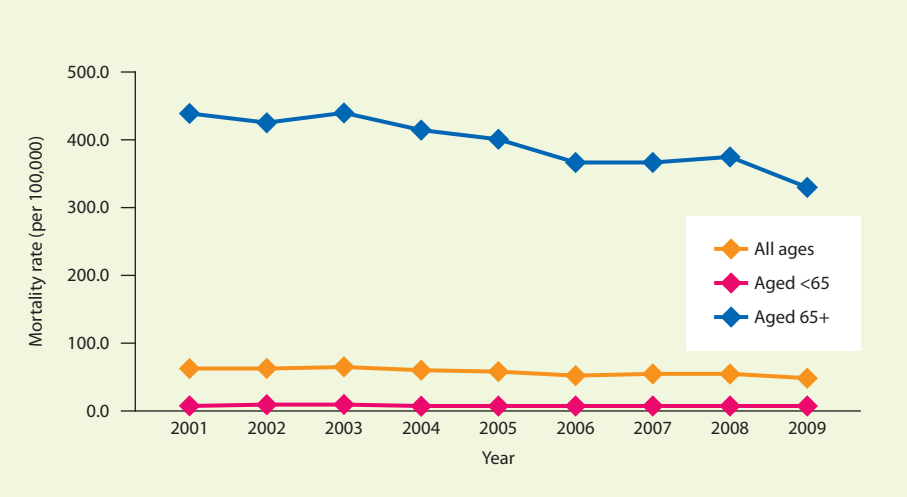
| Age group | 2001 | 2003 | 2005 | 2007 | 2009 |
|---|---|---|---|---|---|
| <65 | 8.6 | 9.6 | 8.3 | 8.5 | 7.9 |
| 65+ | 438.5 | 441.1 | 401.9 | 366.9 | 331.5 |
| Whole population | 63.5 | 64.6 | 58.5 | 54.2 | 49.2 |

** The age-adjusted mortality rates used the Hong Kong population as of mid-2009 as the standard.*

*# ICD-10: I60-I69.*

*Data source: Department of Health of Hong Kong Special Administrative Region (2011)*

**Figure 5.3 Age-adjusted* mortality rates (per 100,000) for stroke, by age group, Hong Kong, 2001-2009**




** The age-adjusted mortality rates used the Hong Kong population as of mid-2009 as the standard.*

*Data source: Department of Health of Hong Kong Special Administrative Region (2011)*

While the mortality rates from stroke increased with age, males had higher mortality rates than females. In 2009, mortality rates from stroke were 347.2 per 100,000 for males and 318.0 per 100,000 for females aged 65 and above after adjusting for age differences (Table 5.2) (Department of Health of Hong Kong Special Administrative Region, 2011).

**Table 5.2 Mortality rates from stroke# (per 100,000) in Hong Kong, by age group and sex, 2009**

| Age group | Male | Female | Total |
|---|---|---|---|
| **<65** | 11.3 | 4.8 | 7.9 |
| **65+** | 347.2 | 318.0 | 331.5 |
| **Whole population** | 53.5 | 45.3 | 49.2 |

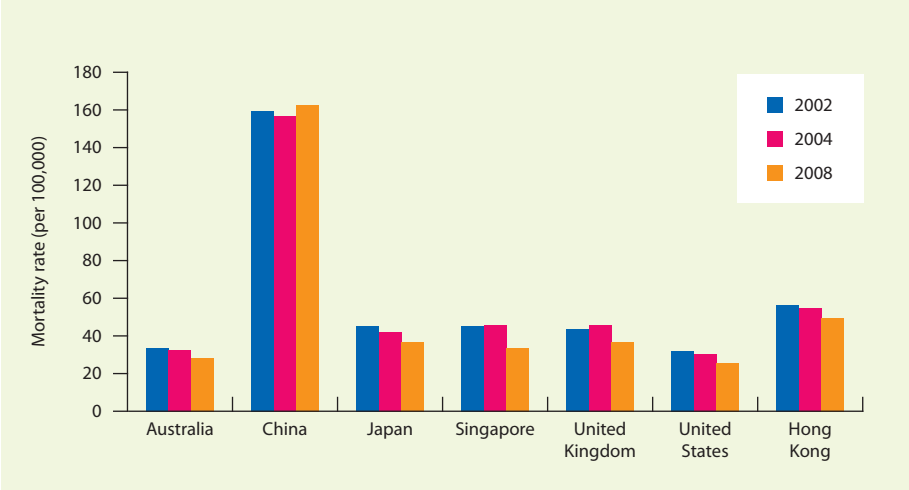
*# ICD-10: I60-I69.*

*Data source: Department of Health of Hong Kong Special Administrative Region (2011)*

## 5.2 Comparison of mortality with other countries

Standardized to the WHO World Standard Population, the age-adjusted mortality rates for stroke in Hong Kong were 56.2 per 100,000 in 2002, 54.7 per 100,000 in 2004 and 49.3 per 100,000 in 2008. The age-adjusted mortality rates of stroke in Hong Kong were higher than the United States, the United Kingdom, Australia, Japan and Singapore but much lower than China (Figure 5.4)(Department of Health of Hong Kong Special Administrative Region, 2011; WHO, 2004a, 2008a). Details about the mortality rates of stroke in individual countries are presented in subsequent sections.

**Figure 5.4 Age-adjusted* mortality rates for stroke (per 100,000), by country, 2002-2008**




** The age-adjusted mortality rates used the WHO standard population as the standard.*

*Data sources: Department of Health of Hong Kong Special Administrative Region (2011) and WHO (2004a , 2008a)*

### *5.2.1 United States*

In the United States, the age-adjusted mortality rates for stroke decreased steadily from 65.5 per 100,000 in 1990 to 60.9 per 100,000 in 2000 and then decreased more rapidly to 43.6 per 100,000 in 2006. Sharing a similar trend, an overall decline in mortality rates for stroke was shown among people aged 65 and over from 1990 to 2006. The decreases in 2000-2006 among those aged 65 and over were faster than that in 1990-2000. The mortality rates increased with age. In 2006, the mortality rate for stroke among those aged 65 to 74 was 96.3 per 100,000, while that among those aged 85 and above was 1,039.6 per 100,000 (Table 5.3) (National Center for Health Statistics of the United States, 2010).

**Table 5.3 Mortality rates for stroke# (per 100,000) in the United States, by age group, 1990-2006**

| Age group | 1990 | 1995 | 2000 | 2005 | 2006 |
|---|---|---|---|---|---|
| 65-74 | 144.4 | 137.2 | 128.6 | 101.1 | 96.3 |
| 75-84 | 499.3 | 481.4 | 461.3 | 359.0 | 335.1 |
| 85+ | 1,633.9 | 1,636.5 | 1,589.2 | 1,141.8 | 1,039.6 |
| Whole population (age-adjusted*) | 65.5 | 63.9 | 60.9 | 46.6 | 43.6 |

*# ICD-9: 430-438 for the years 1990 and 1995, ICD-10: I60-I69 for the year 2000 and after.*

** The age-adjusted mortality rates used the 2000 US standard population as the standard.*

*Data source: National Center for Health Statistics of the United States (2010)*

### 5.2.2 United Kingdom

In the United Kingdom, the age-adjusted mortality rates for stroke increased in both males and females between 2000 and 2003 but then decreased substantially thereafter until 2005 and further fell in 2007. The mortality rates increased with age. In 2007, the mortality rate for stroke among those aged 65 to 74 was 127.6 per 100,000 for males and 96.7 per 100,000 for females, while that among those aged 85 and above was 1,719.5 per 100,000 for males and 1,986.4 per 100,000 for females. Mortality rates for stroke were also consistently higher in males aged below 85 than in females (Table 5.4) (Office for National Statistics of the United Kingdom, 2000, 2003, 2005, 2007).

**Table 5.4 Mortality rates for stroke# (per 100,000) in England and Wales, by age group and sex, 2000-2007**

| Age group | 2000 | | 2003 | | 2005 | | 2007 | |
|---|---|---|---|---|---|---|---|---|
| | Male | Female | Male | Female | Male | Female | Male | Female |
| 65-74 | 191.4 | 148.3 | 179.0 | 137.0 | 146.7 | 113.0 | 127.6 | 96.7 |
| 75-84 | 695.8 | 638.1 | 757.6 | 681.9 | 631.2 | 591.8 | 551.9 | 509.1 |
| 85+ | 1,893.2 | 2,160.8 | 2,340.9 | 2,602.6 | 1,958.6 | 2,238.3 | 1,719.5 | 1,986.4 |
| Whole population (age-adjusted*) | 61.5 | 56.6 | 66.1 | 66.0 | 55.3 | 51.9 | 48.1 | 45.5 |

*# ICD-9: 430-438 for the year 2000, ICD-10: I60-I69 for the year 2003 and after.*

** The age-adjusted mortality rates used the European Standard Population as the standard.*

*Data sources: Office for National Statistics of the United Kingdom (2000, 2003, 2005, 2007)*

### 5.2.3 Australia

In Australia, the age-adjusted mortality rates for stroke have fallen considerably in the last twenty years. Between 1990 and 2007 there has been a nearly 50% drop in stroke mortality rates, with the rate being 88.6 per 100,000 in 1990 to 47.0 per 100,000 in 2007. The mortality rates increased sharply with age. In 2007, the mortality rate for stroke among those aged 85 and above (1,707.5 per 100,000) was over 23 times higher than those aged 65-74 (72.1 per 100,000) (Table 5.5) (Australian Bureau of Statistics, 2009a).

**Table 5.5 Mortality rates for stroke[#] (per 100,000) in Australia, by age group, 1990-2007**

| Age group | 1990 | 2000 | 2005 | 2007 |
|---|---|---|---|---|
| 65-74 | 184.6 | 121.3 | 81.3 | 72.1 |
| 75-84 | 809.5 | 544.1 | 423.2 | 388.8 |
| 85+ | 2,676.4 | 2,173.4 | 1,782.3 | 1,707.5 |
| Whole population (age-adjusted*) | 88.6 | 63.4 | 49.5 | 47.0 |

*[#] ICD-10: I60-I69.*

** The age-adjusted mortality rates used the 30 June 2000 Australian estimated resident population as the standard.*

*Data source: Australian Bureau of Statistics (2009a)*

### 5.2.4 China

In China, crude mortality rates for stroke among urban population were increasing overall, with the rate being 102.4 per 100,000 in 2003 to 111.5 per 100,000 in 2007. The increase may be attributed to ageing of the population. Morality rates increased sharply with age. In 2007, the mortality rate for stroke among those aged 85 and above (3,259.2 per 100,000) was over 13 times higher than those aged 65-69 (236.7 per 100,000). Mortality rates were also consistently higher in males than in females (Table 5.6) (Ministry of Health of the People's Republic of China, 2008).

**Table 5.6 Mortality rates for stroke[#] (per 100,000) in China (urban areas), by age group and sex, 2003-2007**

| | 2003 | 2006 | 2007 |
|---|---|---|---|
| **Male** | | | |
| **65-69** | 534.9 | 315.3 | 291.8 |
| **70-74** | 1,009.4 | 635.3 | 595.2 |
| **75-79** | 1,718.5 | 1,190.7 | 1,142.2 |
| **80-84** | 2,601.5 | 2,048.2 | 2,108.9 |
| **85+** | 3,008.0 | 3,507.9 | 3,634.7 |
| **Female** | | | |
| **65-69** | 351.1 | 210.6 | 183.3 |
| **70-74** | 699.1 | 423.0 | 395.8 |
| **75-79** | 1,264.4 | 865.1 | 822.3 |
| **80-84** | 2,029.9 | 1,618.3 | 1,658.8 |
| **85+** | 2,830.6 | 2,836.4 | 3,059.4 |
| **Total** | | | |
| **65-69** | 443.2 | 262.0 | 236.7 |
| **70-74** | 851.8 | 525.2 | 490.3 |
| **75-79** | 1,473.6 | 1,016.5 | 966.2 |
| **80-84** | 2,271.4 | 1,801.3 | 1,843.5 |
| **85+** | 2,899.7 | 3,080.9 | 3,259.2 |
| **Whole population** | 102.4 | 90.7 | 111.5 |

[#] *ICD-10: I60-I69.*

*Data source: Ministry of Health of the People's Republic of China (2008)*

At all ages, the age-adjusted mortality rates for stroke in urban area of China decreased from 88.3 per 100,000 in 1990 to 49.5 per 100,000 in 2007. The mortality rates were consistently higher in males than females over the years (Table 5.7) (Ministry of Health of the People's Republic of China, 2008).

**Table 5.7 Age-adjusted* mortality rates of stroke# (per 100,000) in China (urban area), by sex, 1990-2007**

| Sex | 1990 | 1995 | 2000 | 2007 |
|---|---|---|---|---|
| Male | 102.1 | 99.4 | 84.4 | 51.6 |
| Female | 76.7 | 70.0 | 58.6 | 47.1 |
| Total | 88.3 | 83.7 | 70.7 | 49.5 |

** Age-adjusted mortality rates used the China national census in 1982 as the standard.*

*# ICD-9: 430-438 for the years 1990, 1995, and 2000, ICD-10: I60-I69 for the year 2007.*

*Data source: Ministry of Health of the People's Republic of China (2008)*

### 5.2.5 Singapore

Stroke mortality rates in Singapore were declining overall. The mortality rates for stroke decreased from 60.9 per 100,000 population in 1990 to 41.6 per 100,000 population in 2007 (Table 5.8) (Singapore Department of Statistics, 2008).

**Table 5.8 Mortality rates for stroke# (per 100,000) in Singapore, 1990-2007**

| | 1990 | 1995 | 2000 | 2005 | 2007 |
|---|---|---|---|---|---|
| Whole population | 60.9 | 56.4 | 49.8 | 45.5 | 41.6 |

*# ICD-9: 430-438.*

*Data source: Singapore Department of Statistics (2008)*

### 5.2.6 Japan

Age-adjusted mortality rates for stroke in Japan decreased slowly after 1995, from 99.3 per 100,000 (males) and 64.0 per 100,000 (females) in 1995 to 55.4 per 100,000 (males) and 31.6 per 100,000 (females) in 2007. The mortality rates increased with age. In 2007, the mortality rates for stroke among those aged 80 to 84 were seven times those of 65 to 69 year olds. Male stroke mortality rates were approximately twice those of females (Table 5.9) (Ministry of Health, Labour and Welfare of Japan, 2010).

**Table 5.9 Mortality rates for stroke# (per 100,000) in Japan, by age group and sex, 1995-2007**

| | 1995 | 2000 | 2005 | 2007 |
|---|---|---|---|---|
| **Male** | | | | |
| **65-69** | 226.5 | 176.8 | 141.4 | 128.7 |
| **70-74** | 418.1 | 321.9 | 264.5 | 231.1 |
| **75-79** | 851.8 | 605.0 | 500.6 | 443.3 |
| **80-84** | 1,707.4 | 1,226.9 | 941.3 | 820.0 |
| **Total (crude)** | 114.2 | 102.7 | 103.3 | 99.2 |
| **Total (age-adjusted*)** | 99.3 | 74.2 | 61.9 | 55.4 |
| **Female** | | | | |
| **65-69** | 114.4 | 85.5 | 66.0 | 54.2 |
| **70-74** | 240.3 | 168.1 | 127.6 | 110.1 |
| **75-79** | 533.9 | 358.7 | 264.8 | 229.3 |
| **80-84** | 1,175.9 | 800.0 | 592.4 | 498.7 |
| **Total (crude)** | 121.4 | 108.2 | 107.1 | 102.3 |
| **Total (age-adjusted*)** | 64.0 | 45.7 | 36.1 | 31.6 |
| **Both sexes** | | | | |
| **65-69** | 166.9 | 128.7 | 102.0 | 89.8 |
| **70-74** | 313.8 | 237.7 | 190.4 | 165.9 |
| **75-79** | 655.6 | 455.2 | 366.0 | 321.8 |
| **80-84** | 1,366.3 | 949.4 | 717.4 | 620.3 |
| **Whole population (crude)** | 117.9 | 105.5 | 105.3 | 100.8 |

*# ICD-10: I60-I69.*

** Age-adjusted mortality rates used the 1985 national model population in Japan as the standard.*

*Data source: Ministry of Health, Labour and Welfare of Japan (2010)*

## 5.3 Summary

Stroke is the fourth leading cause of death in Hong Kong. In 2009, there were 3,443 deaths from stroke, accounting for 8.4% of all deaths. Although the age-adjusted stroke mortality rate among people aged 65 and above decreased between 2001 (63.5 per 100,000) and 2009 (49.2 per 100,000), the number of deaths from stroke increased gradually among those aged 65 and above during the same period, probably attributed by the ageing population. Standardized to the WHO World Standard Population, the age-adjusted mortality rates for stroke in Hong Kong were higher than the United States, the United Kingdom, Australia, Japan and Singapore but much lower than China.

# Chapter 6

# Trends in Stroke Case-fatality in Hong Kong

Chapter 6

# Trends in Stroke Case-fatality in Hong Kong

## 6.1 Case-fatality trends of stroke

Understanding the pattern of case-fatality can offer an opportunity to both potentially identify risk groups and to develop preventive strategies. In Hong Kong, a slow decrease in stroke case-fatality was observed between 1999 and 2007. Based on hospital admission data, the 30-day case-fatality rates for stroke among stroke patients aged 65 and above have decreased slightly from 14.0% in 1999 to 12.8% in 2007. Case-fatality rates of stroke increased steeply with age, and females aged 85 and above tended to have a higher case-fatality rate of stroke than their male counterparts (Table 6.1).

**Table 6.1 30-day case-fatality rates of stroke among stroke patients aged 65 and above, by age group and sex, Hong Kong, 1999-2007**

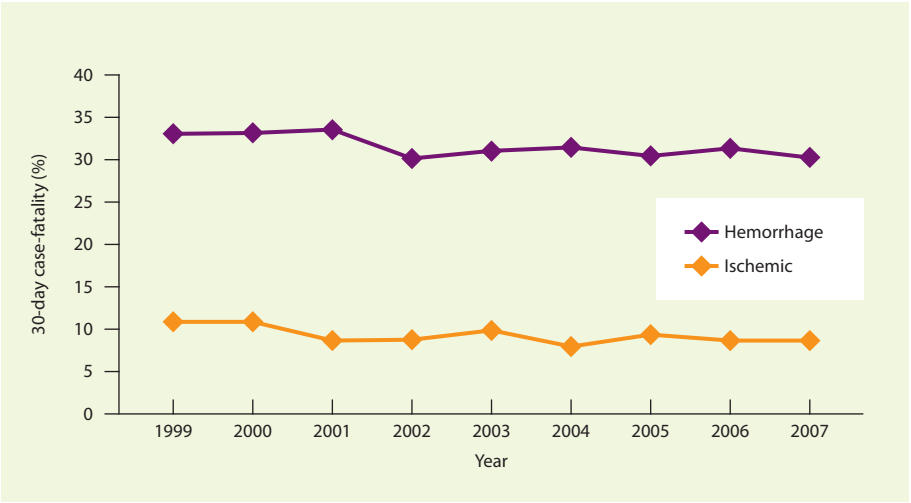
| | 1999 | 2001 | 2003 | 2005 | 2007 |
|---|---|---|---|---|---|
| **Male** | | | | | |
| **65-74** | 10.3% | 9.6% | 9.2% | 10.1% | 9.8% |
| **75-84** | 14.2% | 11.1% | 12.9% | 12.6% | 13.2% |
| **85+** | 19.4% | 16.4% | 20.3% | 16.6% | 18.1% |
| **65+ (age-adjusted*)** | 12.9% | 11.0% | 11.9% | 11.8% | 12.1% |
| **Female** | | | | | |
| **65-74** | 10.2% | 10.8% | 9.8% | 9.8% | 8.3% |
| **75-84** | 14.9% | 13.9% | 14.4% | 14.5% | 13.3% |
| **85+** | 22.7% | 17.6% | 24.4% | 20.5% | 21.0% |
| **65+ (age-adjusted*)** | 15.1% | 13.7% | 15.2% | 14.3% | 13.4% |
| **Total** | | | | | |
| **65-74** | 10.2% | 10.1% | 9.4% | 9.9% | 9.2% |
| **75-84** | 14.5% | 12.5% | 13.7% | 13.5% | 13.2% |
| **85+** | 21.7% | 17.2% | 23.1% | 19.3% | 20.0% |
| **65+ (age-adjusted*)** | 14.0% | 12.4% | 13.6% | 13.1% | 12.8% |

** The age-adjusted case-fatality rates used the total population of patients admitted for stroke from 1999 to 2007 as the standard.*

*Data source: Authors' calculations*

A cohort study (Shatin Stroke Registry) of patients admitted with acute stroke to a general hospital in Hong Kong found that the overall 30-day case-fatality rate was 25.4% for all strokes (Kay *et al.*, 1992). Based on hospital admission data, the case-fatality rate of hemorrhagic stroke and ischemic stroke among the Hong Kong population aged 65 and above remained stable from 1999 to 2007 (Figure 6.1). Also, a higher case-fatality rate of hemorrhagic stroke was noted during the same period. Case-fatality rate of hemorrhagic stroke was approximately three times that of ischemic stroke (Figure 6.1).

**Figure 6.1 30-day case-fatality rates for strokes in Hong Kong, by stroke subtypes, 1999-2007**




*Data source: Authors' calculations*

## 6.2 Comparison of case-fatality with other countries

Comparing case-fatality rate of stroke in different parts of the world may increase our understanding of health care planning, prevention and management of stroke. However, comparison studies of the case-fatality rate of stroke were found to be limited. According to the Shatin Stroke Registry in Hong Kong, the 30-day case-fatality rate (25.4%) was significantly higher than that of most other registries from other countries. The higher rate observed in Hong Kong may be in part due to the larger proportion of hemorrhages (Table 6.2) (Kay *et al.*, 1992).

**Table 6.2 30-day case-fatality rates of stroke in five Western registries and in one local registry in Hong Kong**

| Study | Country | Population size | Age | Case-fatality | Source |
|---|---|---|---|---|---|
| The US National Institute of Neurological Disorders and Stroke (NINDS) Stroke Data Bank | United States | 1,562 | All ages | 14.2% | Foulkes *et al.* (1988) |
| The Lehigh Valley Stroke Register | United States | 2,621 | NA | 20.2% | Friday *et al.* (1989) |
| The Lausanne Stroke Registry | Switzerland | 1,000 | 20-89 | 8.2% | Bogousslavsky *et al.* (1988) |
| The Dijon Stroke Registry | France | 800 | NA | 24.7% | Giroud *et al.* (1989) |
| The Oxfordshire Community Stroke Project | United Kingdom | 642 | All ages | 23.9% | Bamford *et al.* (1990) |
| The Shatin Stroke Registry | Hong Kong | 777 | All ages | 25.4% | Kay *et al.* (1992) |

*NA: Not available.*

In recent years, several population-based stroke rate studies have been published. The following sections draw on a variety of sources to present the case-fatality rates of stroke of some published population-based studies of selected countries.

### *6.2.1 United States*

Population-based data on trends in case-fatality of stroke are scarce, with only one population-based study thus far reporting time-trend data for case-fatality rate of stroke in the United States. Based on data from the Framingham Study of 9,152 persons aged 55 years or older, the 30-day case-fatality rates decreased significantly in males (from 23% to 14%; P=0.01) but insignificantly in females (from 21% to 20%; P=0.32) during the periods 1950 to 1977 and 1990 to 2004 (over 174,917 person-years of follow-up) (Table 6.3) (Carandang *et al.*, 2006).

**Table 6.3 30-day case-fatality of stroke in the United States, by sex, 1950-2004**

| Sex | 1950-1977 | 1978-1989 | 1990-2004 |
|---|---|---|---|
| Male | 23% | 20% | 14% |
| Female | 21% | 21% | 20% |

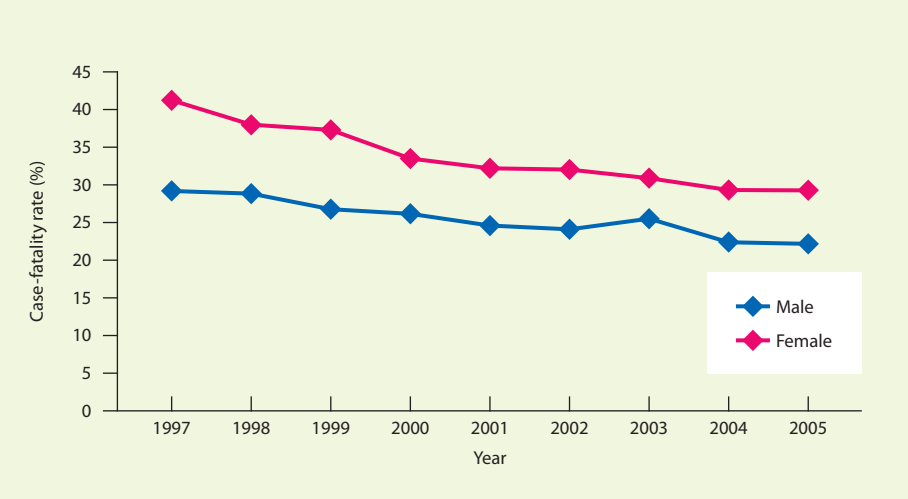
*Data source: Carandang et al. (2006)*

The case-fatality rates for stroke were also evaluated in other studies. In the Atherosclerosis Risk in Communities Cohort study for persons aged 45-64, the age-, sex- and race-adjusted 30-day case-fatality rate was 10.3% for all strokes, 7.3% for ischemic strokes and 33.1% for hemorrhagic strokes. Higher case-fatality rates were found in men (11.0%) than in women (9.8%) (Rosamond *et al.*, 1999). Similar rates were reported in the Cardiovascular Health Study of persons aged 65 years or older, with the one-month case-fatality of stroke being 12.6% for all strokes, 8.1% for ischemic strokes and 44.6% for hemorrhagic strokes (El-Saed *et al.*, 2006).

### *6.2.2 United Kingdom*

Based on data from the South London Stroke Register in the United Kingdom, the overall case-fatality rates of stroke were 16.6% at 7 days, 25.7% at 28 days, 32.9% at 90 days and 36.7% at 180 days but with no significant differences between ethnic groups (Wolfe *et al.*, 2002). Trend data for case-fatality rate of stroke in the United Kingdom is also available. According to a population-based cohort study, there was a declining trend in one-year case-fatality rate of stroke between 1997 and 2005. In males, the one-year case-fatality declined from 29.2% in 1997 to 22.2% in 2005. In females, the decline was from 41.2% in 1997 to 29.2% in 2005. Reducing one-year case-fatality after acute stroke may be partly explained by increased prescribing of antihypertensive, statin and antiplatelet drugs to patients with recent strokes (Figure 6.2) (Gulliford *et al.* 2009).

**Figure 6.2 One-year case-fatality of stroke in the United Kingdom, by sex, 1997-2005**




*Data source: Gulliford et al. (2009)*

### 6.2.3 Australia

Based on data from the North East Melbourne Stroke Incidence Study in Australia, the overall 28-day and one-year case-fatality rates for all first-ever strokes were 20% and 37%, respectively (Thrift *et al.*, 2001). Trend data for case-fatality rate of stroke in Australia is also available. In the Perth Community Stroke study, the 28-day case-fatality rates ranged from 20.2% to 22.5% over three study periods from 1989 to 2001 (Table 6.4) (Islam *et al.*, 2008).

**Table 6.4 28-day case-fatality of first-ever strokes in Australia, 1989-1990, 1995-1996, 2000-2001**

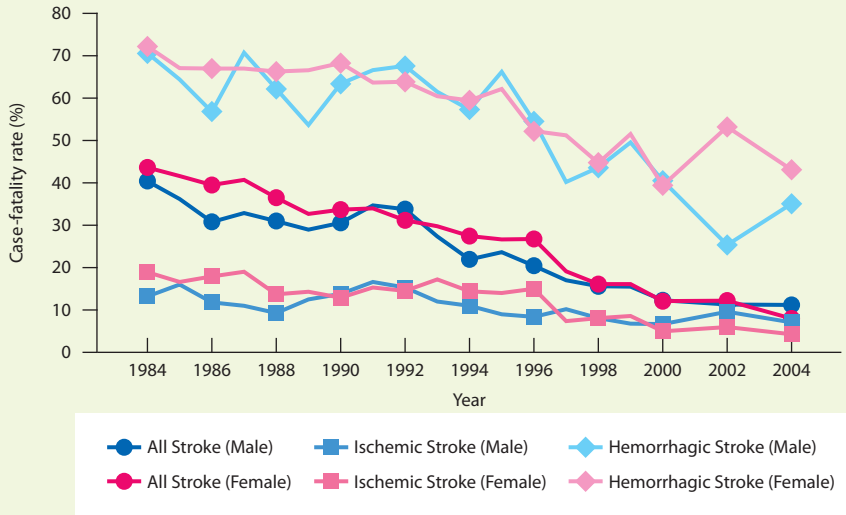
| Stroke type | 1989-1990 | 1995-1996 | 2000-2001 |
|---|---|---|---|
| Ischemic stroke | 8.7% | 14.5% | 13.8% |
| Primary intracerebral hemorrhage | 37.5% | 45.5% | 47.4% |
| Subarachnoid hemorrhage | 40.0% | 20.0% | 25.0% |
| All strokes | 21.9% | 22.5% | 20.2% |

*Data source: Islam et al. (2008)*

### 6.2.4 China

In China, based on data of the Sino-MONICA-Beijing project from 1984 to 2004, Zhao *et al.* (2008) examined the changes in trends of incidence rates and case-fatality rates of stroke. The age-adjusted case-fatality rates decreased in hemorrhagic stroke, ischemic stroke and total stroke in both males and females. There was a 1.7% decline in the case-fatality rate of hemorrhagic stroke and 0.5% decline in that of ischemic stroke annually (Figure 6.3).

**Figure 6.3 Age-adjusted* case-fatality rates of stroke in Sino-MONICA population aged 25-74, 1984-2004**




** The age-adjusted case-fatality rates used the age distribution of all the stroke cases in 1984 to 2004 as the standard.*

*Data source: Zhao et al. (2008)*

### 6.2.5 Singapore

Information on case-fatality rate of stroke in Singapore is not readily available.

### 6.2.6 Japan

Population-based data on trends in case-fatality of stroke are scarce, with only one early population-based study thus far reporting time-trend data for case-fatality rate of stroke in Japan. Morikawa *et al.* (2000) revealed the trends of stroke incidence and case-fatality from the data of a community-based stroke registry in a rural area in Japan. The 28-day case-fatality rates for all strokes improved from 18.0% to 14.2% in males and from 26.8% to 19.1% in females from 1977 to 1991 (Table 6.5).

**Table 6.5 28-day case-fatality rates of stroke in Japan, by sex, 1977-1981, 1982-1986, 1987-1991**

| | 1977-1981 | 1982-1986 | 1987-1991 |
|---|---|---|---|
| **Male** | | | |
| **25-64** | 15.7% | 14.4% | 8.0% |
| **65-74** | 13.8% | 10.6% | 9.1% |
| **75+** | 25.4% | 23.5% | 22.1% |
| **Total** | 18.0% | 16.3% | 14.2% |
| **Female** | | | |
| **25-64** | 22.6% | 13.0% | 18.2% |
| **65-74** | 25.3% | 27.1% | 14.9% |
| **75+** | 30.3% | 26.7% | 20.9% |
| **Total** | 26.8% | 24.5% | 19.1% |

*Data source: Morikawa et al. (2000)*

## 6.3 Summary

In Hong Kong, a slow decrease in stroke case-fatality rate was observed between 1999 and 2007. Based on hospital admission data, the 30-day case-fatality rates for stroke (ICD-9: 430-434, 436-437) among stroke patients aged 65 and above have decreased from 14.0% in 1999 to 12.8% in 2007. Case-fatality rates of stroke increased steeply with age, and females aged 85 and above tended to have a higher case-fatality rate of stroke than their male counterparts. A higher case-fatality rate of hemorrhagic stroke was also noted during the same period.

Chapter 7

# Physical, Psychological and Social Consequences of Stroke

# Chapter 7

# Physical, Psychological and Social Consequences of Stroke

The impact of stroke can be devastating, leaving a person facing a lifetime of recovery. Successful stroke recovery not only enables the stroke survivor to regain physical function and reduces stress on caregivers but also reduces the burden of stroke on society. Existing stroke recovery strategy focuses mainly on restoration of physical function after stroke; however, the psychological and social impact of stroke also influences the stroke recovery. In this chapter, physical, psychological and social consequences of stroke are presented. Physical consequences of stroke include functional limitation and cognitive decline; psychological consequences of stroke include depression and poor quality of life; and social consequences of stroke include role change and social isolation. The aim of stroke recovery for stroke survivors and their families is returning stroke survivors to society with the ability to function and adapt to their cognitive and physical impairments as well as to altered social roles and relationships with their families and friends.

## 7.1 Physical consequences of stroke

### *7.1.1 Functional limitations*

Stroke is a leading cause of functional limitations worldwide. In a prospective population-based registry in Australia, Hankey *et al.* (2002) found that long term disability is a common sequela among stroke survivors and one-third remained disabled five years after stroke. In a prospective population-based registry of 490 patients with first-ever stroke in England, Patel *et al.* (2006) found that the prevalence of disability and handicap were high at three years after stroke, with 26% of subjects being classified as moderately or severely disabled (Barthel Index < 15) and 51% handicapped (Frenchay Activity Index < 15). Results from a population-based survey of Hong Kong Chinese population are similar, identifying stroke as a strong predictor for severe functional limitation (Barthel Index < 15) among Chinese aged 70 years and above (Woo *et al.*, 1998a).

Functional limitations following stroke affect both psychological well being and the level of participation of survivors in society. A previous qualitative study has shown that loss of mobility causes access restrictions within the survivor's home and the community, which may lead to psychological distress and social isolation (Pound *et al.*, 1998). Van Wijk *et al.* (2006) also found that decline in mobility was associated with depression in the second year after stroke. Functional disability was also suggested to be a risk factor associated with handicap (Chau *et al.*, 2007; Lo *et al.*, 2008).

### *7.1.2 Cognitive impairment and dementia*

Cognitive impairment following stroke is common. According to a population-based register of first-ever strokes in south London, the prevalence rate of cognitive impairment, as measured by the Mini-Mental State Examination (MMSE) score, was 39% at three months post stroke and remained over 30% up to three years after first stroke (Patel *et al.*, 2003). The prevalence of cognitive impairment increases with age. In a cohort study of older stroke patients aged 70 and above in Sweden, the prevalence rate of cognitive impairment at 1.5 years after stroke was 72% (Lindén *et al.*, 2004).

A considerable number of studies of cognitive impairment after stroke have been reported in Hong Kong. Sze *et al.* (2000) studied 793 Hong Kong Chinese patients in an attempt to identify factors that may predict stroke disability at discharge. Using the Abbreviated Mental Test (AMT) in the acute stage, the prevalence rate of cognitive impairment at 3 to 10 days after stroke was 18.5%. A more recent study assessing Hong Kong Chinese patients aged 60 and above suggested that the prevalence rate of cognitive impairment, as measured by the MMSE score, was 21.8% at 3 months after their stroke (Tang *et al.*, 2006).

Data from the Elderly Health Centre (EHC) cohort recruited between 1998 and 2001 included information about cognitive impairment severity, which was determined by the AMT. An AMT score of 0-3 indicated severe cognitive impairment and 4-7 moderate impairment. Of the 1,988 subjects with stroke, over 10% had severe or moderate cognitive impairment (Table 7.1) (Department of Health of the Hong Kong Special Administrative Region, n.d.).

**Table 7.1 Cognitive function of people aged 65 and above in EHC cohort, by stroke status, 1998-2001**

| | | Cognitive function* | | |
|---|---|---|---|---|
| **Stroke status** | **N** | **Normal** | **Moderate** | **Severe** |
| **With stroke** | 1,988 | 89.3% | 7.5% | 3.2% |
| **Without stroke** | 64,776 | 93.8% | 5.3% | 0.8% |
| **Total** | 66,764 | 93.7% | 5.4% | 0.9% |

** AMT as assessment tool and the classification of the level of cognitive impairment was based on the scores (0-3 Severe impairment; 4-7 Moderate impairment and 8-10 Normal).*

*Data sources: Department of Health of the Hong Kong Special Administrative Region (n.d.) and authors' calculations*

Cognitive impairment following stroke is also common in institutional populations. Based on the same cohort, the prevalence rates of severe or moderate impairment among the people living in institutions were 12.4% and 16.6%, respectively (Table 7.2).

**Table 7.2 Cognitive function of people aged 65 and above in EHC cohort with stroke, by living status, 1998-2001**

| | | Cognitive function* | | |
|---|---|---|---|---|
| **Living status** | **N** | **Normal** | **Moderate** | **Severe** |
| **Living in institutions** | 169 | 71.0% | 16.6% | 12.4% |
| **Living in community** | 1,819 | 91.0% | 6.7% | 2.3% |
| **Total** | 1,988 | 89.3% | 7.5% | 3.2% |

** AMT as assessment tool and the classification of the level of cognitive impairment was based on the scores (0-3 Severe impairment; 4-7 Moderate impairment and 8-10 Normal).*

*Data sources: Department of Health of the Hong Kong Special Administrative Region (n.d.) and authors' calculations*

Cognitive impairment is a major cause of dependency in stroke survivors (Narasimhalu *et al.*, 2011; Stephens *et al.*, 2005) and has considerable impact on stroke recovery (Pohjasvaara *et al.*, 2002), quality of life (Nys *et al.*, 2006) and survival (Oksala *et al.*, 2009). Previous study has also shown that cognitive recovery was associated with less institutionalization and being less disabled (Patel *et al.*, 2003).

In addition to cognitive impairment, dementia is also a prevalent consequence after the onset of stroke. The relationship between stroke and dementia has been widely studied, while the risk and rate of dementia after stroke vary between studies (Leys *et al.*, 2005). A 10-year nested case-control study in a community in the United States (The Framingham Study) found that people with first-ever stroke had a two-fold increased risk of dementia compared to those without stroke (Relative risk = 2.0; 95% CI: 1.4-2.9) after controlling for age, sex and education (Ivan *et al.*, 2004). Similar results were observed in another population-based study in Rochester, Minnesota, with the cumulative incidence rate of dementia after first-ever ischemic stroke increasing from 7% at one year post stroke, to 10% at three years post stroke and to 48% at 25 years post stroke. People with first-ever ischemic stroke had 8.8 times higher risk of dementia compared to those without stroke at one year post stroke (Kokmen *et al.*, 1996).

A number of individual epidemiological studies have examined the prevalence of post stroke dementia in Hong Kong. Tang *et al.*(2004) reported a figure of 20% in a group of 280 Hong Kong Chinese stroke patients aged 50 and above. After the exclusion of patients with pre-stroke dementia, the prevalence of dementia dropped to 15.5%.

Based on the PHS 2003/2004, the prevalence rates of dementia were much higher among stroke patients (6.6%) than among stroke-free subjects (2.1%) (P<0.01) (Table 7.3) (Department of Health of Hong Kong Special Administrative Region and Department of Community Medicine of the University of Hong Kong, 2005). However, these populations may be underestimated because people with dementia were unlikely to be interviewed in the survey; hence, people with dementia may be under-represented in the sample.

**Table 7.3 Prevalence rates of self-reported dementia among community-dwelling people aged 65 and above in Hong Kong, by stroke status, 2003-2004**

| | Signs of dementia present? | |
|---|---|---|
| **Stroke status** | **No** | **Yes** |
| **With stroke** | 93.4% | 6.6% |
| **Without stroke** | 97.9% | 2.1% |

*Data sources: Department of Health of Hong Kong Special Administrative Region and Department of Community Medicine of the University of Hong Kong (2005) and authors' calculations*

Post stroke dementia is also one of the main causes of dependency in survivors. Patients with post stroke dementia are more often functionally impaired (Zhu *et al.*, 1998) and have higher mortality rates (Desmond *et al.*, 2002). Because of the ageing population and a better survival after stroke, the prevalence of dementia after stroke is likely to increase in the future posing a treble burden to the health care and social services systems. Hence, the formulation of post stroke dementia care strategy as part of a stroke recovery strategy would be very important.

## 7.2 Psychological consequences of stroke

### *7.2.1 Depression*

Psychological consequences following stroke include a wide range of emotional disturbances, of which depression has received most attention. Post stroke depression is very common. In a systematic review of 51 studies conducted between 1977 and 2002, depressive symptoms were present in 33% (95% CI: 29%-36%) of all stroke survivors at any time during follow-up (Hackett *et al.*, 2005b). Eriksson *et al.* (2004) reported a prevalence rate of 14.3% at three month after stroke based on self-reported data in a Swedish national register.

In Hong Kong, Lee *et al.* (2007) estimated the incidence of depression among first-ever ischemic stroke patients between 2004 and 2005. Using Diagnostic and Statistical Manual of Mental Disorders fourth edition (DSM-IV) criteria, the incidence rate of depression at one month after stroke was 24.0% among people aged 50 and above. The rate was 27.4% when assessed by the Geriatric Depression Scale (GDS) short-form.

Post stroke depression is also common among older adults. Using the EHC data, it was shown that the prevalence rates of depression (GDS ≥ 8) were much higher among stroke patients (16.2%) than among stroke-free subjects (9.4%) (P<0.01) (Table 7.4) (Department of Health of Hong Kong Special Administrative Region, n.d.).

**Table 7.4 Prevalence rates of depression among people aged 65 and above in EHC cohort in Hong Kong, by stroke status, 1998-2001**

| | | Prevalence of depression | |
|---|---|---|---|
| **Stroke status** | **N** | **GDS#<8** | **GDS#≥8** |
| **With stroke** | 1,988 | 83.8% | 16.2% |
| **Without stroke** | 64,768 | 90.6% | 9.4% |
| **Total** | 66,756 | 90.4% | 9.6% |

*# GDS short-form scale (Range 0-15) ≥8 indicates depressive symptoms.*

*Data sources: Department of Health of Hong Kong Special Administrative Region (n.d.) and authors' calculations*

The consequences of post stroke depression are highly significant. It has severe implications for functional capabilities (Lo *et al.*, 2008; Schmid *et al.*, 2011) and quality of life (King, 1996) of stroke survivors. In addition, it influences stroke recovery (Ramasubbu, 2000) as well as length of stay in hospital (Schubert *et al.*, 1992). Several studies have been undertaken to identify the predictors of depression after stroke. A systematic review found that physical disability, stroke severity and cognitive impairment were consistently associated with post stroke depression (Hackett and Anderson, 2005a). Given the high prevalence of depression following stroke and its implications, it is recommended that the assessment of depression should be incorporated into stroke recovery so as to identify stroke patients suffering from depression for better psychological support and treatment.

### *7.2.2 Quality of Life*

The onset of stroke and its associated cognitive and functional disabilities have been linked to poor quality of life. Based on the PHS 2003/2004, older people aged 65 and above with stroke were more likely to rate their health as poor compared to those without stroke (Table 7.5) (Department of Health of Hong Kong Special Administrative Region and Department of Community Medicine of the University of Hong Kong, 2005). Similar results were found in the EHC cohort recruited between 1998 and 2001 (Table 7.6).

**Table 7.5 Self-rated health status of people aged 65 and above in PHS, by stroke status, 2003-2004**

| | Self-rated health | |
|---|---|---|
| **Stroke status** | **Good#** | **Poor*** |
| **With stroke** | 9.8 % | 90.2 % |
| **Without stroke** | 37.1 % | 62.9 % |

*# The category "Good" refers to excellent, very good or good self-rated health status.*

** The category "Poor" refers to fair or poor self-rated health status.*

*Data source: Department of Health of Hong Kong Special Administrative Region and Department of Community Medicine of the University of Hong Kong (2005)*

**Table 7.6 Self-rated health status of people aged 65 and above in EHC cohort, by stroke status, 1998-2001**

| | | Self-rated health compared with others of similar age group | | |
|---|---|---|---|---|
| **Stroke status** | **N** | **Better** | **Normal** | **Worse** |
| **With stroke** | 1,997 | 18.7% | 64.6% | 16.7% |
| **Without stroke** | 64,816 | 23.9% | 68.7% | 7.4% |
| **Total** | 66,813 | 23.7% | 68.6% | 7.7% |

*Data sources: Department of Health of Hong Kong Special Administrative Region (n.d.) and authors' calculations*

The psychological impact of depression (King, 1996; Sullivan *et al.*, 2000) and lack of social support may also contribute to poor quality of life among stroke survivors. A longitudinal study of 215 Chinese stroke patients aged 41-93, using the Sickness Impact Profile (SIP) as a measurement of quality of life, found that the mean SIP scores were 42.50 (SD=9.60) at 48 hours after stroke hospital admission, 36.88 (SD=12.89) at two weeks after stroke and 31.78 (SD=15.41) at three months after stroke. Those who had lower functional ability, less social support satisfaction, fewer support persons, more bed-days and more previous stroke, tended to have lower quality of life at 3 months after stroke (Mackenzie and Chang, 2002). Kwok *et al.* (2006) also showed that self-perceived health-related quality of life deteriorated significantly at 12 months following stroke in terms of psychological, social interaction and living environment in a prospective cohort study of 268 Chinese survivors of stroke. A recent study of Chinese first-ever ischemic stroke patients aged 50 years and above in 2004-2005, using the Modified Rankin Scale for Quality of Life (MRSQoL), which is a 6-point scale ranging from 0 to 5, with 5 being the lowest level of QoL, found that the mean MRSQoL scores were 2.36 (SD=1.30) at one month and 2.14 (SD=1.16) at six months following stroke, respectively. About two-thirds of the subjects showed an unchanged or lower quality of life at six months when compared to that at one month after stroke. Length of hospital stay, functional status, cognitive function and level of worry about current health at one month after stroke were predictors of quality of life at six months after stroke (Lee *et al.*, 2009).

## 7.3 Social consequences of stroke

Stroke affects not only the physical functioning and psychological well-being of stroke survivors, but also the social roles and relationships of survivors with their family members and friends. After a stroke, the roles of the stroke survivor and the caregiver in the family may undergo change. However, often both the stroke survivor and the caregiver are not adequately prepared for the role changes due to a lack of knowledge of the disease process and/or the personal attributes needed to become the primary care recipient and caregiver (Moore *et al.*, 2002). Consequently, role changes may add stress to relationships with family members and may also lower self-esteem and cause depression in the stroke survivor.

Loss of self-esteem after stroke often influences the interpersonal relationships and decreases social interaction and social support. Previous studies have reported self-esteem following stroke was significantly associated with functional independence (Chang and Mackenzie, 1998) and societal participation restriction (Chau *et al.*, 2009). Social interaction and social support were also associated with cognitive resilience (Fratiglioni *et al.*, 2004; Glymour *et al.*, 2008), stroke recovery (Berkman and Glass, 2000) and other outcome events after stroke (Boden-Albala *et al.*, 2005). Given the significant psychosocial impact of stroke, more study is needed to examine the use of psychosocial interventions in improving stroke recovery.

## 7.4 Summary

Stroke not only has its greatest impact on physical and cognitive function, but also affects the survivor's psychological well-being, social roles and relationships with their families and friends. Cognitive impairment, dementia and depression are common among stroke survivors and evidence suggests that they are the main causes of dependency. Depression after stroke can also affect the survivor's emotional functioning, functional and cognitive abilities, and quality of life. Changes in social roles associated with stroke may also add stress to relationships with family members and may lower self-esteem and cause depression in the stroke survivor. Evidence suggests that loss of self-esteem following stroke contributes to functional disability and societal participation restriction. Given that the physical, psychological and social consequences of stroke are interrelated, they should also be integrated into stroke recovery.

Chapter 8

# Burden of Disability from Stroke in Hong Kong

# Chapter 8

# Burden of Disability from Stroke in Hong Kong

## 8.1 Life expectancy for people with stroke

Using the Hong Kong Life Tables 2001-2036 (Census and Statistics Department of Hong Kong Special Administrative Region, 2007b) and estimates of the relative risk of mortality from stroke from the GBD study (Truelsen *et al.*, 2006a), we estimated life expectancy at the age between 65 and 69 in Hong Kong with stroke and without stroke. In 2006, male stroke survivors were more likely to live longer than their female counterparts. Among stroke survivors aged between 65 and 69 years, the life expectancy was 10.9 years for males and 8.0 years for females (Table 8.1).

**Table 8.1 Life expectancy at the age group of 65-69 (in years) among people with and without stroke in Hong Kong, by sex, 2006**

| Sex | General population | Population without stroke | Population with stroke | Difference |
|---|---|---|---|---|
| Male | 16.7 | 17.5 | 10.9 | 6.6 |
| Female | 16.5 | 17.3 | 8.0 | 9.3 |

*Data source: Authors' calculations*

## 8.2 Estimation of Disability-Adjusted Life Years (DALYs)

Burden of disease is a concept relating to loss of life, health and well-being which can be quantified by Disability-Adjusted Life Years (DALYs) combining the impact of premature mortality and morbidity. The premature mortality component is measured in terms of years of life lost (YLLs) and the morbidity component in terms of years of life span living in states of less than full health (years lost due to disability, YLDs). The burden of stroke in terms of DALYs has been studied worldwide. The following section presents the methods and results of the estimation of the burden of disease from stroke in Hong Kong.

### 8.2.1 Years of Life Lost (YLLs)

YLLs are calculated based on the age at which the person dies and the life expectancy for people of that age, as determined by a life table constructed by Census and Statistics Department of Hong Kong Special Administrative Region, (2007b). In 2006, the 2,896 people aged 65 and above who died from stroke (ICD-10: I60-I69) resulted in over 12,500 YLLs (Table 8.2). About 60% of these YLLs were for males.

**Table 8.2 Years of life Lost (YLLs) due to stroke in Hong Kong, by sex, in 2006**

| | No. of death | Life expectancy* | YLLs |
|---|---|---|---|
| **Male** | | | |
| **65-69** | 162 | 10.9 | 1,772.3 |
| **70-74** | 229 | 8.5 | 1,936.0 |
| **75-79** | 350 | 6.4 | 2,240.4 |
| **80-84** | 297 | 4.4 | 1,318.4 |
| **85+** | 309 | 1.6 | 499.0 |
| **65+** | | | 7,766.2 |
| **Female** | | | |
| **65-69** | 75 | 8.0 | 596.8 |
| **70-74** | 156 | 6.1 | 944.6 |
| **75-79** | 274 | 4.8 | 1,306.6 |
| **80-84** | 343 | 3.3 | 1,145.2 |
| **85+** | 701 | 1.1 | 766.6 |
| **65+** | | | 4,759.7 |

*Note: Individual cells may not sum to total due to rounding.*

** Average of 5yr age group.*

*Data source: Authors' calculations*

### 8.2.2 Years Lost due to Disability (YLDs)

YLDs from stroke are calculated by multiplying the prevalence of stroke by the life span with stroke and the disability weight. Different disability weights for stroke have been used in different studies. Based on the Dutch weights from the GBD study, disability weights for first ever stroke with mild, moderate and severe level of long-term disability are 0.36, 0.63 and 0.92, respectively (Francescutti *et al.*, 2005; Mathers *et al.*, 1999; Stouthard *et al.*, 1997; Truelsen *et al.*, 2006a). Full recovery is given zero disability weight. Because disability weights for stroke are defined for different levels of severity of stroke, the estimation of YLDs require the average

disability weight to be calculated. Based on an Italian study, the proportions of full recovery, mild, moderate and severe stroke were 45%, 21%, 12% and 22%, respectively (Francescutti *et al.*, 2005). Hence, combined with the disability weights listed above, the average disability weight for stroke is calculated as (0.45 x 0) + (0.21 x 0.36) + (0.12 x 0.63) + (0.22 x 0.92) = 0.35. Assuming that all people with stroke in 2006 experienced their condition for the entire year, there were over 106,000 YLDs due to stroke for people aged 65 and above in 2006 in Hong Kong (Tables 8.3 – 8.4).

**Table 8.3 Years lost due to disability (YLDs) from stroke in Hong Kong, 2006**

| | Estimated no. of people with stroke* | Life expectancy with stroke# | Disability weight | YLDs |
|---|---|---|---|---|
| **Male** | | | | |
| **65-74** | 12,228 | 9.7 | 0.35 | 41,930.2 |
| **75-79** | 6,060 | 6.4 | 0.35 | 13,717.3 |
| **80-84** | 3,127 | 4.4 | 0.35 | 4,907.7 |
| **85+** | 2,329 | 1.6 | 0.35 | 1,329.8 |
| **65+** | 23,744 | | | 61,885.0 |
| **Female** | | | | |
| **65-74** | 8,701 | 7.0 | 0.35 | 21,554.5 |
| **75-79** | 7,539 | 4.8 | 0.35 | 12,712.0 |
| **80-84** | 5,908 | 3.3 | 0.35 | 6,974.9 |
| **85+** | 8,588 | 1.1 | 0.35 | 3,320.8 |
| **65+** | 30,735 | | | 44,562.2 |

*Note: Individual cells may not sum to total due to rounding.*

** Based on the methodology used in Section 3.2.*

*# Average of 5yr/10yr age group.*

*Data source: Authors' calculations*

### *8.2.3 Disability-Adjusted Life Years (DALYs)*

The total burden of disease from stroke, measured in DALYs is the sum of the burden from premature death (YLLs) and the burden of disability (YLDs). In total, almost 119,000 years of healthy life were lost due to stroke for people aged 65 and above in Hong Kong in 2006. The majority of burden was due to disability, with YLDs making up nearly 90% of DALYs. The remaining 10% of the burden was due to the YLLs from stroke (Table 8.4).

**Table 8.4 DALYs due to stroke among people aged 65 and above in Hong Kong, by sex, 2006**

| Aged 65+ | Male | Female | Total |
|---|---|---|---|
| YLLs | 7,766.2 | 4,759.7 | 12,525.9 |
| YLDs | 61,885.0 | 44,562.2 | 106,447.2 |
| DALYs | 69,651.2 | 49,321.9 | 118,973.1 |

*Data source: Authors' calculations*

## 8.3 Summary

Stroke is the leading cause of functional disability in older people. In 2006, almost 119,000 DALYs were lost due to stroke among older people in Hong Kong. The majority of the burden was due to disability, with over 106,000 YLDs making up 90% of DALYs. The remaining 10% of the burden was due to the estimated premature mortality of 13,000 YLLs from stroke.

Chapter 9

# Economic Burden from Stroke in Hong Kong

# Chapter 9

# Economic Burden from Stroke in Hong Kong

The high morbidity associated with stroke contributes to an enormous economic burden of this condition on the health care and social services systems. In the United States, the total cost of stroke for 2010 was estimated at US$ 73.7 billion, with US$ 48.2 billion (65.4%) spent on direct medical expenditure including cost of physicians and other health professionals, acute and long-term care, medications and other medical durables, and US$ 25.5 billion on indirect cost of stroke in the lost productivity resulting from morbidity and mortality (American Heart Association Statistics Committee and Stroke Statistics Subcommittee, 2010). In European countries, total annual cost of stroke is estimated at € 27 billion, with € 18.5 billion for direct cost and € 8.5 billion for indirect cost (Allender *et al.*, 2008). In Hong Kong, the cost of stroke for hospitalization and institutional care of older people was estimated to be HK$ 1.9 billion (US$ 250 million) in 2001, with HK$ 0.6 billion spent on independent or mild disability stroke patients and HK$ 0.8 billion on moderate to severe disability stroke patients for once-off treatment, and HK$ 0.1 billion on patients who required institutional care (Woo *et al.*, 1997). In this chapter, we estimate the direct, indirect and intangible cost of stroke in Hong Kong for 2006, 2010 and 2036. Direct medical costs include cost of hospitalization, out-patient care, rehabilitation service and community allied health service. Cost of institutional care is also accounted for in the direct cost calculations. Indirect costs include cost of premature death and productivity lost. Intangible costs include the decreased quality of life of stroke patients.

## 9.1 Direct medical costs

### *9.1.1 Hospitalization*

#### Public hospital costs

Costs of hospitalization were estimated separately for public and private hospitals. The public hospital costs were estimated by multiplying the number of bed days for stroke (ICD-10: I60-I69) patients aged 65 and above with the average cost of a bed day per day for a public hospital. Based on the HA database of hospital utilization in 2006, the number of bed-day for stroke cases as the principal diagnosis in public hospitals was 420,767 in Hong Kong in 2006, of which 320,100 bed-days were contributed by people aged 65 and above. With a unit cost of an in-patient bed day (based on the public charge for non-eligible persons) of HK$ 3,300 per day (Special Supplement No. 4 to Gazette No. 13/2003, 2003), it was estimated that the annual cost of public hospitalization for stroke in people aged 65 and above was around HK$ 1,056.3 million (320,100 x HK$ 3,300) in Hong Kong in 2006 (Table 9.1).

**Table 9.1 Estimated cost of public hospitalization for people aged 65 and above with stroke in Hong Kong, 2006**

| Aged 65+ | 2006 |
|---|---|
| Number of bed days for stroke cases in public hospitals | 420,767 |
| Number of these bed days that were contributed by people aged 65 and above | 320,100 |
| Cost per in-patient bed-day (HK$) | 3,300 |
| **Estimated cost of public hospitalization (HK$ million)** | **1,056.3** |

*Data source: Authors' calculations*

## Private hospital costs

The private hospital costs were estimated by multiplying the number of in-patient discharges and deaths for stroke cases aged 65 and above with the mean number of bed-days and average cost of a bed-day for a private hospital. The total number of in-patient discharges and deaths from private hospitals was obtained from the HA Statistical Report 06/07. To estimate the number for stroke cases aged 65 and above, the proportion for this age group from public hospital admission episodes was applied. The mean number of bed days and average cost of a bed day for private hospitals were assumed to be the same as public hospitals.

Based on the HA Statistical Report 06/07, there were 1,078 in-patient discharges and deaths (in-patient episodes) with stroke (ICD-10: I60-I69) as the principal diagnosis in private hospitals, in Hong Kong in 2006 (Hong Kong Hospital Authority, 2006-2007). Assuming that 74% of these episodes came from those aged 65 and above, the mean bed-day of these episodes was 20 days, and the average cost of a bed-day for a private hospital was HK$ 3,300, it was estimated that the annual cost of private hospitalization for stroke in people aged 65 and above was around HK$ 52.0 million (792 x 20 x HK$ 3,300) in Hong Kong in 2006 (Table 9.2).

**Table 9.2 Estimated cost of private hospitalization for people aged 65 and above with stroke in Hong Kong, 2006**

| Aged 65+ | 2006 |
|---|---|
| Number of stroke in-patient episodes in private hospitals | 1,078 |
| Estimated number of these episodes that were contributed by people aged 65 and above | 792 |
| Estimated mean bed-day of each of these episodes | 20.0 |
| Cost per in-patient bed-day (HK$) | 3,300 |
| **Estimated cost of private hospitalization (HK$ million)** | **52.0** |

*Data source: Authors' calculations*

### Total hospitalization cost

The total hospitalization costs were the sum of the public hospital costs and the private hospital costs, which were estimated at HK$1,108.3 million.

## *9.1.2 Out-patient care*

There are three types of out-patient clinics or services provided by the public sector. These are General Out-Patient Clinic (GOPC), Specialist Out-Patient Clinic (SOPC) and Accident and Emergency service (A&E). There are also two types of outpatient clinics or services provided by the private sector. These are general practitioner (GP) and private specialist. In this section, several assumptions have been made to estimate the costs of outpatient care. We assume that prior to every admission to public acute hospitals with 24-hour A&E services due to stroke would require one A&E consultation. We also assume that after being discharged from public hospital, a stroke patient took three visits to a SOPC in the first year and another three visits to a GOPC in the subsequent years. For patients admitted to private hospitals, they took three visits to a private stroke specialist clinic and another three visits to a GP after being discharged in the respective period.

### Accident and Emergency Department (A&E) visits

The total A&E costs were estimated by multiplying the number of stroke admission (to HA acute hospitals) episodes for those aged 65 and above with the cost of an A&E consultation. The unit cost of HK$ 570 for an A&E visit (based on the public charges to non-eligible persons in Hong Kong) was obtained from the Gazette (Special Supplement No. 4 to Gazette No. 13/2003, 2003). Hence, the cost of A&E for stroke in people aged 65 and above was estimated to be around HK$ 7.9 million (Table 9.3).

**Table 9.3 Estimated cost of A&E for people aged 65 and above with stroke in Hong Kong, 2006**

| Aged 65+ | 2006 |
|---|---|
| Number of A&E admissions due to stroke | 13,830 |
| Cost per attendance (HK$) | 570 |
| **Estimated cost of A&E (HK$ million)** | **7.9** |

*Data source: Authors' calculations*

### Specialist visits

The total SOPC and private specialist costs were estimated by multiplying the number of stroke survivors with the average number of consultations and the cost per attendance. The number of stroke survivors was estimated by the number of hospital discharges excluding deaths and stroke survivors were assumed to have three specialist visits (SOPC for those admitted to HA hospitals and private specialist for those admitted to private hospitals) a year. In the calculation of private specialist cost, the total number of stroke patients in private hospitals was obtained from the HA Statistical Report 06/07 (Hospital Authority of Hong Kong Special Administrative Region, 2006-2007); the number of stroke survivors was estimated by applying the mortality rate as observed in public hospitals; and the corresponding number for stroke survivors aged 65 and above was estimated by applying the proportion of this age group as in public hospitals. The unit cost of HK$ 700 for a SOPC visit (based on the public charge for non-eligible persons in Hong Kong) was obtained from the Gazette (Special Supplement No. 4 to Gazette No. 13/2003, 2003) and the same cost was assumed for a private specialist visit. Hence, it was estimated that the cost of SOPC visits was HK$ 25.7 million and the cost of private specialist visits was HK$ 1.5 million for people aged 65 and above with stroke in Hong Kong in 2006 (Tables 9.4 and 9.5).

**Table 9.4 Estimated cost of SOPC for people aged 65 and above with stroke in Hong Kong, 2006**

| Aged 65+ | 2006 |
|---|---|
| Number of stroke survivors discharged from HA hospitals excluding deaths | 12,244 |
| Average number of consultations in a year | 3 |
| Cost per attendance (HK$) | 700 |
| **Estimated cost of SOPC (HK$ million )** | **25.7** |

*Data source: Authors' calculations*

**Table 9.5 Estimated cost of private specialist for people aged 65 and above with stroke in Hong Kong, 2006**

| Aged 65+ | 2006 |
|---|---|
| Estimated number of stroke survivors discharged from private hospitals excluding deaths | 710 |
| Average number of consultations in a year | 3 |
| Cost per attendance (HK$) | 700 |
| **Estimated cost of private specialist (HK$ million )** | **1.5** |

*Data source: Authors' calculations*

## General medical consultation visits

The total GOPC and private GP costs were estimated by multiplying the number of past stroke cases who visited the respective clinics by the average number of consultations and the average cost per attendance. The number of past stroke cases was estimated by prevalence rate of stroke minus incidence rate of stroke (Department of Health of Hong Kong Special Administrative Region and Department of Community Medicine of the University of Hong Kong, 2005) and then applied to the Hong Kong population in 2006 and past stroke cases were assumed to have three general medical consultations (GOPC for those admitted to HA hospitals and private GP for those admitted to private hospitals) a year. The number of past stroke patients aged 65 and above who visited public or private clinics was estimated by applying the proportion of persons with chronic diseases preferred public or private clinics as obtained from the Harvard Household Survey. With a unit cost of HK$ 215 for a GOPC visit based on the public charges for non-eligible persons in Hong Kong (Special Supplement No. 4 to Gazette No. 13/2003, 2003) and the same cost was assumed for a private GP consultation, it was estimated that the cost of GOPC was HK$ 20.0 million and the cost of private GP was HK$ 12.0 million for people aged 65 and above with stroke in Hong Kong in 2006 (Tables 9.6 and 9.7).

**Table 9.6 Estimated cost of GOPC for people aged 65 and above with stroke in Hong Kong, 2006**

| Aged 65+ | 2006 |
|---|---|
| Hong Kong Population | 852,100 |
| Stroke prevalence minus stroke incidence | 5.8% |
| Estimated number of past stroke patients aged 65 and above | 49,553 |
| Proportion of patients with chronic diseases preferred public outpatient service | 62.5% |
| Average number of consultations in a year | 3 |
| Cost per attendance (HK$) | 215 |
| **Estimated cost of GOPC (HK$ million)** | **20.0** |

*Data source: Authors' calculations*

**Table 9.7 Estimated cost of GP for people aged 65 and above with stroke in Hong Kong, 2006**

| Aged 65+ | 2006 |
|---|---|
| Hong Kong Population | 852,100 |
| Stroke prevalence minus stroke incidence | 5.8% |
| Estimated number of past stroke patients aged 65 and above | 49,553 |
| Proportion of patients with chronic diseases preferred private outpatient service | 37.5% |
| Average number of consultations in a year | 3 |
| Cost per attendance (HK$) | 215 |
| **Estimated cost of GP (HK$ million)** | **12.0** |

*Data source: Authors' calculations*

## Total cost for outpatient care

The total cost for outpatient care for patients aged 65 and above with stroke in 2006 is the sum of the A&E, SOPC, private specialist, GOPC and private GP costs, which were estimated to be around HK$ 67 million.

### 9.1.3 Rehabilitation services

Rehabilitation services are essential to help stroke patients become as independent as possible and to attain the best possible quality of life. However, with limited resources, patients in the public sector usually face the difficulties of long waiting periods for required rehabilitation programmes, infrequent rehabilitation arrangements and limited time for rehabilitation programmes. In this section, the cost of rehabilitation services, including acquisition of rehabilitation aids and attendance of rehabilitation day hospitals, was calculated for stroke survivors aged 65 and above with moderate to severe disability.

#### Rehabilitation aids

The cost of rehabilitation aids was estimated by multiplying the number of stroke survivors with moderate to severe disability with the cost per patient. The number of stroke patients were obtained from the HA discharge data. The outcomes of stroke among stroke survivors, including moderate (12%) and severe (22%) disabilities, were taken from a national burden of disease study conducted in Italy (Francescutti *et al.*, 2005). The cost of HK$ 1,910 per patient for rehabilitation aids was obtained from an estimation based on service figures from allied health disciplines in a rehabilitation hospital in Hong Kong. Hence, it was estimated that the cost of rehabilitation aids for stroke in people aged 65 and above was approximately HK$ 8.0 million (4,163 x HK$ 1,910) in Hong Kong in 2006 (Table 9.8).

**Table 9.8 Estimated cost of rehabilitation aids for people aged 65 and above with stroke in Hong Kong, 2006**

| Aged 65+ | 2006 |
|---|---|
| Number of stroke survivors discharged from HA hospitals excluding deaths | 12,244 |
| Number of stroke survivors with moderate to severe disability | 4,163 |
| Cost per patient per year (HK$) | 1,910 |
| **Estimated cost of rehabilitation aids (HK$ million)** | **8.0** |

*Data source: Authors' calculations*

### Rehabilitation day hospitals

The cost of rehabilitation day hospitals was estimated by multiplying the number of stroke survivors with moderate to severe disability with the number of attendance per survivor and the cost per attendance. The number of stroke survivors with moderate to severe disability was obtained in the same way as in the calculation of rehabilitation aids cost. It was assumed that a stroke survivor would attend a rehabilitation day hospital two days a week for three months (i.e. 24 days in total) after being discharged from the hospital. The unit cost of $1,400 per attendance to a rehabilitation day hospital (based on the public charges to non-eligible persons in Hong Kong) was taken from the Gazette (Special Supplement No. 4 to Gazette No. 13/2003, 2003). It was estimated that the cost of rehabilitation day hospitals for stroke in people aged 65 and above was around HK$ 139.9 million (4,163 x 24 x HK$1,400) in Hong Kong in 2006 (Table 9.9).

**Table 9.9 Estimated cost of rehabilitation day hospitals for people aged 65 and above with stroke in Hong Kong, 2006**

| Aged 65+ | 2006 |
|---|---|
| Number of stroke survivors discharged from HA hospitals excluding deaths | 12,244 |
| Number of stroke survivors with moderate to severe disability | 4,163 |
| Number of visits after being discharged from the hospital | 24 |
| Cost per attendance (HK$) | 1,400 |
| **Estimated cost of rehabilitation day hospitals (HK$ million)** | **139.9** |

*Data source: Authors' calculations*

### Estimation of total cost of rehabilitation services

The total cost of rehabilitation services (public sector) for patients aged 65 and above with stroke is the sum of the cost for rehabilitation aids and the cost for rehabilitation day hospital. It was estimated that in 2006, the annual cost of rehabilitation services was around HK$ 147.8 million.

### 9.1.4 Community allied health services

Community allied health services provide care for people who are ready to be discharged from hospital following a stroke and maintain disabled stroke patients in their own homes. In Hong Kong, most of these services are provided in the public setting. In the following section, the cost of community services for stroke patients aged 65 and above was estimated by multiplying the estimated episodes of community visits for this age group with the cost per treatment in each service.

The estimated total episodes of community visits by allied health professionals in Hong Kong were 19,176, assuming that 60% of these were due to stroke. The proportion for those aged 65 and above from the HA hospital discharge episodes excluding deaths was applied to the total episodes of community visits in order to estimate the episodes for this age group. The cost of HK$ 1,050 per treatment for community allied health service (based on the public charges to non-eligible persons in Hong Kong) was taken from the Gazette (Special Supplement No. 4 to Gazette No. 13/2003, 2003). Hence, it was estimated that the cost of community allied health services for stroke in people aged 65 and above was around HK$ 8.9 million (8,492 x HK$ 1,050) in Hong Kong in 2006 (Table 9.10).

**Table 9.10 Estimated cost of community allied health services for people aged 65 and above with stroke in Hong Kong, 2006**

| Aged 65+ | 2006 |
|---|---|
| Total episodes of community visits by allied health professionals due to stroke | 8,492 |
| Cost per treatment (HK$) | 1,050 |
| **Estimated cost of community allied health services (HK$ million)** | **8.9** |

*Data source: Authors' calculations*

### 9.1.5 Direct medical costs and projection

Table 9.11 shows the summary of the direct medical costs of stroke for people aged 65 and above in Hong Kong in 2006. The direct medical cost of stroke is the sum of the cost of hospitalization, outpatient care, rehabilitation services and community allied health services, which was estimated to be around HK$ 1,332 million. Hospitalization was the largest component, accounting for over 80% of the direct medical cost.

**Table 9.11 Summary of direct medical costs of stroke among people aged 65 and above in Hong Kong, 2006**

| Aged 65+ | 2006 |
|---|---|
| Hospitalization (HK$ million) | 1,108.3 |
| Outpatient care (HK$ million) | 67.0 |
| Rehabilitation services (HK$ million) | 147.8 |
| Community allied health services (HK$ million) | 8.9 |
| **Estimated direct medical costs (HK$ million)** | **1,332.1** |

*Note: Individual cells may not sum to total due to rounding.*
*Data source: Authors' calculations*

The direct medical costs of stroke per capita among people aged 65 and above was estimated by dividing the direct medical costs of stroke for those aged 65 and above by the estimated number of stroke patients in 2006. Based on the methodology in section 3.2, the number of stroke patients aged 65 and above was estimated to be 54,479 in Hong Kong in 2006. Hence, the direct medical cost per patient was estimated to be around HK$ 24,452 (Table 9.12).

**Table 9.12 Estimated direct medical costs per capita among people aged 65 and above with stroke in Hong Kong, 2006**

| Aged 65+ | 2006 |
|---|---|
| Estimated direct medical costs per year (HK$ million) | 1,332.1 |
| Estimated number of people with stroke aged 65 and above | 54,479 |
| **Estimated direct medical costs per stroke patient (HK$)** | **24,451.8** |

*Data source: Authors' calculations*

Based on the above estimation, the economic burden of stroke, in terms of medical costs, among people aged 65 and above was projected to year 2010 and 2036. Assuming the medical cost per patient remained constant, the annual direct medical cost of stroke for people aged 65 and above was estimated to be around HK$ 1,490 million per year in 2010. By 2036, this would increase to around HK$ 3,979 million (Table 9.13).

**Table 9.13 Estimated direct medical costs for people aged 65 and above with stroke in Hong Kong, 2010 and 2036**

| Aged 65+ | 2010 | 2036 |
|---|---|---|
| Projected number of people with stroke | 60,915 | 162,724 |
| Estimated direct medical costs per patient (HK$) | 24,451.8 | 24,451.8 |
| **Estimated direct medical costs per year (HK$ million)** | **1,489.5** | **3,978.9** |

*Data source: Authors' calculations*

## 9.2 Direct cost of institutional care

### Government subsidized institutional care places

The cost of institutional care was estimated by multiplying the number of institutionalized stroke patients with the average cost per year for institutional care. Based on the methodology in section 3.2, the number of institutionalized stroke patients aged 65 and above was estimated to be 16,029 in Hong Kong in 2006. Based on statistics provided by the Social Welfare Department (SWD), about 32% of institutional places were subsidized by the Hong Kong government in 2010 (Social Welfare Department of Hong Kong Special Administrative Region, 2010). Hence, it was estimated that 5,178 people with stroke would be living in government subsidized places in Hong Kong in 2006.

Based on the report published by the Audit Commission of Hong Kong (Audit Commission of Hong Kong Special Administrative Region, 2002), the estimated average government subsidies for providing residential care services for the elderly in 2001 was about HK$ 97,311 per place (HK$ 2,417.6 million / 24,844 places). Based on the SWD figures, the average charge for a subsidized place each month paid by the elderly or their family caregivers was approximately HK$ 1,755 (or HK$ 21,060 per year) in 2010 (Social Welfare Department of Hong Kong Special Administrative Region, 2010). Hence, assuming the costs are stable over the years, the cost for a government subsidized institutional care place was estimated to be around HK$ 118,371 (= HK$ 97,311 + HK$ 21,060) per year whereas the cost of government subsidized institutional care for people aged 65 and above with stroke was estimated to be around HK$ 610.9 million in Hong Kong in 2006 (Table 9.14).

**Table 9.14 Estimated cost of government subsidized institutional care for people aged 65 and above with stroke in Hong Kong, 2006**

| Aged 65+ | 2006 |
|---|---|
| Number of people with stroke in institutional care | 16,029 |
| Proportion of government subsidized places among all institutional places | 32.3% |
| Number of people with stroke living in government subsidized places | 5,178 |
| Costs per place per year (HK$ million) | 0.118 |
| **Estimated annual cost of government subsidized institutional care for stroke patients aged 65 and above (HK$ million)** | **610.9** |

*Data source: Authors' calculations*

Costs projection for government subsidized institutional care was also carried out. In section 3.2, we estimated that in 2010, there would be about 18,876 people aged 65 and above living in institutions in Hong Kong with stroke. Assuming a constant percentage of government subsidized places among all institutional places between 2010 and 2036, using the same methodology, by 2010, the cost of government subsidized institutional care for people aged 65 and above with stroke would increase to around HK$ 719.4 million. By 2036, this would increase to HK$ 1,987.5 million (Table 9.15).

**Table 9.15 Estimated cost of government subsidized institutional care for people aged 65 and above with stroke in Hong Kong, 2010 and 2036**

| Aged 65+ | 2010 | 2036 |
|---|---|---|
| Projected number of people with stroke in institutional care | 18,876 | 52,146 |
| Proportion of government subsidized places among all institutional places | 32.3% | 32.3% |
| Projected number of people with stroke living in government subsidized places | 6,097 | 16,843 |
| Costs per place per year (HK$ million) | 0.118 | 0.118 |
| **Estimated annual cost of government subsidized institutional care for stroke patients aged 65 and above (HK$ million)** | **719.4** | **1,987.5** |

*Data source: Authors' calculations*

### Private institutional care places

Although places not subsidized by government include private homes and institutions run by non-governmental organizations, for simplicity, we used private institutional care places to describe both categories.

The cost of private institutional care was estimated by multiplying the number of institutionalized stroke patients in private institutional care with the average cost per year for institutional care. The number of stroke patients was estimated to be approximately two-thirds of the total number of people with stroke in institutional care. With a unit cost of a private institutional care place of HK$ 6,000 per month (i.e. HK$ 0.072 million per year) (Consumer Council of Hong Kong Special Administrative Region, 2006), the cost of private institutional care for stroke patients aged 65 and above was estimated to be around HK$ 781.3 million in Hong Kong in 2006 (Table 9.16).

**Table 9.16 Estimated cost of private institutional care for people aged 65 and above with stroke in Hong Kong, 2006**

| Aged 65+ | 2006 |
|---|---|
| Number of people with stroke in institutional care | 16,029 |
| Proportion of private places among all institutional places | 67.7% |
| Number of people with stroke living in private institutional care | 10,852 |
| Costs per place per year (HK$ million) | 0.072 |
| **Estimated annual cost of private institutional care for stroke patients aged 65 and above (HK$ million)** | **781.3** |

*Data source: Authors' calculations*

Costs projection for private institutional care was also carried out. Assuming a constant percentage of private institutional care places among all institutional places between 2006 and 2036, using the same methodology as for the cost projection of government subsidized institutional care, we estimated that the cost of private institutional care for people aged 65 and above with stroke would be around HK$ 920.1 million in 2010. By 2036, this would increase to HK$ 2,541.8 million (Table 9.17).

**Table 9.17 Estimated cost of private institutional care for people aged 65 and above with stroke in Hong Kong, 2010 and 2036**

| Aged 65+ | 2010 | 2036 |
|---|---|---|
| Projected number of people with stroke in institutional care | 18,876 | 52,146 |
| Proportion of private places among all institutional places | 67.7% | 67.7% |
| Projected number of people with stroke living in private institutional care | 12,779 | 35,303 |
| Average charges for a place at private institutional care unit per year (HK$ million) | 0.072 | 0.072 |
| **Estimated annual cost of private institutional care for stroke patients aged 65 and above (HK$ million)** | **920.1** | **2,541.8** |

*Data source: Authors' calculations*

### Estimated total cost of institutional care

The total cost of institutional care for patients aged 65 and above with stroke was estimated by totalling the cost for government subsidized institutional care places and the cost for private institutional care places. It was estimated that in 2010, the annual cost of institutional care in people aged 65 and above was around HK$ 1,639.5 million. By 2036, this would increase to around HK$ 4,529.3 million. Nevertheless, these estimates have not taken into account subsidies from the non-governmental organizations.

## 9.3 Indirect cost of premature death

The indirect cost resulting from premature death from stroke was based on the estimated YLLs calculated by the authors. In section 8.2.1, we estimated that in 2006, there were about 12,500 YLLs among people aged 65 and above with stroke in Hong Kong. A value of $240,000 for a life year was applied to the total life years lost. This value was based on a willingness-to-pay (WTP) estimate of GBP20,000 (HK$ 240,000) for a disease to prevent a life year lost (i.e. NICE threshold value for a cost-effective intervention). Hence, the cost for premature deaths was estimated to be around HK$ 3,006.2 million (Table 9.18).

**Table 9.18 Estimated cost of premature death for people aged 65 and above with stroke in Hong Kong, 2006**

| Aged 65+ | 2006 |
|---|---|
| Life year lost due to stroke | 12,525.9 |
| Value of a life (HK$) | 240,000 |
| **Estimated cost of premature death (HK$ million)** | **3,006.2** |

*Data source: Authors' calculations*

## 9.4 Indirect cost of productivity lost

Productivity lost of stroke survivors is a significant burden to the individual and to society. Nevertheless, the average age of retirement was found to be near 65 years, and therefore there were substantial declines in productivity among those aged 65 and over. Assuming that no productivity lost was incurred for stroke survivors aged 65 and above, productivity lost of this segment of population is not estimated in this report. However, productivity lost from informal caregivers which is one of the main burdens to society could be significant. The cost of informal care and unpaid work is indeed a controversial and complicated issue, and several methods have been proposed. Informal care should be valued by the opportunity cost of the caregivers' time; however, identifying this opportunity cost is not straightforward.

We estimated the cost of informal care by valuing the alternative paid employment of the time spent on caring. In section 3.2, we estimated that in 2010, there would be about 42,039 people aged 65 and above living in the community in Hong Kong with stroke. Using a median wage from main employment of HK$ 10,000 per month in 2006 as reference (Census and Statistics Department of Hong Kong Special Administrative Region, 2007a), it was estimated that the cost of informal care for people aged 65 and above with stroke was around HK$5,044.7 million in 2010. By 2036, this would increase to HK$ 13,269.4 million (Table 9.19).

**Table 9.19 Estimated cost of informal care for people aged 65 and above with stroke in Hong Kong, 2010 and 2036**

| Aged 65+ | 2010 | 2036 |
|---|---|---|
| Projected number of people with stroke living in the community | 42,039 | 110,578 |
| Median monthly income from main employment (HK$) | 10,000 | 10,000 |
| **Estimated cost of informal care per year (HK$ million)** | **5,044.7** | **13,269.4** |

*Data source: Authors' calculations*

## 9.5 Intangible cost

There was strong evidence that stroke causes substantial loss of quality of life for both the stroke patients (e.g. depression, pain and other illnesses or health problems like increased risk of dementia) and their caregivers (e.g. problems with their jobs, physical and mental health). This section estimates the Quality Adjusted Life Years (QALYs) lost contributed by stroke in Hong Kong in 2006.

### *9.5.1 Quality Adjusted Life Years (QALYs) Lost*

The QALYs lost is the equivalent number of fully healthy years of life lost to a disease. It is based on the actual number of years lost corrected for the quality of life during those years on the basis of a preference weight ranging from 0 (dead) to 1 (perfect health). Preference weights are based on utility values that reflect a person's preference for a particular health state. Because locally derived utility values are not available, utility values reported in an overseas review were adopted (Post *et al.*, 2001). According to this review, a utility of minor stroke might range between 0.50 and 0.70 and a utility of major stroke might range between 0 and 0.30. Hence, in our calculation of QALYs, a utility value of 0.6 was assumed for a minor stroke and a value of 0.15 for a major stroke. The weight for the loss in utility (i.e. 0.4 and 0.85 for minor and major strokes respectively), derived from one minus the utility value, was then applied to the total expected remaining life years of the respective stroke patients in order to get the total QALYs lost. By multiplying the number of stroke patients by the expected remaining life years of the respective stroke patients with the weight for the loss in utility, the QALYs lost of stroke in 2006 was estimated to be between 133,269 and 283,198 QALYs. Nevertheless, no utility values were found for stroke caregivers and therefore this calculation was not included in this report (Table 9.20).

**Table 9.20 QALYs lost due to minor and major strokes among people aged 65 and above in Hong Kong, by age group, 2006**

| Age group | No. of patients | Expected remaining life years | Minor strokes | | Major strokes | |
|---|---|---|---|---|---|---|
| | | | Utility loss weight | QALYs lost | Utility loss weight | QALYs lost |
| **65-69** | 1,907 | 9.8 | 0.4 | 7,493 | 0.85 | 15,923 |
| **70-74** | 2,717 | 7.4 | 0.4 | 8,086 | 0.85 | 17,183 |
| **75-79** | 3,008 | 5.6 | 0.4 | 6,742 | 0.85 | 14,327 |
| **80-84** | 2,503 | 3.8 | 0.4 | 3,835 | 0.85 | 8,150 |
| **85+** | 2,405 | 1.3 | 0.4 | 1,216 | 0.85 | 2,584 |
| **Total for HA incidence** | 12,540 | | | 27,373 | | 58,168 |
| **65-69** | 7,045 | 9.8 | 0.4 | 27,681 | 0.85 | 58,822 |
| **70-74** | 10,219 | 7.4 | 0.4 | 30,412 | 0.85 | 64,625 |
| **75-79** | 13,010 | 5.6 | 0.4 | 29,162 | 0.85 | 61,970 |
| **80-84** | 8,663 | 3.8 | 0.4 | 13,274 | 0.85 | 28,207 |
| **85+** | 10,617 | 1.3 | 0.4 | 5,367 | 0.85 | 11,405 |
| **Total for past strokes** | 49,553 | | | 105,896 | | 225,030 |
| **Total QALYs lost** | | | | 133,269 | | 283,198 |

*Note: Individual cells may not sum to total due to rounding.*

*Data source: Authors' calculations*

## 9.6 Summary

Hospitalization, out-patient care, rehabilitation service and community allied health service were the major components of direct medical costs of stroke. In 2006, over HK$ 1,332 million was spent on these services alone, of which hospitalization was the largest, accounting for over 80% of the cost. By 2036, the direct medical cost is expected to increase to about HK$ 3,979 million per year. The cost of institutional care was found to be substantial and was projected to increase by 1.8 times to HK$ 4,529 million per year as the prevalence of people with stroke living in institutions also increases. The indirect cost resulting from premature death from stroke and lost productivity were also found to be significant. The intangible cost due to stroke ranged from 133,000 to 283,000 QALYs.

# Chapter 10

# Implications and Recommendations for Hong Kong

# Chapter 10

# Implications and Recommendations for Hong Kong

## Incidence

Although the incidence of ischemic stroke is following a declining trend, the incidence is still high, indicating the need for better preventive measures. Compared with New York and Inner London, stroke was found to be the leading cause of avoidable mortality (Chau *et al.*, 2011a). No declining trend was observed for hemorrhagic stroke. The differential trends in ischemic and hemorrhagic stroke may be explained partly by a difference in risk factors for stroke sub-types (Woo *et al.*, 1992) and differential trends in risk factors. Thus for ischemic stroke, declining incidence may reflect the falling prevalence of smoking and hypercholesterolemia, rather than trends in prevalence of hypertension since the latter has actually increased (Department of Clinical Biochemistry of Queen Mary Hospital of Hong Kong, 1997; Department of Health of Hong Kong Special Administrative Region, 2004/2005; Department of Health of Hong Kong Special Administrative Region and Department of Community Medicine of the University of Hong Kong, 2005). The latter may also explain the static trend in incidence of cerebral hemorrhage, with a rising trend in the middle aged. This observation highlights the importance of population control of hypertension in the prevention of both ischemic and hemorrhagic stroke. Improvement in control may lead to a more rapid decline in the incidence of ischemic stroke and a decline in the incidence of hemorrhagic stroke, in particular preventing the middle-age rise in incidence of cerebral hemorrhage.

Although health education regarding healthy lifestyles with respect to prevention has been a regular feature in preventive and treatment settings, they have been largely targeted at the individual level. Furthermore, the importance of reducing salt intake in reducing the risk of hypertension has not been widely promoted. A population nutrition survey in Hong Kong showed that 78% of the adult population had a sodium intake greater than 2300mg, a value considered to be associated with the age-related rise in blood pressure (Woo *et al.*, 1998c). The average intake increased from 8.0g per day to 9.9g per day from 1989-1991 to 2000-2002, respectively (The Chinese University of Hong Kong, 2005). It has been shown that a 5g a day increase in salt intake was associated with a 23% higher risk of stroke (Appel, 2009). Although other countries have adopted population-wide strategies for salt reduction (World Action On Salt and Health (WASH)) consisting of surveys providing information on salt content of individual foods, setting sodium-reduction targets for food categories with cooperation

from the food industry, Hong Kong has only just recently passed legislation for mandatory nutrition food labelling with effect from July 2010. For example, Japan, Finland and the United Kingdom implemented a variety of population wide strategies aimed to reduce salt intakes (He and MacGregor, 2009). Authorities have requested the food industry reduce salt content of commonly consumed foods, to clearly label high salt content foods and to regulate prices of high salt content foods (The NHS National Institute for Health and Clinical Excellence of the United Kingdom, 2010). Similar public health initiatives in Hong Kong to reduce salt intake may form one of the key strategies directed at reducing the incidence of ischemic, and particularly hemorrhagic stroke. Further studies on other factors which predispose to hypertension such as work stress may also be important in population reduction of stroke incidence.

Public health efforts in reducing smoking prevalence continue to be of importance, particularly population wide smoke ban policies, such as the banning of smoking in restaurants, indoor workplaces and public areas since July 2007. The increasing trend among women and the young showed that such policies continue to be important (Tobacco Control Office of the Department of Health of Hong Kong, 2010).

It is known that aspirin may be associated with cerebral hemorrhage (Wong *et al.*, 2000). The increasing trend in aspirin prescription (Hospital Authority Chief Pharmacist Office) may have contributed to the static incidence of hemorrhagic stroke. Since Chinese populations tend to have higher incidence of intra-cerebral hemorrhage compared with Western populations (Feldmann *et al.*, 1990; Kay *et al.*, 1992), further studies in the Chinese population on risks and benefits of aspirin may provide more data to guide practice.

Although the prevalence rates of diabetes mellitus have decreased among females, the rates have not decreased among middle-aged and older males. The lack of awareness of diagnosis in about half of those with diabetes may have led to poor management and a higher risk of ischemic stroke. In future, ischemic stroke trends may reflect unfavourable directions as a result of the increasing hypertension prevalence rate, the increasing prevalence rate of young female smokers, as well as the static prevalence rate of diabetes mellitus among older males.

The findings highlight the need for a population strategy for controlling risk factors in achieving reductions in stroke incidence, particularly strategies for better population control of hypertension in Hong Kong.

## Case-fatality

The slower rate of decline in case-fatality compared with the decline in incidence suggests that public awareness of symptoms of onset of stroke could be improved, so that the time between onset and presentation at hospitals may be shortened, enabling the application of thrombolytic therapy or other revascularization procedures where indicated. The provision of stroke units in major hospitals may also help save lives. A study in the United Kingdom showed that in general, levels of knowledge about recognizing and preventing stroke were poor. It is likely that the same situation exists in Hong Kong. The reason for the higher case-fatality among women is uncertain, but is unlikely to be a reflection of any gender bias in treatment.

## Rehabilitation

Approximately half of all stroke survivors have moderate to severe disability requiring rehabilitation in order to maximize recovery of function. Most of the recovery occurs during the six months following stroke but may occur up to one year after stroke, particularly with cognitive dysfunction. In Hong Kong, the average duration of overnight stay in Hospital Authority beds for those with a diagnosis of stroke is about 30 days (acute and non-acute hospitals combined). Hence, patients may need to be discharged from hospital even when suffering from significant functional impairment. Furthermore, there is a suggestion that stroke rehabilitation efficiency may be adversely affected by declining staff numbers (Woo et al., 2008). In some cases, a temporary period of stay in residential care homes for the elderly may be an alternative option to returning home, which would be followed by a period of outpatient rehabilitation. However, there is little provision for maintenance rehabilitation following maximum recovery to prevent functional gains being lost. The need for improvement in the organization and provision of stroke rehabilitation services is apparent.

## Care setting

Patients with stroke need to receive care at the acute stage in stroke units, followed by rehabilitation in non-acute hospitals or other institutional settings for longer periods of time. Currently Geriatric Day Hospitals play a major role after discharge from non-acute hospitals. Other partially or entirely self-financed services include community rehabilitation centres as well as transitional care places within a residential care setting. Attention to psychosocial aspects would be an important part of rehabilitation.

## Recommendations

- Efforts towards effective stroke prevention are needed, in particular better control of hypertension.
- Raising public awareness of symptoms of acute stroke may reduce delay in arrival at hospitals, enabling appropriate early treatment that may reduce mortality and disability.
- Provision of rehabilitation services for longer periods at appropriate institutional or community settings is needed to maximize recovery potential.
- Community centres may incorporate maintenance stroke rehabilitation exercises as part of their regular programme of activities.
- Features of such community services should include:
  - An environment that motivates people with stroke to continue to attend
  - Preventive components such as optimizing control of hypertension, diabetes and other cardiovascular risk factors
  - Building of social support
  - Provision of caregiver training
  - Screening for and dealing with depression or post-stroke dementia
  - Promotion of self-management concepts
  - Flexible caring options in terms of frequency and duration of attendance
  - Liaison with multiple service providers in the private and public sectors
  - Provision of aids and home adaptations

# Chapter 11

# Conclusion

# Chapter 11

# Conclusion

Nearly 55,000 people aged 65 and above had stroke in Hong Kong in 2006, and over 60,000 in 2010. With the ageing population, the number of cases of stroke is expected to increase to about 163,000 by 2036. The impact of stroke can be devastating, affecting both the health and well-being of stroke survivors and their family members. In 2006, nearly 119,000 DALYs were lost due to stroke in Hong Kong. The costs for stroke are also enormous, with hospitalization and institutional care contributing to most of the financial costs of stroke. In 2010, the estimated cost of institutional care in people aged 65 and above was HK$ 1,640 million. By 2036, it is expected to increase by 1.8 times to HK$ 4,529 million per year. The indirect cost resulting from premature death from stroke and lost productivity from informal carers was also found to be significant. With the publication of this report highlighting the impact of stroke on an ageing population, it is hoped that public awareness can be raised and a strategy can be developed to improve the quality of life and quality of care for stroke survivors. Hence, formulation of a stroke care strategy as part of the care of the elderly strategy would be important for Hong Kong, in view of the magnitude of the stroke burden.

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# Note

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