

SINGAPORE STROKE REGISTRY REPORT NO. 3

**TRENDS IN STROKE IN SINGAPORE  
2005 - 2012**

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Application for written permission should be addressed to :

Deputy Director  
National Registry of Diseases Office  
Health Promotion Board  
Level 5, 3 Second Hospital Avenue  
Singapore 168937

Fax : (65) 6536-5307  
Email : [hpb\\_servicenrdo@hpb.gov.sg](mailto:hpb_servicenrdo@hpb.gov.sg)

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# FOREWORD

Since its set-up in 2002, the Singapore Stroke Registry has worked hard to collect data on stroke in Singapore. The information collected includes data on age, gender, ethnicity, stroke risk factors, stroke subtype, performance of investigations, administered treatments, provision of care, complications, and outcome at time of hospital discharge.

This report would not have been possible without the whole-hearted support of many people and organisations, who made data available, collected data, analysed data, prepared reports, provided guidance. I am particularly grateful to the registry coordinators who have worked tirelessly and spared no effort to carefully extract valuable data, and statisticians who have painstakingly analysed the data.

I am sure the information in this report will be helpful to anyone interested in and caring for patients with stroke.

**Dr N V Ramani**

Chairman

Singapore Stroke Registry

## **SINGAPORE STROKE REGISTRY ADVISORY COMMITTEE**

Chairman	Dr N V Ramani Consultant, Raffles Hospital
Members	Dr Aftab Ahmad Associate Consultant, Jurong General Hospital (Alexandra Hospital)
	Dr Ang Yan Hoon Senior Consultant, Khoo Teck Puat Hospital
	Dr Bernard Chan Senior Consultant, National University of Singapore
	Dr Chang Hui Meng Senior Consultant, National Neuroscience Institute
	Dr Chow Khuan Yew Deputy Director, National Registry of Diseases Office, HPB
	Assoc Prof Kong Keng He Senior Consultant, Tan Tock Seng Hospital
	Dr Sherry Young Senior Consultant, Changi General Hospital
	Dr Tang Kok Foo Mount Elizabeth Hospital

## **NATIONAL REGISTRY OF DISEASES OFFICE**

Registry Coordinators	Ms Koh Geok Yan
	Ms Yeo Nguang Luang
	Ms Teo Wan Cheng
	Ms Lim Mui Yang
	Ms Lucille Hoi
Epidemiologist	Dr Jin Aizhen
Data Management	Mr William Ho

We would like to thank Ms Loy En Yun (HPB) for kindly vetting this report.

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## EXECUTIVE SUMMARY

The crude incidence rates have remained stable while the age-standardised incidence rates (ASIR) decreased then stabilized (Table 4.1.1). The age-standardised mortality rate (ASMR) has declined from 2005 to 2008, after which there were small variations (Figure 5.1.1).

The ratio of stroke episodes among men as compared to women was approximately 1.31:1 from 2005 to 2012 (Table 4.2.1). The ASMR was higher among males than females and has declined significantly from 2005 to 2012 in both genders (Figure 5.2.3).

Malays had the highest ASIR for stroke from 2005 onwards, followed by Indians and Chinese, whose rates were similar (Figure 4.3.3). The ASIR for Chinese has fallen significantly over the 8-year period; the ASIR for Indians has also fallen, while the ASIR for Malays has been increasing significantly. The crude mortality rates (CMRs) among the various ethnicities have remained stable while there was a decrease in ASMR among the Malays after 2005 and also among Chinese (Figure 5.3.1).

The ASIRs of ischaemic stroke have fallen over the 8-year period while those for haemorrhagic stroke have remained stable (Figure 4.4.3).

The overall crude 30-day case-fatality rates (CFR) have remained stable, ranging from 8.4% to 10.5% in 2005 - 2012 (Table 6.1.1). Similar to CMRs, the CFR for females was greater than that for males (Table 6.2.2).

Hypertension and hyperlipidaemia were the two most common risk factors among the stroke patients (Table 7.1.1). The proportion of first-ever stroke patients with hyperlipidaemia has increased over time while that of other risk factors has remained stable.

The percentage of ischaemic stroke patients taking anticoagulants upon arrival and upon discharge had increased between 2009 and 2012 (Figures 8.1.1, 8.1.3) while the percentage of ischaemic stroke patients given antiplatelets upon arrival had increased by 12.04% from 2009 to 2012. The percentage of ischaemic stroke patients given antiplatelets during hospitalisation has exceeded 90% since 2009 (Figure 8.1.2).

The two most common complications seen in stroke cases included urinary tract infections (UTI) and pneumonia (Figure 9.1.1). The percentage of stroke patients with no common complications has remained above 80% since 2005.

## 1. INTRODUCTION

The primary aim of the National Registry of Diseases Office (NRDO) is to collect and analyse data to support the national disease management plans, policy formulation and programme planning.

The Singapore Stroke Registry was set up in 2002 to obtain epidemiological and clinical data on stroke cases diagnosed in Singapore from all public hospitals.

Stroke is a significant cause of death and disability in Singapore. In 2011, stroke was the 4<sup>th</sup> highest cause of death, accounting for 9.0% of total deaths in Singapore<sup>1</sup>. In 2004, stroke was the second highest cause of premature mortality and the seventh highest cause of disability burden<sup>2</sup>. It was also the third highest cause of the overall burden of disease burden in Singapore.

## 2. SOURCE OF DATA AND DATA COLLECTION

This report is based on the data collected for the year 2005– 2012, as at 22th August 2013. The data used is mainly from Mediclaims listing. Case finding was supplemented by Hospital In-patient Discharge Summary (HIDS) review and death registry from the Ministry of Home Affairs (MHA). Name lists from Mediclaims, HIDS and MHA were merged using the NRIC number to obtain the master patient list. The patient lists for the respective hospitals were generated from the master list. Case notes were then traced from the medical record offices at the respective hospitals and the cases were verified by the registry coordinators. We have also included, from year 2011 onwards, cases that were diagnosed and also those that died, at emergency departments of the various hospitals.

Cases extracted from Mediclaims, HIDS and MHA were coded based on the International Classification of Diseases 9th Revision (ICD-9 Clinical Modification). It covered ICD-9 codes: 430, 431, 432, 433, 434, 436 and 437 while excluding 432.1 (Subdural haemorrhage), 435 (Transient cerebral ischaemia) and 438 (Late effects of cerebrovascular disease) during 2005-2011, while including ICD-10 codes I60-I68 and excluding I62.0 for year 2012.

The MONICA (Monitoring Trends and Determinants in Cardiovascular Disease, World Health Organization) criteria were used for episode management. Recurrence of stroke after 28 days of the preceding recorded stroke episode was counted as another episode. Stroke episodes that occurred within the year 2005 to 2012 were recorded. Once the cases were verified, data was captured electronically into registry forms which were later uploaded and transferred into the database in the National Registry of Diseases system.

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1 Singapore Health Facts 2010, Principle Causes of Death.  
[http://www.moh.gov.sg/content/moh\\_web/home/statistics/Health\\_Facts\\_Singapore/Principal\\_Causes\\_of\\_Death.html](http://www.moh.gov.sg/content/moh_web/home/statistics/Health_Facts_Singapore/Principal_Causes_of_Death.html)

2 Personal Communication, Epidemiology & Disease Control Division, MOH, Singapore.

There are two types of stroke: ischaemic and haemorrhagic stroke. Ischaemic stroke is more common (about 80% of all strokes in Singapore) and occurs when a blood vessel becomes blocked, usually by a blood clot. Haemorrhagic stroke occurs when a blood vessel in the brain bursts or breaks, causing bleeding in or around the brain.

The analysis covers public hospitals in Singapore namely Alexandra Hospital, Changi General Hospital, Kandang Kerbau Women's & Children's Hospital, Khoo Teck Puat Hospital, National University Hospital, Singapore General Hospital, and Tan Tock Seng Hospital. Data from private hospitals (about 6% of all stroke episodes) are not included in the analysis.

This report can be downloaded at National Registry of Diseases Office Website: [www.nrdo.gov.sg](http://www.nrdo.gov.sg).

## **2.1 Data Cleaning And Analysis**

The data management team checks the data for obvious errors and inconsistencies. These data items were then extracted and passed to the stroke registry coordinators for verification and data cleaning.

Population denominators were derived using Department of Statistics mid-year population estimates. Crude rates were computed using these denominators. Segi World Population was used for direct standardisation to calculate age-standardised rates for stroke incidence and mortality while the age structure (5-year age groups from ages 15 to 85) of stroke incidence for all stroke cases in the registry was used for direct standardization to calculate the age-standardised rate for 30-day case fatality rate. The 2012 Census population was used as the denominator to calculate incidence rates. Stroke cases of Singapore residents i.e. citizens and permanent residents of Singapore aged 15 years and above were included in the analysis. The 95% confidence intervals were calculated in accordance to the methods used by the International Agency for Research on Cancer<sup>3</sup>.

When computing the percentages of patients on medications, only ischaemic stroke patients are included. Patients with contraindications to taking the medications were excluded in the analysis for all dose types. Patients may be contraindicated to a particular type of medication within the same broad category of the medications hence physicians can switch to its alternative. Patients who were transferred to another hospital for management upon discharge or who died, were also excluded in the analysis for medication on discharge. Information on medications on arrival and upon discharge was collected by the stroke registry from 2009 onwards.

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3 Cancer Registration: Principles and Methods. IARC Scientific Publication No. 95  
<http://www.iarc.fr/en/publications/pdfs-online/epi/sp95/sp95-chap11.pdf>.

### 3. GLOSSARY

Crude rate (CIR, CMR): Crude incidence or mortality rate is the number of first and recurrent stroke cases or deaths divided by the mid-year general population respectively.

Age-standardised incidence rate (ASIR): Age-standardised incidence rate is the incidence rate that would be observed if the general population had the age structure of an external world standard population. Age standardisation facilitates the comparison of rates across time, and also across countries.

Age-standardised mortality rate (ASMR): Age-standardised mortality rate is the mortality rate that would be observed if the general population had the age structure of an external world standard population.

30-day Case Fatality Rate (CFR): This refers to the proportion of stroke events that are fatal within 30 days of onset, regardless if the death occurred within or outside the hospital.

### 4. STROKE INCIDENCE 2005 - 2012: ALL RESIDENTS

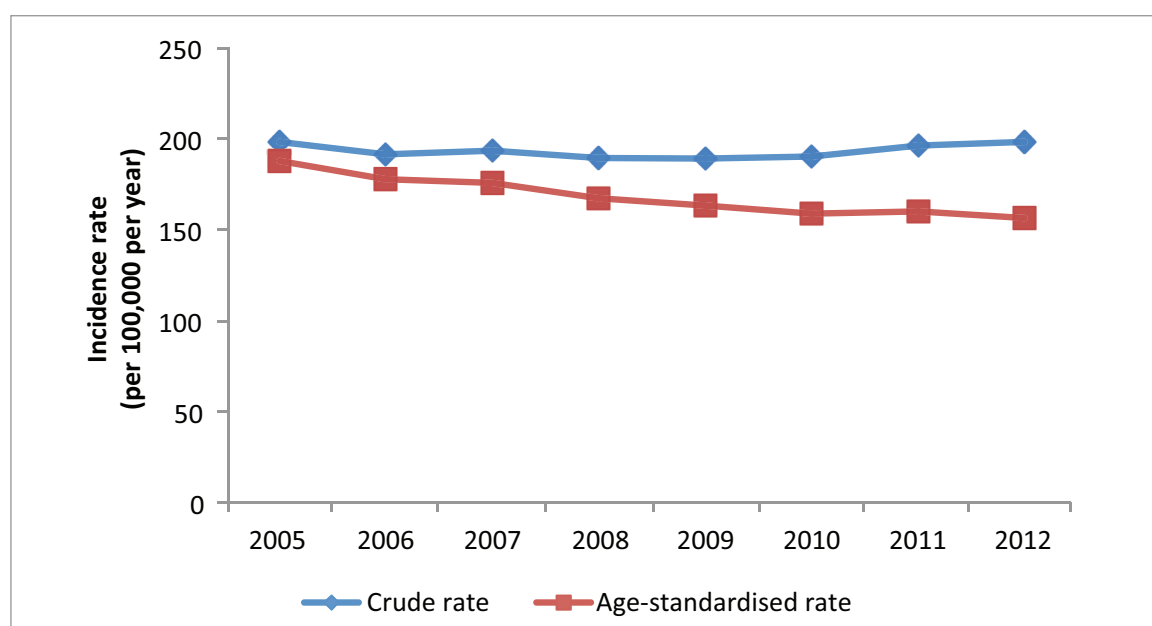
#### 4.1 Stroke Incidences, Overall, 2005 - 2012

The average number of stroke episodes from 2005 to 2012 was approximately 5,760 a year. The number of stroke episodes in 2012 was 6,280. (Table 4.1.1) .The crude incidence rates have remained stable while the age-standardised incidence rates decreased then stabilized, with average annual percentage change (AAPC) -2.47% (95%CI: -3.15 to -1.78) and  $P < 0.0001$ . This corresponds to the decreasing national prevalence of hypertension (from 27.3% in 1998 to 23.5% in 2010) and hyperlipidemia (from 25.4% in 1998 to 17.4% in 2010).

**Table 4.1.1 STROKE INCIDENCE (PER 100,000 POPULATION), 2005 - 2012**

	2005	2006	2007	2008	2009	2010	2011	2012
No. of cases	5459	5401	5578	5583	5758	5887	6136	6280
Crude rate	196.9 (191.7-202.1)	190.2 (185.1-195.3)	192.0 (187.0-197.1)	187.9 (183.0-192.8)	187.8 (183.0-192.7)	188.8 (184.0-193.7)	194.7 (189.8-199.5)	196.7 (191.9-201.6)
Age-standardised rate	186.4 (181.4-191.5)	176.4 (171.6-181.2)	174.5 (169.9-179.2)	166.1 (161.6-170.5)	162.3 (158.0-166.5)	157.9 (153.8-162.0)	159.0 (154.9-163.0)	155.3 (151.4-159.2)

**Figure 4.1.1 CRUDE AND AGE-STANDARDISED INCIDENCE RATES OF STROKE, (PER 100,000 POPULATION), 2005 - 2012**



The number and crude incidence rate (CIR) of stroke increased with age. (Tables 4.1.2, 4.1.3). The incidence rates for those aged 60 years and above have consistently declined since 2007. The median age of incident stroke has remained at 68 years over the past 4 years (Table 4.1.4).

**Table 4.1.2 INCIDENT STROKE CASES BY AGE GROUP, 2005 - 2012**

Age Group	2005	2006	2007	2008	2009	2010	2011	2012
15 - 19	6	4	6	9	9	2	7	7
20 - 24	7	10	5	8	8	9	12	10
25 - 29	14	12	15	14	14	19	15	7
30 - 34	29	30	30	32	30	43	40	30
35 - 39	58	47	60	59	76	86	69	91
40 - 44	129	124	150	138	153	143	154	174
45 - 49	294	286	309	256	321	311	309	337
50 - 54	426	421	469	478	505	536	601	528
55 - 59	596	608	583	629	645	671	673	723
60 - 64	586	542	631	649	721	712	787	872
65 - 69	692	692	785	708	683	650	655	670
70 - 74	762	823	743	735	701	720	839	831
75 - 79	736	729	722	748	725	737	748	712
80 - 84	532	541	537	541	584	686	615	642
85+	592	532	533	579	583	562	612	646

**Table 4.1.3 AGE-SPECIFIC INCIDENCE RATE OF STROKE  
(PER 100,000 POPULATION), 2005 - 2012**

Age Group	2005	2006	2007	2008	2009	2010	2011	2012
15 - 19	2.6 (0.5-4.6)	1.6 (0.0-3.2)	2.3 (0.5-4.2)	3.4 (1.2-5.7)	3.4 (1.2-5.7)	0.8 (0.0-1.8)	2.7 (0.7-4.7)	2.7 (0.7-4.7)
20 - 24	3.2 (0.8-5.6)	4.6 (1.7-7.4)	2.3 (0.3-4.3)	3.5 (1.1-6.0)	3.3 (1.0-5.6)	3.6 (1.3-6.0)	4.7 (2.0-7.4)	3.8 (1.4-6.1)
25 - 29	5.6 (2.7-8.6)	4.8 (2.1-7.5)	5.9 (2.9-8.9)	5.3 (2.5-8.1)	5.1 (2.4-7.8)	7.0 (3.8-10.1)	5.7 (2.8-8.6)	2.7 (0.7-4.8)
30 - 34	9.9 (6.3-13.5)	10.2 (6.6-13.9)	10.2 (6.5-13.8)	11.0 (7.2-14.9)	10.1 (6.5-13.7)	14.4 (10.1-18.7)	13.4 (9.3-17.6)	10.2 (6.5-13.8)
35 - 39	19.4 (14.4-24.4)	15.8 (11.3-20.3)	19.9 (14.8-24.9)	19.2 (14.3-24.1)	24.0 (18.6-29.3)	26.9 (21.2-32.6)	21.8 (16.7-27.0)	29.0 (23.0-34.9)
40 - 44	40.1 (33.2-47.0)	38.4 (31.6-45.1)	46.7 (39.3-54.2)	43.5 (36.2-50.7)	48.9 (41.1-56.6)	46.2 (38.6-53.8)	50.2 (42.3-58.2)	56.3 (48.0-64.7)
45 - 49	95.6 (84.7-106.5)	91.4 (80.8-102.0)	97.9 (87.0-108.8)	80.5 (70.6-90.4)	99.5 (88.6-110.4)	96.1 (85.5-106.8)	95.4 (84.7-106.0)	105.0 (93.8-116.2)
50 - 54	167.6 (151.7-183.5)	157.7 (142.6-172.7)	168.0 (152.8-183.2)	165.3 (150.5-180.1)	169.8 (155.0-184.6)	176.9 (161.9-191.8)	195.1 (179.5-210.7)	170.1 (155.6-184.6)
55 - 59	301.3 (277.1-325.5)	283.3 (260.8-305.8)	263.9 (242.5-285.3)	274.2 (252.8-295.6)	268.9 (248.1-289.6)	269.8 (249.4-290.2)	258.2 (238.6-277.7)	266.0 (246.6-285.4)
60 - 64	498.3 (458.0-538.6)	458.2 (419.6-496.7)	465.7 (429.3-502.0)	423.6 (391.0-456.2)	424.9 (393.9-455.9)	370.8 (343.6-398.1)	378.0 (351.6-404.4)	407.5 (380.4-434.5)
65 - 69	684.5 (633.5-735.5)	636.0 (588.6-683.4)	689.8 (641.6-738.1)	614.6 (569.3-659.9)	587.3 (543.2-631.3)	582.9 (538.1-627.7)	582.7 (538.1-627.4)	519.8 (480.4-559.1)
70 - 74	996.1 (925.4-1066.8)	1051.1 (979.3-1122.9)	945.3 (877.3-1013.3)	904.1 (838.7-969.4)	801.1 (741.8-860.5)	777.4 (720.6-834.2)	839.0 (782.2-895.8)	796.0 (741.9-850.1)
75 - 79	1426.4 (1323.3-1529.4)	1340.1 (1242.8-1437.4)	1271.1 (1178.4-1363.8)	1267.8 (1176.9-1358.7)	1180.8 (1094.8-1266.7)	1130.7 (1049.1-1212.4)	1118.1 (1038.0-1198.2)	1051.7 (974.4-1129.0)
80 - 84	1913.7 (1751.1-2076.3)	1840.1 (1685.1-1995.2)	1704.8 (1560.6-1849.0)	1595.9 (1461.4-1730.3)	1574.1 (1446.5-1701.8)	1721.9 (1593.1-1850.8)	1457.3 (1342.2-1572.5)	1455.8 (1343.2-1568.4)
85+	2631.1 (2419.2-2843.1)	2244.7 (2054.0-2435.5)	2132.0 (1951.0-2313.0)	2193.2 (2014.5-2371.8)	2097.1 (1926.9-2267.4)	1922.0 (1763.1-2080.9)	1967.8 (1811.9-2123.8)	1922.6 (1774.4-2070.9)

**Table 4.1.4 MEDIAN AGE OF INCIDENT STROKE CASES, 2005 - 2012**

	2005	2006	2007	2008	2009	2010	2011	2012
Median Age	69	69	68	69	68	68	68	68

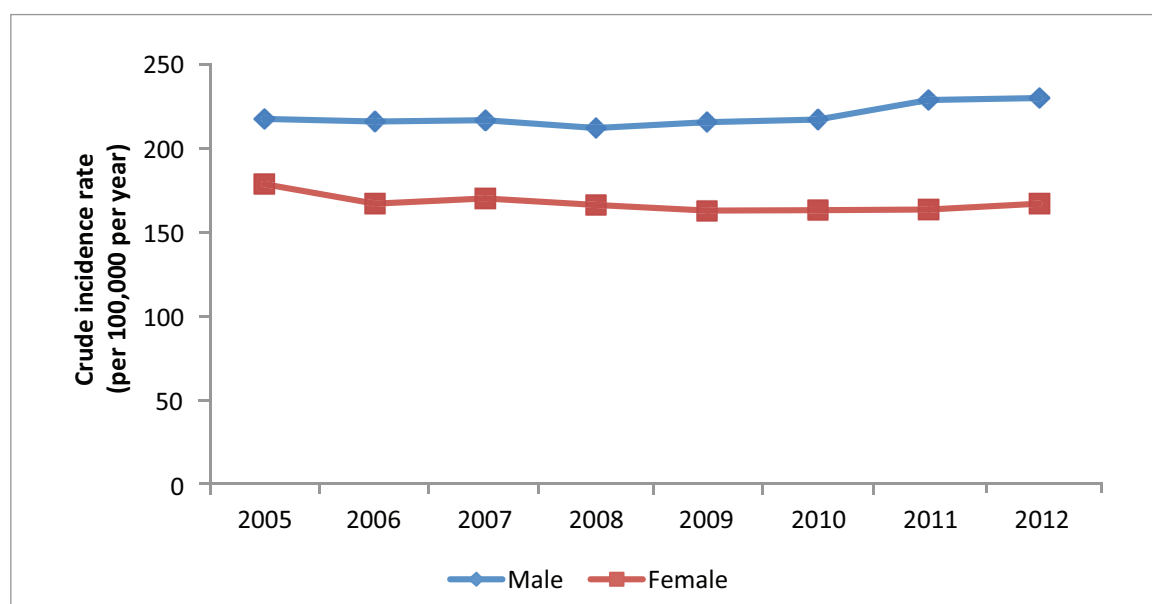
## 4.2 Incidence Of Stroke Cases, By Gender, 2005 - 2012

The ratio of stroke episodes among men as compared to women was approximately 1.31:1 from 2005 to 2012 (Table 4.2.1). The national health survey reported higher prevalences of risk factors for stroke among males than females, such as diabetes, hypertension and hyperlipidemia and especially for smoking. The CIRs have been observed to be stable (Figure 4.2.2) while the ASIRs have declined over the 8-year period in both genders (Figure 4.2.3). AAPC for males was -2.08%, 95% CI (-2.86 to -1.19) and P=0.001. AAPC for females was -3.25%, 95% CI (-3.92 to -2.66) and P<0.0001.

**Table 4.2.1 INCIDENT STROKE CASES, BY GENDER, 2005 - 2012**

Gender	2005	2006	2007	2008	2009	2010	2011	2012
Male	2949	2995	3073	3073	3217	3295	3505	3564
Female	2510	2406	2505	2510	2541	2592	2631	2716
Ratio (M vs F)	1.17	1.24	1.23	1.22	1.27	1.27	1.33	1.31

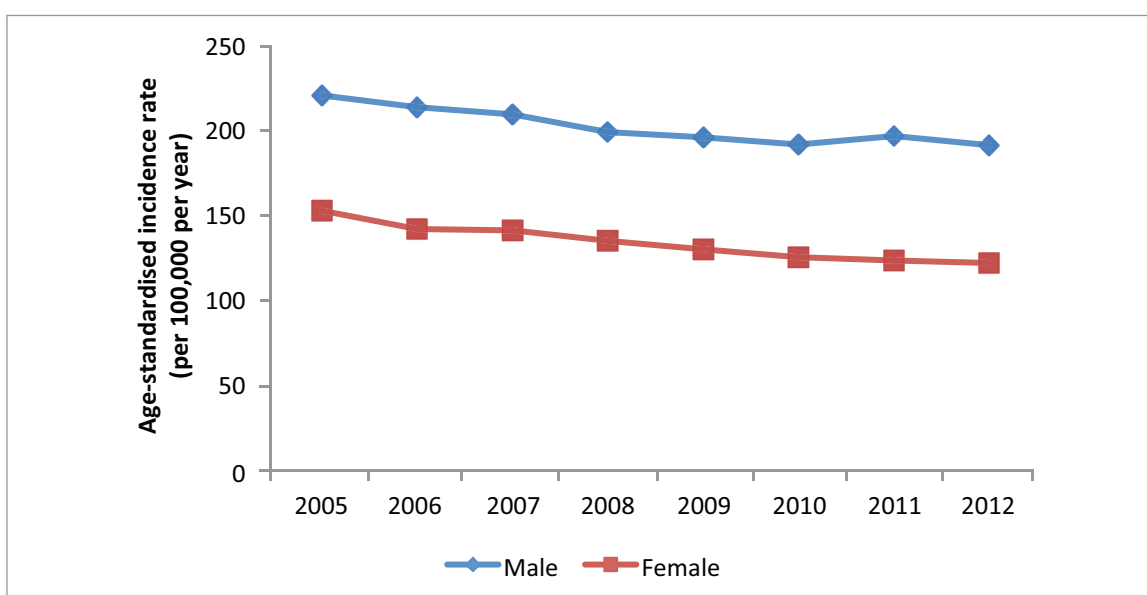
**Figure 4.2.2 CRUDE INCIDENCE RATE OF STROKE (PER 100,000 POPULATION), BY GENDER, 2005 - 2012**



**Table 4.2.2 CRUDE INCIDENCE RATE OF STROKE (PER 100,000 POPULATION), BY GENDER, 2005 - 2012**

Gender	2005	2006	2007	2008	2009	2010	2011	2012
Male	216.3 (208.5-224.2)	214.6 (207.0-222.3)	215.4 (207.8-223.0)	210.7 (203.2-218.1)	214.1 (206.7-221.5)	215.8 (208.4-223.2)	227.2 (219.7-234.7)	228.4 (220.9-235.9)
Female	178.1 (171.1-185.1)	166.6 (159.9-173.2)	169.5 (162.8-176.1)	165.9 (159.4-172.4)	162.6 (156.2-168.9)	163.0 (156.7-169.2)	163.4 (157.2-169.7)	166.5 (160.2-172.7)

**Figure 4.2.3 AGE-STANDARDISED INCIDENCE RATE OF STROKE (PER 100,000 POPULATION), BY GENDER, 2005 - 2012**



**Table 4.2.3 AGE-STANDARDISED INCIDENCE RATE OF STROKE (PER 100,000 POPULATION), BY GENDER, 2005 - 2012**

Gender	2005	2006	2007	2008	2009	2010	2011	2012
Male	222.4 (214.2-230.6)	215.3 (207.5-223.2)	210.8 (203.2-218.4)	200.0 (192.9-207.2)	197.0 (190.1-203.9)	192.6 (185.9-199.3)	197.8 (191.1-204.5)	192.0 (185.6-198.4)
Female	152.1 (146.0-158.2)	140.9 (135.0-146.7)	140.3 (134.7-146.0)	133.9 (128.5-139.3)	128.6 (123.5-133.8)	123.9 (118.9-128.8)	121.9 (117.1-126.7)	120.2 (115.6-124.9)



The age-specific rates among males and females were decreasing above the 60-years age group (Tables 4.2.4A and Table 4.2.4B).

**Table 4.2.4A AGE-SPECIFIC INCIDENCE RATE OF STROKE  
(PER 100,000 POPULATION), BY MALE, 2005 - 2012**

Age Group	2005	2006	2007	2008	2009	2010	2011	2012
15 - 19	5.0 (1.0-8.9)	1.6 (0.0-3.8)	3.0 (0.1-6.0)	3.0 (0.1-5.9)	3.7 (0.5-7.0)	0.0 (0.0-0.0)	2.3 (0.0-4.8)	3.8 (0.5-7.1)
20 - 24	4.5 (0.6-8.5)	4.5 (0.6-8.4)	3.6 (0.1-7.2)	3.5 (0.1-7.0)	4.1 (0.5-7.8)	5.6 (1.5-9.8)	7.0 (2.4-11.6)	3.8 (0.5-7.1)
25 - 29	5.1 (1.0-9.1)	6.7 (2.0-11.3)	9.0 (3.7-14.3)	6.3 (1.9-10.7)	5.3 (1.4-9.2)	6.1 (1.9-10.3)	6.3 (1.9-10.7)	3.2 (0.1-6.4)
30 - 34	12.0 (6.3-17.7)	13.5 (7.4-19.5)	12.7 (6.5-13.8)	13.7 (7.5-19.8)	12.6 (6.8-18.4)	16.1 (9.5-22.6)	20.4 (13.0-27.9)	11.4 (5.8-16.9)
35 - 39	27.9 (19.3-36.4)	21.9 (14.3-29.5)	27.1 (18.7-35.5)	24.0 (16.2-31.9)	29.7 (21.1-38.2)	35.8 (26.4-45.2)	29.9 (21.2-38.5)	40.7 (30.6-50.8)
40 - 44	43.8 (33.6-54.0)	45.5 (35.2-55.9)	58.3 (46.5-70.1)	49.1 (38.2-59.9)	64.8 (52.2-77.5)	69.3 (56.1-82.5)	67.7 (54.5-80.8)	81.3 (67.0-95.7)
45 - 49	118.5 (101.4-135.6)	122.6 (105.4-139.9)	125.9 (108.5-143.4)	108.8 (92.7-125.0)	124.6 (107.5-141.8)	128.0 (110.7-145.4)	122.1 (105.1-139.0)	134.1 (116.2-152.0)
50 - 54	232.4 (206.1-258.8)	205.9 (181.7-230.2)	220.2 (195.7-244.7)	221.7 (197.5-245.9)	238.0 (213.2-262.7)	247.5 (222.6-272.5)	283.8 (257.3-310.3)	228.0 (204.3-251.6)
55 - 59	403.7 (364.0-443.3)	386.0 (348.8-423.2)	346.3 (311.6-381.1)	372.5 (337.2-407.8)	385.4 (350.3-420.4)	380.5 (346.3-414.8)	373.4 (340.2-406.5)	368.0 (335.8-400.2)
60 - 64	659.7 (593.2-726.2)	603.4 (540.2-666.7)	613.2 (553.8-672.6)	541.8 (489.3-594.4)	560.3 (509.6-611.0)	489.5 (444.9-534.0)	504.9 (461.4-548.3)	555.8 (510.8-600.7)
65 - 69	836.4 (754.9-918.0)	798.8 (721.8-875.9)	845.7 (768.0-923.4)	763.7 (690.4-837.0)	698.6 (629.0-768.2)	740.8 (667.7-813.9)	743.1 (670.4-815.7)	629.8 (567.5-692.1)
70 - 74	1186.2 (1072.0-1300.5)	1214.5 (1100.5-1328.5)	1138.1 (1028.2-1248.0)	1090.7 (985.0-1196.4)	965.3 (869.5-1061.2)	895.4 (805.8-984.9)	980.5 (890.1-1070.9)	954.1 (866.6-1041.5)
75 - 79	1458.7 (1298.4-1619.0)	1504.3 (1346.5-1662.1)	1401.6 (1253.1-1550.2)	1418.0 (1272.1-1563.8)	1363.3 (1223.2-1503.3)	1276.0 (1144.2-1407.8)	1209.6 (1083.3-1336.0)	1266.0 (1138.0-1394.0)
80 - 84	2090.9 (1820.7-2361.1)	11965.5 (1710.4-2220.6)	1821.1 (1582.6-2059.6)	1689.4 (1467.7-1911.1)	1572.4 (1368.3-1776.5)	1770.5 (1561.3-1979.8)	1536.1 (1347.6-1724.7)	1445.7 (1267.6-1623.9)
85+	2418.9 (2064.6-2773.3)	2468.4 (2121.9-2814.8)	2012.0 (1706.9-2317.2)	2046.0 (1745.4-2346.5)	1891.3 (1610.3-2172.3)	1610.9 (1357.3-1864.5)	1960.8 (1689.0-2232.5)	1864.9 (1610.8-2118.9)

**Table 4.2.4B AGE-SPECIFIC INCIDENCE RATE OF STROKE  
(PER 100,000 POPULATION), BY FEMALE, 2005 - 2012**

Age Group	2005	2006	2007	2008	2009	2010	2011	2012
15 - 19	0.0 (0.0-0.0)	1.7 (0.0-4.0)	1.6 (0.0-3.8)	3.9 (0.5-7.3)	3.1 (0.1-6.1)	1.5 (0.0-3.7)	3.1 (0.1-6.2)	1.6 (0.0-3.8)
20 - 24	1.8 (0.0-4.4)	4.6 (0.6-8.7)	0.9 (0.0-2.7)	3.6 (0.1-7.1)	2.5 (0.0-5.3)	1.6 (0.0-3.9)	2.4 (0.0-5.0)	3.8 (0.5-7.1)
25 - 29	6.2 (1.9-10.5)	3.0 (0.1-6.0)	3.0 (0.1-6.0)	4.4 (0.9-7.9)	4.9 (1.3-8.6)	7.8 (3.2-12.4)	5.2 (1.3-9.0)	2.3 (0.0-4.9)
30 - 34	7.9 (3.4-12.4)	7.2 (3.0-11.5)	7.8 (3.4-12.3)	8.6 (3.9-13.3)	7.8 (3.4-12.2)	12.9 (7.2-18.5)	7.1 (2.9-11.2)	9.0 (4.3-13.8)
35 - 39	11.2 (5.9-16.5)	9.8 (4.9-14.8)	12.9 (7.3-18.6)	14.6 (8.6-20.6)	18.5 (11.9-25.1)	18.3 (11.8-24.9)	14.2 (8.4-20.0)	17.9 (11.4-24.5)
40 - 44	36.4 (27.0-45.7)	31.2 (22.5-39.8)	35.0 (25.9-44.2)	37.9 (28.3-47.5)	33.1 (24.1-42.1)	23.7 (16.0-31.3)	33.4 (24.3-42.4)	32.4 (23.5-41.2)
45 - 49	72.3 (58.8-85.8)	59.5 (47.3-71.7)	69.2 (56.2-82.3)	51.5 (40.3-62.7)	73.9 (60.6-87.3)	63.7 (51.3-76.0)	68.3 (55.6-81.1)	75.7 (62.2-89.2)
50 - 54	101.6 (84.0-119.2)	108.7 (90.9-126.4)	114.9 (97.0-132.7)	108.0 (91.0-125.0)	100.8 (84.6-117.0)	105.1 (88.7-121.5)	104.8 (88.5-121.0)	111.2 (94.5-127.8)
55 - 59	199.6 (171.8-227.4)	181.2 (155.8-206.7)	181.7 (156.6-206.9)	175.5 (151.3-199.8)	151.5 (129.4-173.5)	158.2 (136.1-180.4)	142.3 (121.8-162.8)	163.2 (141.7-184.7)
60 - 64	344.9 (298.1-391.8)	318.4 (273.4-363.4)	322.7 (280.2-365.1)	309.4 (270.3-348.4)	293.0 (256.8-329.2)	255.1 (223.4-286.9)	254.3 (223.8-284.7)	262.5 (231.9-293.0)
65 - 69	545.5 (482.5-608.5)	488.6 (431.3-546.0)	550.0 (490.7-609.3)	480.2 (425.0-535.4)	486.0 (430.7-541.4)	438.2 (384.4-492.0)	434.0 (380.5-487.4)	416.5 (367.5-465.6)
70 - 74	836.5 (748.6-924.4)	912.7 (821.8-1003.7)	780.7 (696.6-864.8)	744.3 (663.5-825.1)	660.3 (586.9-733.7)	675.6 (603.4-747.9)	718.0 (646.5-789.5)	661.9 (594.9-729.0)
75 - 79	1402.7 (1268.2-1537.2)	1217.9 (1095.5-1340.4)	1172.8 (1054.9-1290.8)	1152.7 (1037.6-1267.8)	1040.3 (933.0-1147.7)	1019.9 (917.0-1122.9)	1047.6 (944.4-1150.8)	884.2 (789.7-978.8)
80 - 84	1797.6 (1594.9-2000.4)	1758.4 (1563.6-1953.2)	1630.2 (1449.6-1810.8)	1536.2 (1367.4-1705.1)	1575.2 (1411.6-1738.9)	1690.9 (1527.4-1854.3)	1406.3 (1261.0-1551.5)	1462.4 (1317.1-1607.7)
85+	2735.1 (2471.3-2998.9)	2132.9 (1905.2-2360.6)	2191.6 (1967.1-2416.1)	2265.5 (2043.8-2487.3)	2198.9 (1985.8-2412.0)	2074.5 (1873.0-2276.1)	1971.3 (1780.9-2161.6)	1951.1 (1768.6-2133.6)

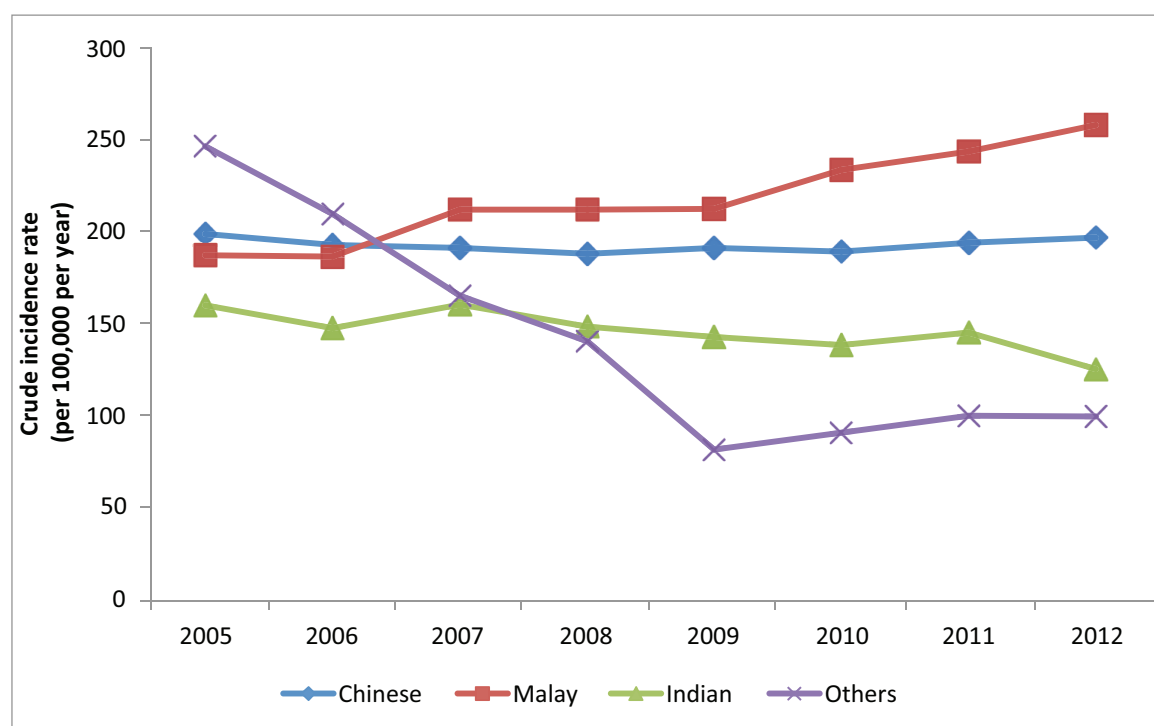
### 4.3 Incidence of Stroke Cases, by Ethnicity, 2005 - 2012

Malays had the highest CIR for stroke from year 2007, followed by Chinese and Indians (Figure 4.3.2).

**Table 4.3.1 STROKE CASES, BY ETHNICITY, 2005 - 2012**

Ethnicity	2005	2006	2007	2008	2009	2010	2011	2012
Chinese	4308	4251	4285	4294	4474	4497	4658	4781
Malay	664	677	787	805	824	922	977	1050
Indian	357	345	390	374	385	380	403	351
Others	357	345	390	374	385	380	403	351

**Figure 4.3.2 CRUDE INCIDENCE RATE OF STROKE (PER 100,000 POPULATION), BY ETHNICITY, 2005 - 2012**

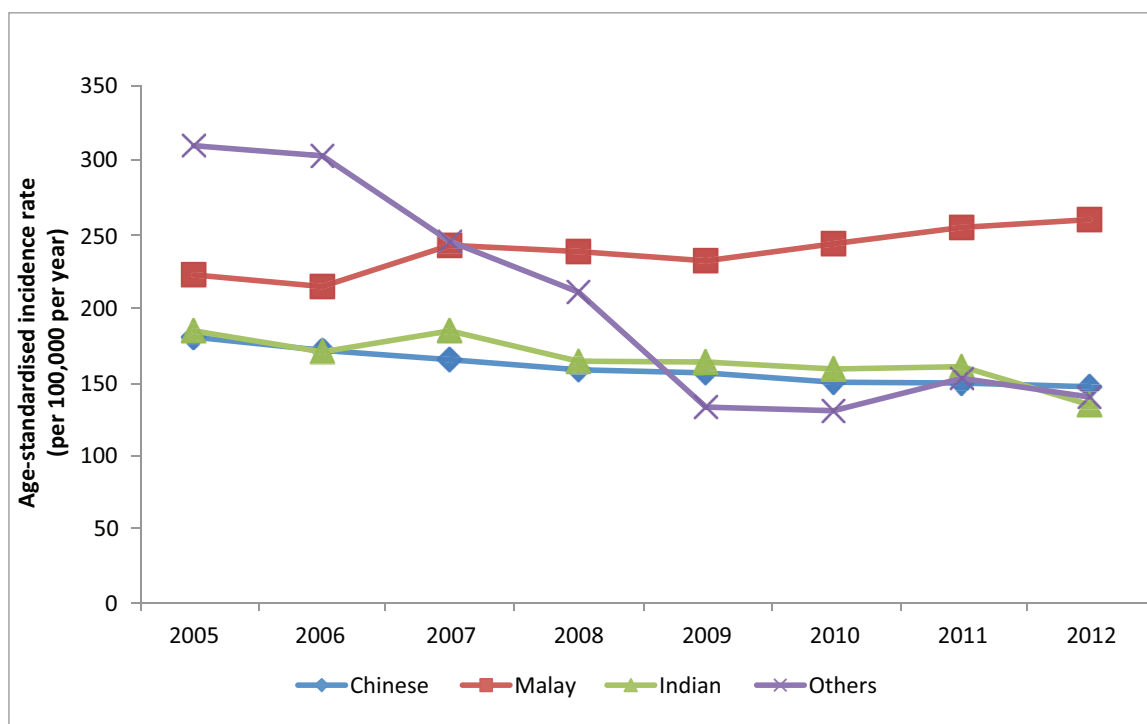


**Table 4.3.2 CRUDE INCIDENCE RATE OF STROKE (PER 100,000 POPULATION), BY ETHNICITY, 2005 - 2012**

Ethnicity	2005	2006	2007	2008	2009	2010	2011	2012
Chinese	200.7 (194.7-206.7)	194.4 (188.6-200.3)	192.6 (186.9-198.4)	189.5 (183.8-195.1)	192.7 (187.1-198.4)	190.9 (185.3-196.5)	195.6 (190.0-201.2)	198.3 (192.7-203.9)
Malay	188.6 (174.3-203.0)	188.0 (173.8-202.1)	213.9 (198.9-228.8)	214.5 (199.3-228.9)	244.0 (199.9-229.2)	235.7 (220.5-250.9)	246.0 (230.6-261.5)	260.5 (244.8-276.3)
Indian	161.0 (144.3-177.7)	148.6 (132.9-164.3)	161.4 (145.4-177.4)	149.1 (134.0-164.2)	143.6 (129.3-157.9)	139.1 (125.1-153.1)	146.1 (131.9-160.4)	125.9 (112.7-139.0)
Others	249.0 (206.2-291.9)	211.6 (174.9-248.2)	166.2 (135.9-196.4)	141.0 (114.7-167.4)	81.3 (62.9-99.6)	90.6 (71.7-109.5)	100.2 (80.4-120.0)	99.7 (80.0-119.4)

Malays had the highest ASIR during the period, followed by Indians and Chinese, whose rates were similar (Figure 4.3.3). But for year 2012, Chinese ranked the 2nd following Malays. Singapore national health survey showed that Malays had higher prevalence of risk factors of stroke, such as hypertension and hyperlipidemia.

The ASIR for Chinese and Indians has fallen over the 8-year period, while the ASIR for Malays has increased. AAPC for Chinese was -2.96% with 95%CI (-3.63 to -2.27) and  $P < 0.0001$ . AAPC for Indians was -3.63% with 95%CI (-5.64 to -1.49) and  $P = 0.006$ . AAPC for Malays was 2.43% with 95%CI (1.01 to 3.77) and  $P = 0.005$ .

**Figure 4.3.3 AGE-STANDARDISED INCIDENCE RATE OF STROKE (PER 100,000 POPULATION), BY ETHNICITY, 2005 - 2012**

**Table 4.3.3 AGE-STANDARDISED INCIDENCE RATE OF STROKE (PER 100,000 POPULATION), BY ETHNICITY, 2005 - 2012**

Ethnicity	2005	2006	2007	2008	2009	2010	2011	2012
Chinese	179.2 (173.7-184.6)	169.6 (164.4-174.8)	163.4 (158.4-168.4)	156.0 (151.3-160.8)	154.1 (149.6-158.7)	147.4 (143.0-151.8)	147.1 (142.8-151.4)	144.4 (140.2-148.5)
Malay	222.5 (204.8-240.2)	214.2 (197.3-231.1)	243.4 (225.7-261.0)	238.9 (221.9-255.9)	232.2 (215.7-248.6)	244.4 (228.0-260.9)	255.6 (238.9-272.4)	261.0 (244.7-277.2)
Indian	183.3 (163.5-203.1)	168.9 (150.2-187.6)	183.3 (164.4-202.2)	162.3 (145.2-179.3)	161.5 (144.7-178.2)	157.0 (140.6-173.4)	158.7 (142.6-174.8)	131.6 (117.4-145.8)
Others	312.6 (256.4-368.8)	305.8 (249.9-361.7)	245.9 (198.4-293.4)	210.7 (169.2-252.3)	130.3 (98.5-162.1)	127.7 (98.9-156.6)	150.2 (117.4-183.0)	137.0 (107.6-166.4)

**Table 4.3.4 INCIDENT STROKE CASES, BY GENDER AND ETHNICITY, 2005 - 2012**

Gender	Ethnicity	2005	2006	2007	2008	2009	2010	2011	2012
Male	Chinese	2283	2312	2349	2380	2505	2501	2638	2728
	Malay	364	370	408	409	440	507	569	557
	Indian	224	232	239	230	230	234	246	218
	Others	78	81	77	54	42	53	52	61
Female	Chinese	2025	1939	1936	1914	1969	1996	2020	2053
	Malay	300	307	379	396	384	415	408	493
	Indian	133	113	151	144	155	146	157	133
	Others	52	47	39	56	33	35	46	37

**Table 4.3.5A CRUDE INCIDENCE RATE OF STROKE (PER 100,000 POPULATION), BY MALE AND ETHNICITY, 2005 - 2012**

Ethnicity	2005	2006	2007	2008	2009	2010	2011	2012
Chinese	217.4 (208.5-226.3)	216.3 (207.5-225.2)	216.2 (207.5-224.9)	215.3 (206.7-224.0)	221.8 (213.1-230.4)	218.4 (209.9-227.0)	228.1 (219.4-236.8)	233.3 (224.5-242.0)
Malay	209.3 (187.8-230.8)	208.1 (186.9-229.3)	224.7 (202.9-246.5)	220.5 (199.1-241.9)	232.6 (210.8-254.3)	263.0 (240.1-285.8)	290.8 (266.9-314.6)	280.3 (257.0-303.6)
Indian	196.0 (170.3-221.6)	193.7 (168.7-218.6)	190.7 (166.6-214.9)	176.2 (153.5-199.0)	164.2 (143.0-185.4)	163.8 (142.8-184.8)	170.8 (149.5-192.2)	150.2 (130.3-170.2)
Others	315.8 (245.7-385.9)	280.3 (219.2-341.3)	230.5 (179.0-282.0)	145.2 (106.4-183.9)	95.9 (66.9-124.9)	115.0 (84.1-146.0)	111.8 (81.4-142.2)	130.1 (97.4-162.7)

**Table 4.3.5B CRUDE INCIDENCE RATE OF STROKE (PER 100,000 POPULATION), BY FEMALE AND ETHNICITY, 2005 - 2012**

Ethnicity	2005	2006	2007	2008	2009	2010	2011	2012
Chinese	184.7 (176.7-192.8)	173.5 (165.8-181.2)	170.1 (162.5-177.7)	164.8 (157.5-172.2)	165.2 (157.9-172.5)	164.9 (157.6-172.1)	164.9 (157.7-172.1)	165.3 (158.2-172.5)
Malay	168.4 (149.4-187.5)	168.3 (149.5-187.1)	203.3 (182.9-223.8)	207.9 (187.4-228.3)	197.0 (177.3-216.7)	209.2 (189.1-229.3)	202.6 (182.9-222.2)	241.3 (220.0-262.6)
Indian	123.7 (102.7-144.7)	100.5 (82.0-119.1)	129.8 (109.1-150.5)	119.6 (100.1-139.1)	121.1 (102.0-140.2)	112.0 (93.9-130.2)	119.1 (100.5-137.8)	99.4 (82.5-116.3)
Others	189.1 (137.7-240.5)	148.7 (106.2-191.3)	107.1 (73.5-140.8)	137.3 (101.3-173.2)	68.0 (44.8-91.3)	68.5 (45.8-91.2)	89.7 (63.8-115.6)	72.0 (48.8-95.2)

Malays had higher ASIR compared to Indians and Chinese among males and females. Among all combinations of gender and ethnicity, ASIR has been decreasing except for Malay males and Malay females (Table 4.3.6)

**Table 4.3.6 AGE-STANDARDISED INCIDENCE RATE OF STROKE (PER 100,000 POPULATION), BY GENDER AND ETHNICITY, 2005 - 2012**

<b>Male</b>								
Ethnicity	2005	2006	2007	2008	2009	2010	2011	2012
Chinese	216.3 (207.3-225.3)	208.9 (200.2-217.5)	201.6 (193.3-209.8)	193.8 (185.9-201.7)	192.3 (184.7-199.9)	182.8 (175.5-190.1)	185.4 (178.2-192.6)	183.2 (176.3-190.2)
Malay	253.7 (226.2-281.2)	251.1 (224.1-278.0)	268.0 (241.0-295.1)	256.3 (230.5-282.0)	255.7 (230.8-280.6)	280.3 (254.7-306.0)	315.6 (288.2-342.9)	294.7 (269.5-320.0)
Indian	216.0 (186.2-245.8)	211.1 (182.3-239.9)	212.1 (183.7-240.4)	191.8 (165.6-218.0)	189.7 (163.8-215.6)	185.3 (160.3-210.3)	190.7 (165.4-215.9)	160.1 (137.9-182.2)
Others	389.4 (299.8-479.0)	371.4 (286.4-456.3)	310.1 (235.6-384.5)	211.6 (150.8-272.3)	134.2 (89.1-179.4)	149.8 (105.9-193.6)	143.4 (100.7-186.2)	153.6 (111.7-195.5)
<b>Female</b>								
Ethnicity	2005	2006	2007	2008	2009	2010	2011	2012
Chinese	144.3 (137.7-150.8)	134.7 (128.4-140.9)	128.1 (122.1-134.0)	120.8 (115.1-126.4)	118.0 (112.6-123.4)	112.9 (107.7-118.0)	111.2 (106.1-116.3)	107.7 (102.8-112.6)
Malay	194.9 (172.0-217.9)	182.7 (161.4-204.0)	221.7 (198.6-244.9)	223.4 (200.8-246.0)	210.1 (188.4-231.8)	211.2 (190.1-232.3)	200.8 (180.5-221.1)	230.7 (209.7-251.6)
Indian	149.8 (123.2-176.4)	122.0 (98.6-145.4)	160.8 (134.1-187.5)	131.5 (109.5-153.6)	135.9 (113.9-158.0)	128.9 (107.3-150.5)	127.1 (106.6-147.5)	104.2 (86.0-122.4)
Others	233.3 (165.6-301.1)	241.9 (167.3-316.5)	178.7 (119.2-238.3)	215.1 (154.5-275.7)	124.2 (77.2-171.3)	107.1 (68.2-146.1)	152.2 (101.8-202.6)	107.1 (69.5-144.7)

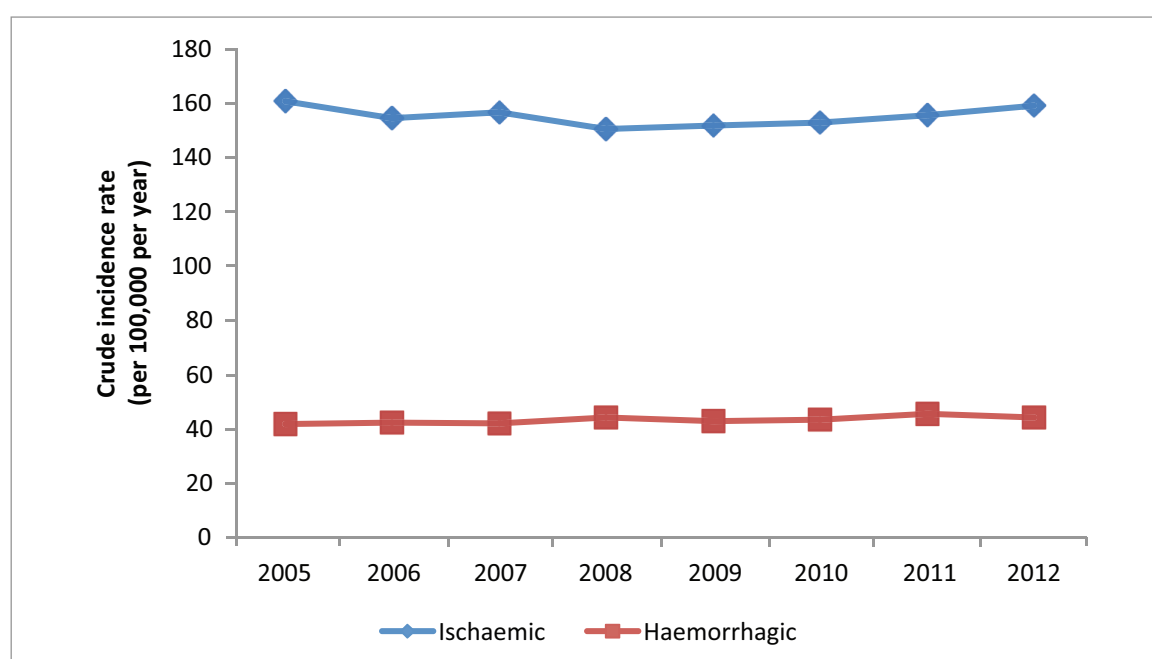
#### 4.4 Incidence of Stroke Cases, by Subtype, 2005 - 2012

**Table 4.4.1 CRUDE INCIDENCE OF STROKE, BY SUBTYPE, 2005 - 2012**

Subtype	2005	2006	2007	2008	2009	2010	2011	2012
Ischaemic	4458	4373	4545	4455	4638	4747	4895	5073
Haemorrhagic	954	995	1009	1097	1091	1124	1211	1182
Unknown	47	33	24	31	29	16	30	25

The ASIR of ischaemic stroke has fallen over the 8-year period with AAPC -2.76% (95%CI: -3.63 to -1.98) and  $P < 0.0001$ , while incidence rates of haemorrhagic stroke have remained constant (Figure 4.4.2, 4.4.3).

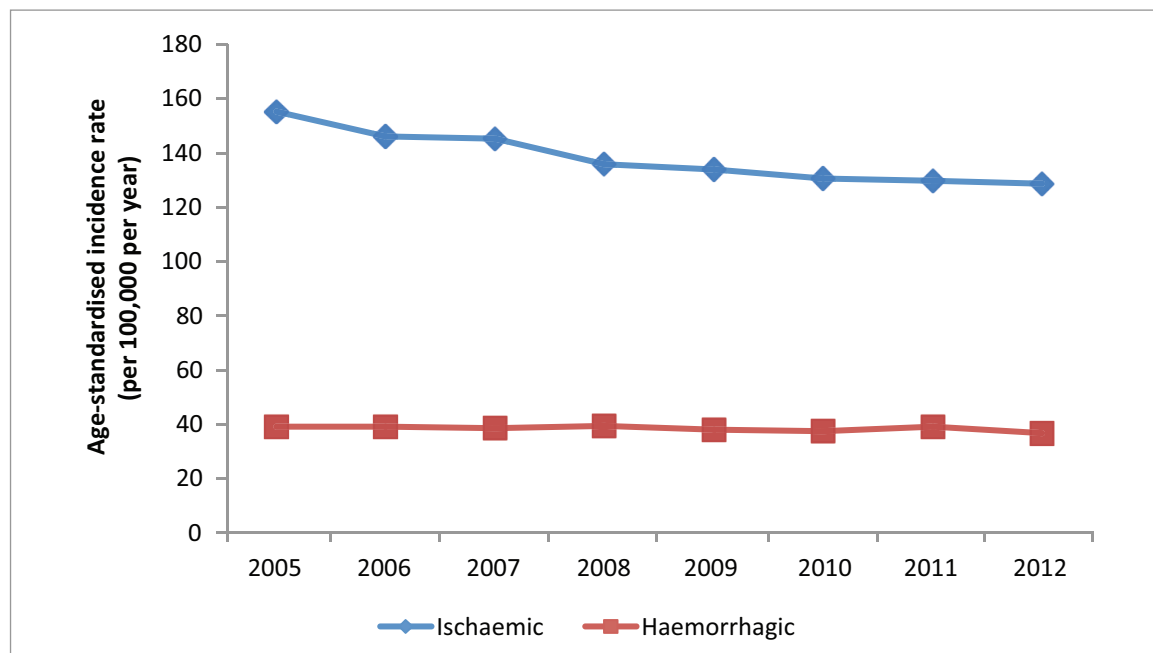
**Figure 4.4.2 CRUDE INCIDENCE RATE OF STROKE (PER 100,000 POPULATION), BY SUBTYPE, 2005 - 2012**



**Table 4.4.2 CRUDE INCIDENCE RATE OF STROKE (PER 100,000 POPULATION), BY SUBTYPE, 2005 - 2012**

Subtype	2005	2006	2007	2008	2009	2010	2011	2012
Ischaemic	160.8 (156.1-165.5)	154.0 (149.4-158.6)	156.5 (151.9-161.0)	149.9 (145.5-154.3)	151.3 (146.9-155.6)	152.3 (147.9-156.6)	155.3 (150.9-159.6)	158.9 (154.6-163.3)
Haemorrhagic	34.4 (32.2-36.6)	35.0 (32.9-37.2)	34.7 (32.6-36.9)	36.9 (34.7-39.1)	35.6 (33.5-37.7)	36.1 (33.9-38.2)	38.4 (36.3-40.6)	37.0 (34.9-39.1)

**Figure 4.4.3 AGE-STANDARDISED INCIDENCE RATE OF STROKE (PER 100,000 POPULATION), BY SUBTYPE, 2005 - 2012**



**Table 4.4.3 AGE-STANDARDISED INCIDENCE RATE OF STROKE (PER 100,000 POPULATION), BY SUBTYPE, 2005 - 2012**

Subtype	2005	2006	2007	2008	2009	2010	2011	2012
Ischaemic	152.7 (148.2-157.3)	143.2 (138.8-147.5)	142.4 (138.1-146.6)	132.6 (128.7-136.6)	130.5 (126.7-134.3)	127.1 (123.4-130.8)	126.3 (122.7-129.9)	125.1 (121.6-128.6)
Haemorrhagic	32.2 (30.1-34.3)	32.2 (30.2-34.3)	31.4 (29.5-33.4)	32.5 (30.6-34.5)	31.0 (29.1-32.9)	30.4 (28.6-32.2)	32.0 (30.1-33.8)	29.6 (27.9-31.3)

**Table 4.4.4 CRUDE INCIDENCE OF STROKE, BY GENDER AND SUBTYPE, 2005 - 2012**

Gender	Subtype	2005	2006	2007	2008	2009	2010	2011	2012
Male	Ischaemic	2419	2442	2527	2451	2592	2671	2817	2904
	Haemorrhagic	506	535	535	609	613	621	677	649
	Unknown	24	18	11	13	12	3	11	11
Female	Ischaemic	2039	1931	2018	2004	2046	2076	2078	2169
	Haemorrhagic	448	460	474	488	478	503	534	533
	Unknown	23	15	13	18	17	13	19	14



**Table 4.4.5 CRUDE INCIDENCE RATE OF STROKE (PER 100,000 POPULATION), BY GENDER AND SUBTYPE, 2005 - 2012**

<b>Male</b>								
<b>Subtype</b>	<b>2005</b>	<b>2006</b>	<b>2007</b>	<b>2008</b>	<b>2009</b>	<b>2010</b>	<b>2011</b>	<b>2012</b>
Ischaemic	177.5 (170.4-184.5)	175.0 (168.1-182.0)	177.1 (170.2-184.0)	168.0 (161.4-174.7)	172.5 (165.8-179.1)	174.9 (168.3-181.6)	182.6 (175.9-189.4)	186.1 (179.3-192.9)
Haemorrhagic	37.1 (33.9-40.4)	38.3 (35.1-41.6)	37.5 (34.3-40.7)	41.8 (38.4-45.1)	40.8 (37.6-44.0)	40.7 (37.5-43.9)	43.9 (40.6-47.2)	41.6 (38.4-44.8)
Unknown	1.8 (1.1-2.5)	1.3 (0.7-1.9)	0.8 (0.3-1.2)	0.9 (0.4-1.4)	0.8 (0.3-1.3)	0.2 (-0.0-0.4)	0.7 (0.3-1.1)	0.7 (0.3-1.1)
<b>Female</b>								
<b>Subtype</b>	<b>2005</b>	<b>2006</b>	<b>2007</b>	<b>2008</b>	<b>2009</b>	<b>2010</b>	<b>2011</b>	<b>2012</b>
Ischaemic	144.7 (138.4-151.0)	133.7 (127.7-139.7)	136.5 (130.6-142.5)	132.5 (126.7-138.3)	130.9 (125.2-136.6)	130.5 (124.9-136.1)	129.1 (123.5-134.6)	133.0 (127.4-138.5)
Haemorrhagic	31.8 (28.8-34.7)	31.8 (28.9-34.8)	32.1 (29.2-35.0)	32.3 (29.4-35.1)	30.6 (27.8-33.3)	31.6 (28.9-34.4)	33.2 (30.4-36.0)	32.7 (29.9-35.4)
Unknown	1.6 (1.0-2.3)	1.0 (0.5-1.6)	0.9 (0.4-1.4)	1.2 (0.6-1.7)	1.1 (0.6-1.6)	0.8 (0.4-1.3)	1.2 (0.6-1.7)	0.9 (0.4-1.3)

For ischaemic strokes, the ASIR among males was higher than females, while the gender difference was small for haemorrhagic stroke. A downward trend was observed among both males and females for ischaemic stroke, but not for haemorrhagic stroke (Table 4.4.6).

**Table 4.4.6 AGE-STANDARDISED INCIDENCE RATE OF STROKE (PER 100,000 POPULATION), BY GENDER AND SUBTYPE, 2005 - 2012**

<b>Male</b>								
<b>Subtype</b>	<b>2005</b>	<b>2006</b>	<b>2007</b>	<b>2008</b>	<b>2009</b>	<b>2010</b>	<b>2011</b>	<b>2012</b>
Ischaemic	183.6 (176.1-191.0)	176.3 (169.2-183.5)	174.3 (167.3-181.2)	160.0 (153.6-166.5)	159.4 (153.1-165.6)	156.3 (150.3-162.3)	159.1 (153.1-165.1)	156.8 (151.0-162.5)
Haemorrhagic	36.9 (33.6-40.2)	37.7 (34.4-40.9)	35.7 (32.6-38.8)	39.1 (36.0-42.3)	36.9 (33.9-39.8)	36.1 (33.2-39.0)	38.0 (35.1-41.0)	34.6 (31.9-37.3)
Unknown	2.0 (1.2-2.7)	1.4 (0.7-2.0)	0.8 (0.3-1.3)	0.9 (0.4-1.4)	0.8 (0.3-1.2)	0.1 (0.0-0.3)	0.7 (0.3-1.1)	0.6 (0.3-1.0)
<b>Female</b>								
<b>Subtype</b>	<b>2005</b>	<b>2006</b>	<b>2007</b>	<b>2008</b>	<b>2009</b>	<b>2010</b>	<b>2011</b>	<b>2012</b>
Ischaemic	123.2 (117.7-128.8)	112.6 (107.4-117.9)	112.3 (107.3-117.4)	106.6 (101.8-111.4)	102.6 (98.0-107.2)	98.3 (93.9-102.7)	94.9 (90.6-99.1)	94.9 (90.7-99.0)
Haemorrhagic	27.7 (25.0-30.3)	27.5 (24.9-30.1)	27.3 (24.8-29.8)	26.4 (24.0-28.8)	25.3 (22.9-27.6)	25.0 (22.7-27.2)	26.3 (24.0-28.6)	24.8 (22.6-27.0)
Unknown	1.2 (0.7-1.7)	0.7 (0.3-1.1)	0.7 (0.3-1.1)	0.9 (0.5-1.4)	0.8 (0.4-1.1)	0.6 (0.3-0.9)	0.7 (0.4-1.1)	0.6 (0.3-0.9)

## 5. STROKE MORTALITY 2005 - 2012: ALL RESIDENTS

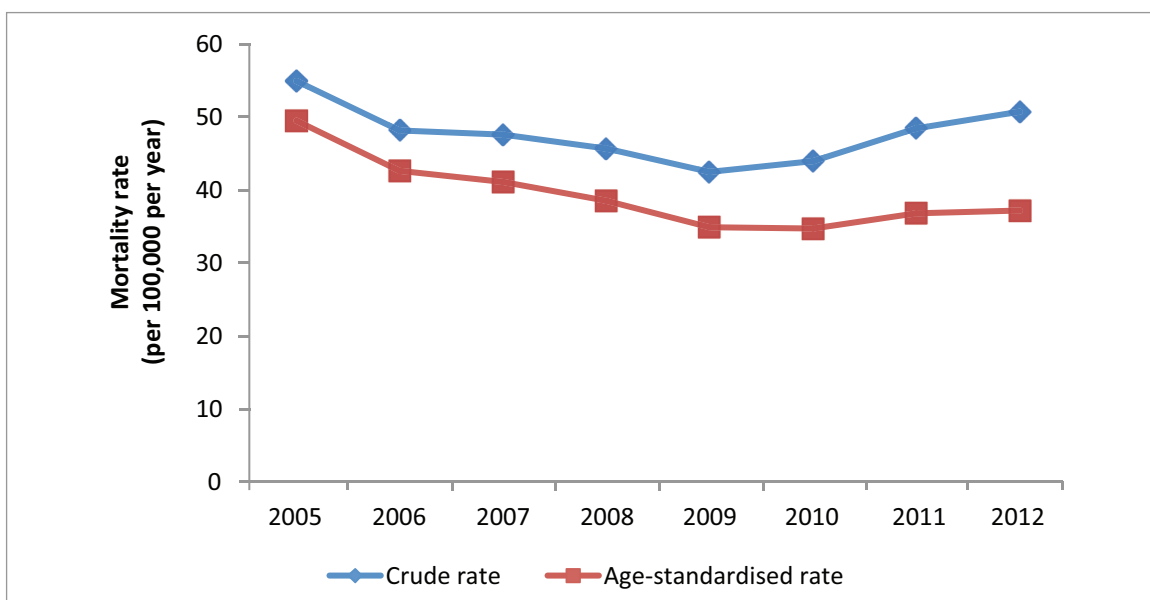
### 5.1 Stroke Mortality, Overall, 2005 - 2012

The age-standardised mortality rate (ASMR) of stroke has declined from 2005 to 2008 and followed by slight increase (Figure 5.1.1), with AAPC -3.92% (95% CI: -6.57 to -1.19) and P=0.013. The decrease could be due to the better treatment of the stroke and also partly due to the decreasing trend of the stroke incidence.

**Table 5.1.1 STROKE MORTALITY (PER 100,000 POPULATION), 2005 - 2012**

	2005	2006	2007	2008	2009	2010	2011	2012
<b>No. of deaths</b>	1525	1368	1384	1358	1304	1373	1529	1622
Crude rate	55.0 (52.2-57.8)	48.2 (45.6-50.7)	47.6 (45.1-50.2)	45.7 (43.3-48.1)	42.5 (40.2-44.8)	44.0 (41.7-46.4)	48.5 (46.1-50.9)	50.8 (48.3-53.3)
Age-standardised rate	49.6 (47.1-52.1)	42.6 (40.3-44.9)	41.1 (38.9-43.3)	38.5 (36.4-40.5)	34.9 (32.9-36.8)	34.7 (32.8-36.6)	36.8 (34.9-38.7)	37.2 (35.4-39.1)

**Figure 5.1.1 STROKE MORTALITY RATE (PER 100,000 POPULATION), 2005 - 2012**



**Table 5.1.2 STROKE MORTALITY BY AGE GROUP, 2005 - 2012**

Age Group	2005	2006	2007	2008	2009	2010	2011	2012
15 - 19	1	0	1	2	4	1	1	0
20 - 24	0	1	0	1	1	2	1	0
25 - 29	2	3	3	3	2	0	3	1
30 - 34	4	7	6	5	7	6	4	5
35 - 39	5	2	1	7	7	10	10	14
40 - 44	26	20	22	20	15	20	23	10
45 - 49	32	36	31	27	26	34	24	32
50 - 54	48	49	55	44	54	49	60	51
55 - 59	70	76	62	82	63	80	78	73
60 - 64	76	77	85	77	62	86	91	104
65 - 69	117	112	113	115	104	89	101	118
70 - 74	209	156	151	148	138	149	161	197
75 - 79	239	200	230	199	186	186	234	185
80 - 84	268	233	218	212	206	247	266	279
85+	428	396	406	416	429	414	472	553

There was a decline in age-specific mortality rates for those aged 60 years and above (Table 5.1.3).

**Table 5.1.3 AGE-SPECIFIC STROKE MORTALITY RATE (PER 100,000 POPULATION), 2005 - 2012**

Age Group	2005	2006	2007	2008	2009	2010	2011	2012
15 - 19	0.4 (0.0-1.3)	0.0 (0.0-0.0)	0.4 (0.0-1.2)	0.8 (0.0-1.8)	1.5 (0.0-3.0)	0.4 (0.0-1.1)	0.4 (0.0-1.1)	0.0 (0.0-0.0)
20 - 24	0.0 (0.0-0.0)	0.5 (0.0-1.3)	0.0 (0.0-0.0)	0.4 (0.0-1.3)	0.4 (0.0-1.2)	0.8 (0.0-1.9)	0.4 (0.0-1.2)	0.0 (0.0-0.0)
25 - 29	0.8 (0.0-1.9)	1.2 (0.0-2.5)	1.2 (0.0-2.5)	1.1 (0.0-2.4)	0.7 (0.0-1.7)	0.0 (0.0-0.0)	1.1 (0.0-2.4)	0.4 (0.0-1.2)
30 - 34	1.4 (0.0-2.7)	2.4 (0.6-4.2)	2.0 (0.4-3.7)	1.7 (0.2-3.2)	2.4 (0.6-4.1)	2.0 (0.4-3.6)	1.3 (0.0-2.7)	1.7 (0.2-3.2)
35 - 39	1.7 (0.2-3.1)	0.7 (0.0-1.6)	0.3 (0.0-1.0)	2.3 (0.6-4.0)	2.2 (0.6-3.8)	3.1 (1.2-5.1)	3.2 (1.2-5.1)	4.5 (2.1-6.8)
40 - 44	8.1 (5.0-11.2)	6.2 (3.5-8.9)	6.9 (4.0-9.7)	6.3 (3.5-9.1)	4.8 (2.4-7.2)	6.5 (3.6-9.3)	7.5 (4.4-10.6)	3.2 (1.2-5.2)
45 - 49	10.4 (6.8-14.0)	11.5 (7.7-15.3)	9.8 (6.4-13.3)	8.5 (5.3-11.7)	8.1 (5.0-11.2)	10.5 (7.0-14.0)	7.4 (4.4-10.4)	10.0 (6.5-13.4)
50 - 54	18.9 (13.5-24.2)	18.4 (13.2-23.5)	19.7 (14.5-24.9)	15.2 (10.7-19.7)	18.2 (13.3-23.0)	16.2 (11.6-20.7)	19.5 (14.5-24.4)	16.4 (11.9-20.9)
55 - 59	35.4 (27.1-43.7)	35.4 (27.5-43.4)	28.1 (21.1-35.1)	35.7 (28.0-43.5)	26.3 (19.8-32.7)	32.2 (25.1-39.2)	29.9 (23.3-36.6)	26.9 (20.7-33.0)
60 - 64	64.6 (50.1-79.2)	65.1 (50.6-79.6)	62.7 (49.4-76.1)	50.3 (39.0-61.5)	36.5 (27.4-45.6)	44.8 (35.3-54.3)	43.7 (34.7-52.7)	48.6 (39.3-57.9)
65 - 69	115.7 (94.8-136.7)	102.9 (83.9-122.0)	99.3 (81.0-117.6)	99.8 (81.6-118.1)	89.4 (72.2-106.6)	79.8 (63.2-96.4)	89.9 (72.3-107.4)	91.5 (75.0-108.1)
70 - 74	273.2 (236.2-310.2)	199.2 (168.0-230.5)	192.1 (161.5-222.8)	182.0 (152.7-211.4)	157.7 (131.4-184.0)	160.9 (135.0-186.7)	161.0 (136.1-185.9)	188.7 (162.3-215.0)
75 - 79	463.2 (404.5-521.9)	367.6 (316.7-418.6)	404.9 (352.6-457.3)	337.3 (290.4-384.2)	302.9 (259.4-346.5)	285.4 (244.4-326.4)	349.8 (305.0-394.6)	273.3 (233.9-312.6)
80 - 84	964.0 (848.6-1079.4)	792.5 (690.8-894.3)	692.1 (600.2-783.9)	625.4 (541.2-709.6)	555.3 (479.4-631.1)	620.0 (542.7-697.3)	630.3 (554.6-706.1)	632.7 (558.4-706.9)
85+	1902.2 (1722.0-2082.4)	1670.9 (1506.3-1835.5)	1624.0 (1466.0-1782.0)	1575.8 (1424.3-1727.2)	1543.2 (1397.1-1689.2)	1415.8 (1279.4-1552.2)	1517.7 (1380.8-1654.6)	1645.8 (1508.7-1783.0)

The median age of stroke mortality was 79 from 2008 to 2011 and 80 in year 2012 (Table 5.1.4).

**Table 5.1.4 MEDIAN AGE OF STROKE MORTALITY, 2005 - 2012**

	2005	2006	2007	2008	2009	2010	2011	2012
Median Age	78	78	78	79	79	79	79	80

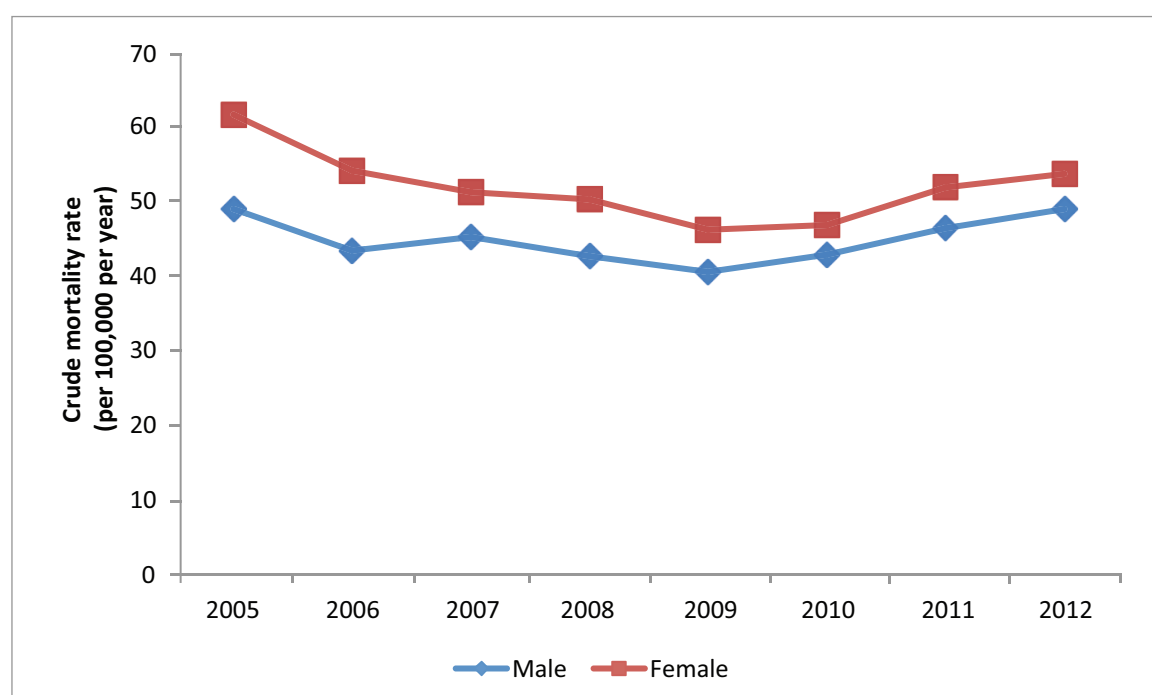
## 5.2 Stroke Mortality, By Gender, 2005 - 2012

**Table 5.2.1 STROKE MORTALITY, BY GENDER, 2005 - 2012**

Gender	2005	2006	2007	2008	2009	2010	2011	2012
Male	659	593	634	608	594	640	704	754
Female	866	775	750	750	710	733	825	868

The CMR for females was higher than that for males and has remained more or less stable over the years (Figure 5.2.2).

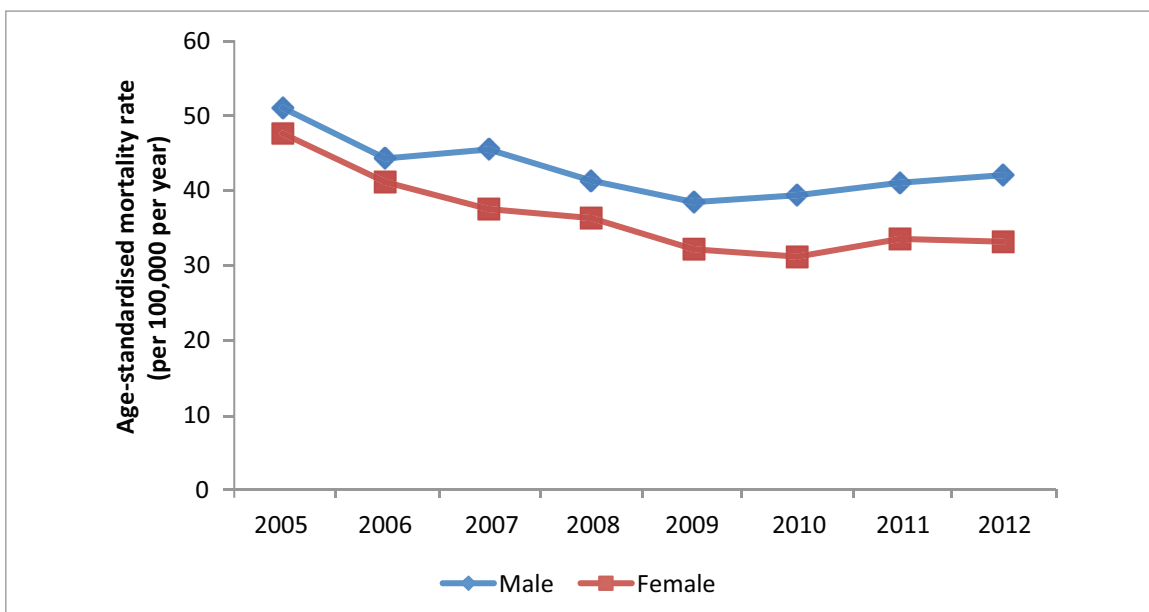
**Figure 5.2.2 CRUDE MORTALITY RATE OF STROKE (PER 100,000 POPULATION), BY GENDER, 2005 - 2012**



**Table 5.2.2 CRUDE MORTALITY RATE OF STROKE (PER 100,000 POPULATION), BY GENDER, 2005 - 2012**

Gender	2005	2006	2007	2008	2009	2010	2011	2012
Male	48.3 (44.7-52.0)	42.5 (39.1-45.9)	44.4 (41.0-47.9)	41.7 (38.4-45.0)	39.5 (36.3-42.7)	41.9 (38.7-45.2)	45.6 (42.3-49.0)	48.3 (44.9-51.8)
Female	61.5 (57.4-65.5)	53.7 (49.9-57.4)	50.7 (47.1-54.4)	49.6 (46.0-53.1)	45.4 (42.1-48.8)	46.1 (42.7-49.4)	51.3 (47.8-54.7)	53.2 (49.7-56.7)

The ASMR was higher among males than females and had declined significantly from 2005 to 2012 in both genders (Figure 5.2.3). Higher proportion of haemorrhagic stroke and more incidences among males lead to higher ASMR, compared to females. AAPC for males was -2.76%, with 95% CI (-5.35 to -0.10) and P=0.045. AAPC for females was -5.16%, with 95% CI (-7.96 to -2.18) and P=0.006.

**Figure 5.2.3 AGE-STANDARDISED MORTALITY RATE OF STROKE (PER 100,000 POPULATION), BY GENDER, 2005 - 2012**

**Table 5.2.3 AGE-STANDARDISED MORTALITY RATE OF STROKE  
(PER 100,000 POPULATION), BY GENDER, 2005 - 2012**

Gender	2005	2006	2007	2008	2009	2010	2011	2012
Male	51.1 (47.2-55.1)	44.1 (40.5-47.7)	45.3 (41.7-48.9)	41.0 (37.7-44.3)	38.0 (34.9-41.1)	39.0 (36.0-42.1)	40.7 (37.6-43.7)	41.8 (38.8-44.9)
Female	47.5 (44.2-50.8)	40.8 (37.8-43.7)	37.1 (34.4-39.8)	35.8 (33.1-38.4)	31.5 (29.1-33.9)	30.5 (28.2-32.8)	33.0 (30.6-35.3)	32.6 (30.4-34.9)

**Table 5.2.4A AGE-SPECIFIC MORTALITY RATE OF STROKE  
(PER 100,000 POPULATION), MALE, 2005 - 2012**

Age Group	2005	2006	2007	2008	2009	2010	2011	2012
15 - 19	0.8 (0.0-2.4)	0.0 (0.0-0.0)	0.0 (0.0-0.0)	0.7 (0.0-2.2)	2.2 (0.0-4.8)	0.7 (0.0-2.2)	0.0 (0.0-0.0)	0.0 (0.0-0.0)
20 - 24	0.0 (0.0-0.0)	0.0 (0.0-0.0)	0.0 (0.0-0.0)	0.0 (0.0-0.0)	0.0 (0.0-0.0)	1.6 (0.0-3.9)	0.8 (0.0-2.3)	0.0 (0.0-0.0)
25 - 29	1.7 (0.0-4.0)	2.5 (0.0-5.3)	1.6 (0.0-3.9)	1.6 (0.0-3.8)	1.5 (0.0-3.6)	0.0 (0.0-0.0)	0.8 (0.0-2.3)	0.8 (0.0-2.4)
30 - 34	2.1 (0.0-4.5)	2.8 (0.1-5.6)	1.4 (0.0-3.4)	2.2 (0.0-4.6)	2.8 (0.1-5.6)	2.1 (0.0-4.5)	2.1 (0.0-4.5)	1.4 (0.0-3.4)
35 - 39	2.7 (0.1-5.4)	0.7 (0.0-2.0)	0.0 (0.0-0.0)	4.0 (0.8-7.2)	2.6 (0.1-5.1)	4.5 (1.2-7.8)	5.2 (1.6-8.8)	4.6 (1.2-8.0)
40 - 44	8.0 (3.7-12.4)	7.4 (3.2-11.6)	9.3 (4.6-14.0)	8.2 (3.7-12.6)	6.4 (2.4-10.4)	8.5 (3.9-13.1)	6.6 (2.5-10.7)	4.6 (1.2-8.1)
45 - 49	12.2 (6.7-17.7)	12.6 (7.1-18.2)	10.7 (5.6-15.7)	11.8 (6.5-17.1)	9.2 (4.5-13.9)	14.1 (8.3-19.8)	6.7 (2.8-10.7)	11.2 (6.0-16.3)
50 - 54	26.5 (17.6-35.4)	20.8 (13.1-28.5)	23.4 (15.4-31.4)	17.2 (10.4-23.9)	24.7 (16.8-32.7)	21.0 (13.7-28.2)	25.7 (17.8-33.7)	21.7 (14.4-29.0)
55 - 59	40.6 (28.0-53.1)	45.8 (33.0-58.6)	35.4 (24.3-46.5)	49.6 (36.7-62.5)	41.5 (30.0-53.0)	42.5 (31.0-53.9)	44.4 (33.0-55.8)	38.1 (27.8-48.5)
60 - 64	71.6 (49.7-93.5)	77.6 (54.9-100.3)	81.0 (59.4-102.6)	61.1 (43.4-78.7)	52.6 (37.0-68.1)	59.1 (43.6-74.5)	53.5 (39.4-67.6)	68.1 (52.3-83.8)
65 - 69	132.5 (100.0-165.0)	119.9 (90.1-149.8)	133.8 (102.9-164.7)	104.4 (77.3-131.5)	95.7 (69.9-121.4)	110.7 (82.4-138.9)	110.9 (82.8-139.0)	112.2 (85.9-138.5)
70 - 74	277.9 (222.6-333.2)	183.8 (139.5-228.2)	209.9 (162.7-257.1)	202.7 (157.1-248.2)	188.1 (145.8-230.4)	177.2 (137.4-217.1)	193.1 (152.9-233.2)	242.2 (198.1-286.2)
75 - 79	486.2 (393.7-578.8)	370.7 (292.3-449.0)	442.6 (359.1-526.1)	324.2 (254.5-394.0)	303.4 (237.3-369.4)	308.4 (243.6-373.2)	398.6 (326.1-471.2)	306.4 (243.4-369.4)
80 - 84	1036.4 (846.1-1226.6)	793.1 (631.0-955.2)	674.8 (529.6-820.0)	712.1 (568.2-856.1)	600.0 (473.9-726.1)	624.5 (500.2-748.8)	650.6 (527.9-773.3)	662.9 (542.2-783.5)
85+	1635.1 (1343.8-1926.5)	1582.3 (1304.9-1859.7)	1602.4 (1330.1-1874.7)	1448.3 (1195.4-1701.2)	1391.3 (1150.3-1632.3)	1361.5 (1128.3-1594.6)	1411.8 (1181.2-1642.4)	1513.5 (1284.6-1742.4)

**Table 5.2.4B AGE-SPECIFIC MORTALITY RATE OF STROKE,  
(PER 100,000 POPULATION), FEMALE, 2005 - 2012**

Age Group	2005	2006	2007	2008	2009	2010	2011	2012
15 - 19	0.0 (0.0-0.0)	0.0 (0.0-0.0)	0.8 (0.0-2.4)	0.8 (0.0-2.3)	0.8 (0.0-2.3)	0.0 (0.0-0.0)	0.8 (0.0-2.3)	0.0 (0.0-0.0)
20 - 24	0.0 (0.0-0.0)	0.9 (0.0-2.7)	0.0 (0.0-0.0)	0.9 (0.0-2.6)	0.8 (0.0-2.5)	0.0 (0.0-0.0)	0.0 (0.0-0.0)	0.0 (0.0-0.0)
25 - 29	0.0 (0.0-0.0)	0.0 (0.0-0.0)	0.8 (0.0-2.2)	0.7 (0.0-2.2)	0.0 (0.0-0.0)	0.0 (0.0-0.0)	1.5 (0.0-3.5)	0.0 (0.0-0.0)
30 - 34	0.7 (0.0-1.9)	2.0 (0.0-4.2)	2.6 (0.1-5.2)	1.3 (0.0-3.2)	1.9 (0.0-4.1)	1.9 (0.0-4.1)	0.6 (0.0-1.9)	1.9 (0.0-4.1)
35 - 39	0.7 (0.0-1.9)	0.7 (0.0-1.9)	0.6 (0.0-1.9)	0.6 (0.0-1.9)	1.8 (0.0-3.9)	1.8 (0.0-3.9)	1.2 (0.0-2.9)	4.3 (1.1-7.5)
40 - 44	8.2 (3.7-12.6)	5.0 (1.5-8.4)	4.4 (1.1-7.6)	4.4 (1.1-7.7)	3.2 (0.4-6.0)	4.5 (1.2-7.8)	8.3 (3.8-12.9)	1.9 (0.0-4.1)
45 - 49	8.5 (3.9-13.2)	10.3 (5.3-15.4)	9.0 (4.3-13.7)	5.1 (1.6-8.6)	6.9 (2.8-11.0)	6.9 (2.8-10.9)	8.1 (3.7-12.5)	8.8 (4.2-13.4)
50 - 54	11.1 (5.3-16.9)	15.8 (9.1-22.6)	15.9 (9.3-22.5)	13.2 (7.3-19.2)	11.5 (6.0-17.0)	11.3 (5.9-16.7)	13.1 (7.4-18.8)	11.1 (5.8-16.3)
55 - 59	30.2 (19.4-41.1)	25.1 (15.6-34.6)	20.8 (12.3-29.3)	21.8 (13.3-30.4)	10.9 (5.0-16.8)	21.8 (13.6-30.0)	15.4 (8.6-22.1)	15.5 (8.9-22.1)
60 - 64	58.0 (38.8-77.3)	53.1 (34.7-71.5)	45.1 (29.2-60.9)	39.8 (25.8-53.8)	20.9 (11.3-30.6)	30.9 (19.8-41.9)	34.2 (23.0-45.3)	29.6 (19.3-39.8)
65 - 69	100.4 (73.4-127.4)	87.6 (63.3-111.8)	68.3 (47.4-89.3)	95.7 (71.1-120.3)	83.7 (60.8-106.7)	51.6 (33.1-70.0)	70.3 (48.8-91.9)	72.2 (51.8-92.6)
70 - 74	269.2 (219.4-319.1)	212.3 (168.4-256.1)	176.9 (136.9-216.9)	164.4 (126.4-202.4)	131.6 (98.9-164.4)	146.8 (113.1-180.5)	133.6 (102.7-164.4)	143.4 (112.1-174.6)
75 - 79	446.3 (370.5-522.2)	365.4 (298.3-432.5)	376.5 (309.7-443.4)	347.3 (284.1-410.5)	302.6 (244.7-360.5)	267.8 (215.1-320.6)	312.2 (255.8-368.5)	247.4 (197.4-297.4)
80 - 84	916.7 (771.9-1061.4)	792.1 (661.4-922.9)	703.1 (584.5-821.7)	570.0 (467.2-672.9)	526.5 (431.9-621.2)	617.1 (518.3-715.9)	617.2 (520.9-713.4)	612.8 (518.7-706.9)
85+	2033.1 (1805.7-2260.5)	1715.2 (1511.0-1919.4)	1634.7 (1440.8-1828.6)	1638.4 (1449.8-1827.0)	1618.3 (1435.5-1801.1)	1442.5 (1274.4-1610.5)	1569.4 (1399.5-1739.2)	1711.1 (1540.2-1882.0)



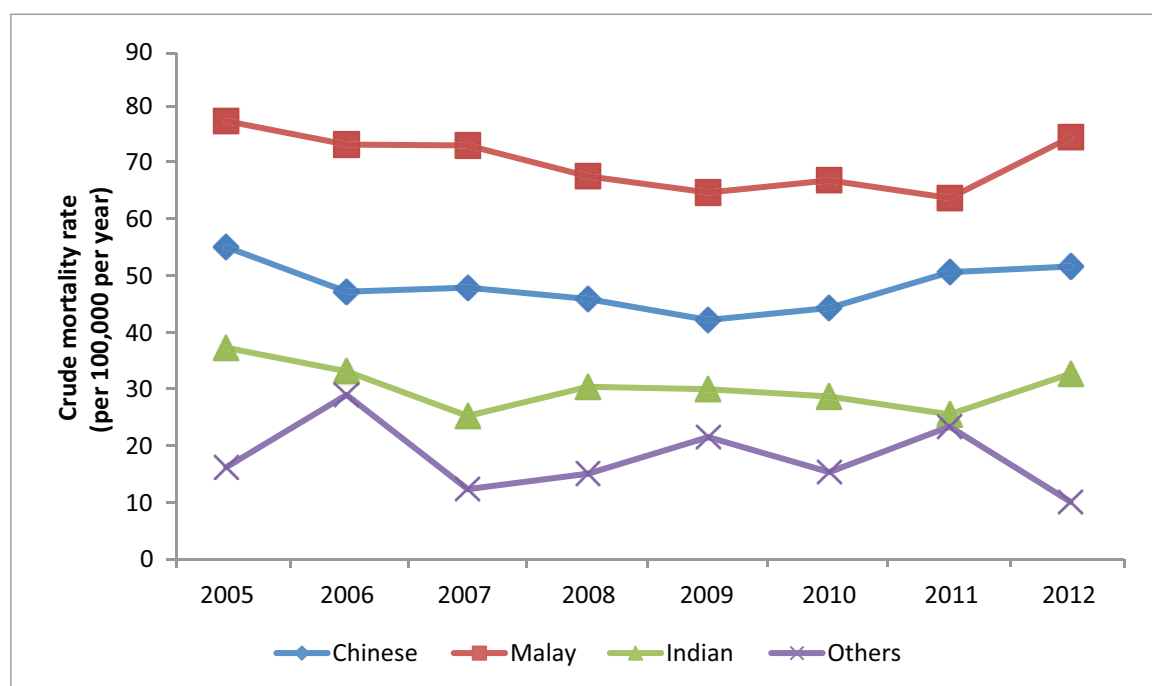
### 5.3 Stroke Mortality, by Ethnicity, 2005 - 2012

**Table 5.3.1 STROKE MORTALITY, BY ETHNICITY, 2005 - 2012**

Ethnicity	2005	2006	2007	2008	2009	2010	2011	2012
Chinese	1166	1015	1051	1022	961	1024	1189	1227
Malay	270	261	266	251	246	259	250	297
Indian	81	75	59	74	78	76	68	89
Others	8	17	8	11	19	14	22	9

The CMRs among the various ethnicities have remained stable (Figure 5.3.1) while there was a decrease in ASMR among the Malays but an upturn in 2012 (Figure 5.3.2). Similarly, the higher proportion of medical histories (risk factors of death) and more incidences among Malays lead to higher ASMR, compared to the other two major ethnic groups. There were slight decreases in ASMR among Chinese (Figure 5.3.2). AAPC for Malays was -3.82%, with 95% CI (-6.20 to -1.39) and P=0.009. AAPC for Chinese was -3.82%, with 95% CI (-6.85 to -0.70) and P=0.024.

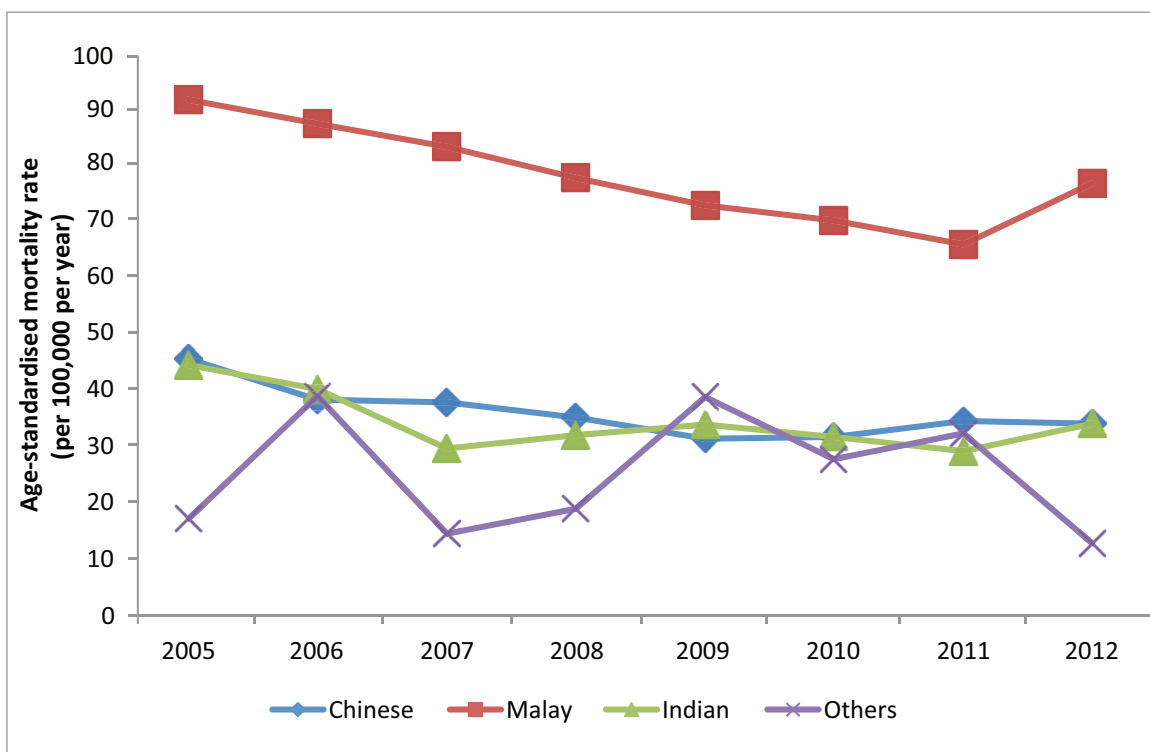
**Figure 5.3.1 CRUDE MORTALITY RATE OF STROKE (PER 100,000 POPULATION), BY ETHNICITY, 2005 - 2012**



**Table 5.3.2 CRUDE MORTALITY RATE OF STROKE (PER 100,000 POPULATION), BY ETHNICITY, 2005 - 2012**

Ethnicity	2005	2006	2007	2008	2009	2010	2011	2012
Chinese	54.3 (51.2-57.4)	46.4 (43.6-49.3)	47.2 (44.4-50.1)	45.1 (42.3-47.9)	41.4 (38.8-44.0)	43.5 (40.8-46.1)	49.9 (47.1-52.8)	50.9 (48.0-53.7)
Malay	76.7 (67.6-85.9)	72.5 (63.7-81.3)	72.3 (63.6-81.0)	66.8 (58.5-75.0)	64.0 (56.0-72.0)	66.2 (58.1-74.3)	63.0 (55.2-70.8)	73.7 (65.3-82.1)
Indian	36.5 (28.6-44.5)	32.3 (25.0-39.6)	24.4 (18.2-30.7)	29.5 (22.8-36.2)	29.1 (22.6-35.6)	27.8 (21.6-34.1)	24.7 (18.8-30.5)	31.9 (25.3-38.5)
Others	15.3 (4.7-25.9)	28.1 (14.7-41.5)	11.5 (3.5-19.4)	14.1 (5.8-22.4)	20.6 (11.3-29.8)	14.4 (6.9-22.0)	22.5 (13.1-31.9)	9.2 (3.2-15.1)

**Figure 5.3.2 AGE-STANDARDISED MORTALITY RATE OF STROKE (PER 100,000 POPULATION), BY ETHNICITY, 2005 - 2012**



**Table 5.3.3 AGE-STANDARDISED MORTALITY RATE OF STROKE  
(PER 100,000 POPULATION), BY ETHNICITY, 2005 - 2012**

Ethnicity	2005	2006	2007	2008	2009	2010	2011	2012
Chinese	45.3 (42.7-47.9)	38.0 (35.6-40.4)	37.5 (35.2-39.8)	34.8 (32.6-37.0)	30.9 (28.9-32.9)	31.2 (29.3-33.2)	34.1 (32.1-36.1)	33.6 (31.7-35.5)
Malay	92.0 (80.6-103.4)	87.7 (76.6-98.9)	83.6 (73.2-94.0)	78.0 (68.1-87.9)	73.0 (63.6-82.4)	70.3 (61.5-79.2)	65.9 (57.4-74.4)	77.0 (68.0-86.0)
Indian	44.2 (34.2-54.1)	39.9 (30.5-49.3)	29.1 (21.4-36.7)	31.5 (24.1-38.9)	33.5 (25.8-41.2)	31.3 (24.0-38.5)	28.7 (21.6-35.9)	33.6 (26.4-40.7)
Others	16.5 (4.9-28.1)	38.6 (19.5-57.7)	13.9 (4.0-23.9)	18.3 (6.9-29.7)	38.4 (20.4-56.4)	27.3 (12.5-42.1)	31.9 (17.4-46.4)	12.1 (3.8-20.4)

**Table 5.3.4 STROKE MORTALITY, BY GENDER AND ETHNICITY, 2005 - 2012**

Gender	Ethnicity	2005	2006	2007	2008	2009	2010	2011	2012
Male	Chinese	482	436	472	448	427	481	538	560
	Malay	117	103	123	106	112	109	118	145
	Indian	55	44	34	50	48	45	36	44
	Others	5	10	5	4	7	5	12	5
Female	Chinese	684	579	579	574	534	543	651	667
	Malay	153	158	143	145	134	150	132	152
	Indian	26	31	25	24	30	31	32	45
	Others	3	7	3	7	12	9	10	4

**Table 5.3.5 CRUDE MORTALITY RATE OF STROKE (PER 100,000 POPULATION), BY GENDER AND ETHNICITY, 2005 - 2012**

Gender	Ethnicity	2005	2006	2007	2008	2009	2010	2011	2012
Male	Chinese	45.9 (41.8-50.0)	40.8 (37.0-44.6)	43.4 (39.5-47.4)	40.5 (36.8-44.3)	37.8 (34.2-41.4)	42.0 (38.3-45.8)	46.5 (42.6-50.5)	47.9 (43.9-51.8)
	Malay	67.3 (55.1-79.5)	57.9 (46.7-69.1)	67.7 (55.8-79.7)	57.1 (46.3-68.0)	59.2 (48.2-70.2)	56.5 (45.9-67.1)	60.3 (49.4-71.2)	73.0 (61.1-84.9)
	Indian	48.1 (35.4-60.8)	36.7 (25.9-47.6)	27.1 (18.0-36.3)	38.3 (27.7-48.9)	34.3 (24.6-44.0)	31.5 (22.3-40.7)	25.0 (16.8-33.2)	30.3 (21.4-39.3)
	Others	20.2 (2.5-38.0)	34.6 (13.2-56.0)	15.0 (1.8-28.1)	10.8 (0.2-21.3)	16.0 (4.1-27.8)	10.9 (1.3-20.4)	25.8 (11.2-40.4)	10.7 (1.3-20.0)
Female	Chinese	62.4 (57.7-67.1)	51.8 (47.6-56.0)	50.9 (46.7-55.0)	49.4 (45.4-53.5)	44.8 (41.0-48.6)	44.8 (41.1-48.6)	53.1 (49.1-57.2)	53.7 (49.6-57.8)
	Malay	85.9 (72.3-99.5)	86.6 (73.1-100.1)	76.7 (64.1-89.3)	76.1 (63.7-88.5)	68.8 (57.1-80.4)	75.6 (63.5-87.7)	65.5 (54.4-76.7)	74.4 (62.6-86.2)
	Indian	24.2 (14.9-33.5)	27.6 (17.9-37.3)	21.5 (13.1-29.9)	19.9 (12.0-27.9)	23.4 (15.1-31.8)	23.8 (15.4-32.2)	24.3 (15.9-32.7)	33.6 (23.8-43.5)
	Others	10.9 (0.0-23.3)	22.2 (5.7-38.6)	8.2 (0.0-17.6)	17.2 (4.4-29.9)	24.7 (10.7-38.7)	17.6 (6.1-29.1)	19.5 (7.4-31.6)	7.8 (0.2-15.4)

**Table 5.3.6 AGE-STANDARDISED MORTALITY RATE OF STROKE (PER 100,000 POPULATION), BY GENDER AND ETHNICITY, 2005 - 2012**

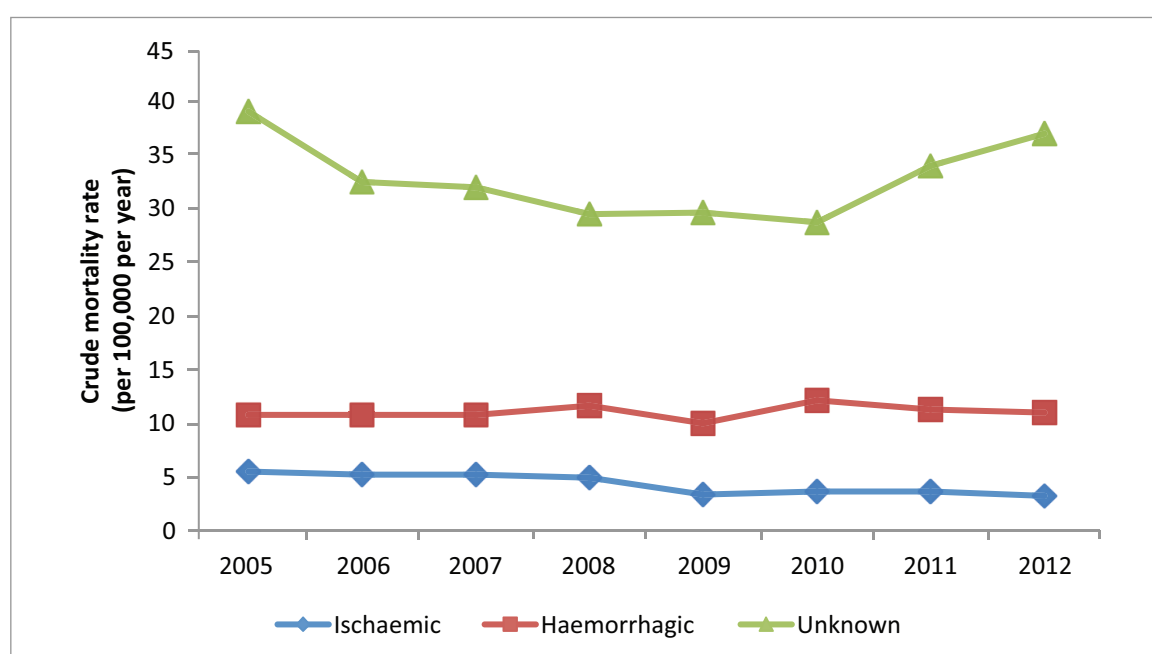
Gender	Ethnicity	2005	2006	2007	2008	2009	2010	2011	2012
Male	Chinese	47.6 (43.3-51.9)	41.1 (37.2-45.0)	42.8 (38.9-46.7)	38.2 (34.7-41.8)	34.2 (30.9-37.5)	36.8 (33.4-40.1)	38.7 (35.4-42.0)	38.8 (35.5-42.0)
	Malay	82.2 (66.7-97.7)	72.1 (57.5-86.7)	82.2 (67.2-97.2)	69.8 (56.1-83.4)	72.9 (59.1-86.8)	65.8 (53.0-78.6)	66.2 (53.8-78.7)	82.0 (68.3-95.7)
	Indian	50.6 (36.6-64.5)	40.1 (27.5-52.7)	31.3 (20.3-42.3)	38.3 (27.2-49.5)	38.9 (27.2-50.6)	35.9 (24.8-47.0)	30.0 (19.6-40.5)	33.3 (23.0-43.6)
	Others	23.6 (2.1-45.2)	48.3 (16.9-79.6)	14.5 (1.5-27.6)	10.5 (0.0-22.0)	34.0 (7.0-61.0)	18.8 (1.5-36.0)	38.4 (15.4-61.5)	13.5 (1.2-25.8)
Female	Chinese	42.6 (39.3-45.9)	35.1 (32.1-38.1)	33.0 (30.2-35.8)	31.5 (28.8-34.2)	27.2 (24.8-29.6)	26.2 (23.9-28.5)	29.7 (27.3-32.1)	28.6 (26.3-30.9)
	Malay	100.9 (84.2-117.5)	102.8 (86.1-119.6)	85.2 (70.7-99.7)	85.1 (71.0-99.2)	72.9 (60.2-85.7)	74.4 (62.1-86.7)	65.3 (53.7-76.9)	72.6 (60.7-84.5)
	Indian	38.8 (23.0-54.5)	41.1 (26.2-56.1)	30.7 (18.1-43.3)	24.7 (14.5-35.0)	30.3 (19.0-41.5)	26.8 (17.1-36.6)	29.5 (18.9-40.1)	35.8 (25.1-46.6)
	Others	13.0 (0.0-28.2)	28.4 (7.0-49.7)	12.1 (0.0-25.9)	20.9 (3.9-38.0)	39.1 (14.0-64.3)	35.1 (10.5-59.7)	21.6 (7.5-35.8)	11.5 (0.0-23.6)

## 5.4 Stroke Mortality, by Subtype, 2005 - 2012

**Table 5.4.1 STROKE MORTALITY, BY SUBTYPE, 2005 - 2012**

Subtype	2005	2006	2007	2008	2009	2010	2011	2012
Ischaemic	146	143	146	139	95	106	107	96
Haemorrhagic	295	301	308	341	300	373	350	346
Unknown	1084	924	930	878	909	894	1072	1180

**Figure 5.4.1 CRUDE MORTALITY RATE OF STROKE (PER 100,000 POPULATION), BY SUBTYPE, 2005 - 2012**

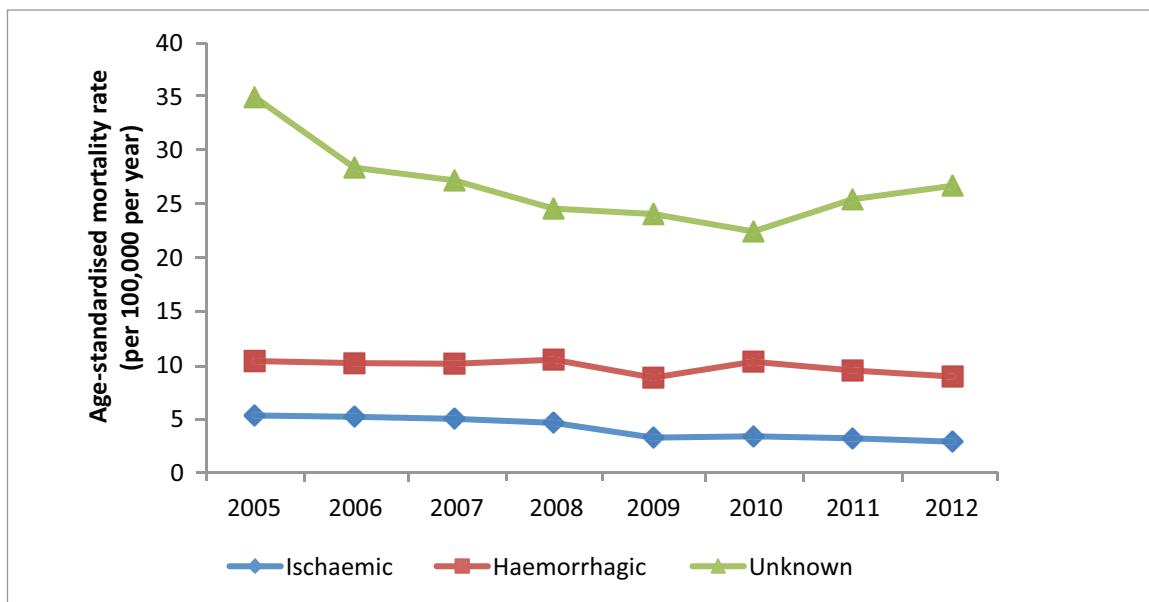


**Table 5.4.2 CRUDE MORTALITY RATE OF STROKE (PER 100,000 POPULATION), BY SUBTYPE, 2005 - 2012**

Subtype	2005	2006	2007	2008	2009	2010	2011	2012
Ischaemic	5.3 (4.4-6.1)	5.0 (4.2-5.9)	5.0 (4.2-5.8)	4.7 (3.9-5.5)	3.1 (2.5-3.7)	3.4 (147.9-156.6)	3.4 (2.8-4.0)	3.0 (2.4-3.6)
Haemorrhagic	10.6 (9.4-11.9)	10.6 (9.4-11.8)	10.6 (9.4-11.8)	11.5 (10.3-12.7)	9.8 (8.7-10.9)	12.0 (10.8-13.2)	11.1 (9.9-12.3)	10.8 (9.7-12.0)
Unknown	39.1 (36.8-41.4)	32.5 (30.4-34.6)	32.0 (30.0-34.1)	29.5 (27.6-31.5)	29.6 (27.7-31.6)	28.7 (26.8-30.6)	34.0 (32.0-36.0)	37.0 (34.9-39.1)

The age-standardised mortality rate for Ischaemic Stroke has been declining significantly during the period, with AAPC -11.48% (95% CI: -14.95 to -7.87) and P<0.0001.

**Figure 5.4.2 AGE-STANDARDISED MORTALITY RATE OF STROKE (PER 100,000 POPULATION), BY SUBTYPE, 2005 - 2012**



**Table 5.4.3 AGE-STANDARDISED MORTALITY RATE OF STROKE (PER 100,000 POPULATION), BY SUBTYPE, 2005 - 2012**

Subtype	2005	2006	2007	2008	2009	2010	2011	2012
Ischaemic	4.7 (3.9-5.5)	4.6 (3.8-5.3)	4.4 (3.7-5.1)	4.0 (3.3-4.7)	2.6 (2.1-3.2)	2.7 (2.2-3.3)	2.5 (2.1-3.0)	2.2 (1.8-2.6)
Haemorrhagic	9.9 (8.7-11.0)	9.7 (8.6-10.8)	9.6 (8.5-10.7)	10.0 (9.0-11.1)	8.3 (7.4-9.3)	9.8 (8.8-10.8)	9.0 (8.0-9.9)	8.4 (7.5-9.3)
Unknown	35.0 (32.9-37.2)	28.3 (26.5-30.2)	27.1 (25.3-28.8)	24.4 (22.7-26.0)	23.9 (22.3-25.5)	22.2 (20.7-23.6)	25.3 (23.7-26.8)	26.6 (25.1-28.1)

**Table 5.4.4 STROKE MORTALITY, BY GENDER AND SUBTYPE, 2005 - 2012**

Gender	Subtype	2005	2006	2007	2008	2009	2010	2011	2012
Male	Ischaemic	63	58	55	65	45	40	54	43
	Haemorrhagic	137	158	167	180	165	215	183	193
	Unknown	459	377	412	363	384	385	467	518
Female	Ischaemic	83	85	91	74	50	66	53	53
	Haemorrhagic	158	143	141	161	135	158	167	153
	Unknown	158	143	141	161	135	158	167	153

**Table 5.4.5 CRUDE MORTALITY RATE OF STROKE (PER 100,000 POPULATION), BY GENDER AND SUBTYPE, 2005 - 2012**

Gender	Subtype	2005	2006	2007	2008	2009	2010	2011	2012
Male	Ischaemic	4.6 (3.5-5.8)	4.2 (3.1-5.2)	3.9 (2.8-4.9)	4.5 (3.4-5.5)	3.0 (2.1-3.9)	2.6 (1.8-3.4)	3.5 (2.6-4.4)	2.8 (1.9-3.6)
	Haemorrhagic	10.1 (8.4-11.7)	11.3 (9.6-13.1)	11.7 (9.9-13.5)	12.3 (10.5-14.1)	11.0 (9.3-12.7)	14.1 (12.2-16.0)	11.9 (10.1-13.6)	12.4 (10.6-14.1)
	Unknown	33.7 (30.6-36.8)	27.0 (24.3-29.7)	28.9 (26.1-31.7)	24.9 (22.3-27.4)	25.6 (23.0-28.1)	25.2 (22.7-27.7)	30.3 (27.5-33.0)	33.2 (30.3-36.1)
Female	Ischaemic	5.9 (4.6-7.2)	5.9 (4.6-7.1)	6.2 (4.9-7.4)	4.9 (3.8-6.0)	3.2 (2.3-4.1)	4.1 (3.1-5.2)	3.3 (2.4-4.2)	3.2 (2.4-4.1)
	Haemorrhagic	11.2 (9.5-13.0)	9.9 (8.3-11.5)	9.5 (8.0-11.1)	10.6 (9.0-12.3)	8.6 (7.2-10.1)	9.9 (8.4-11.5)	10.4 (8.8-11.9)	9.4 (7.9-10.9)
	Unknown	44.4 (40.9-47.8)	37.9 (34.7-41.0)	35.0 (32.0-38.1)	34.0 (31.1-37.0)	33.6 (30.7-36.5)	32.0 (29.2-34.8)	37.6 (34.6-40.6)	40.6 (37.5-43.7)

**Table 5.4.6 AGE-STANDARDISED MORTALITY RATE OF STROKE (PER 100,000 POPULATION), BY GENDER AND SUBTYPE, 2005 - 2012**

Gender	Subtype	2005	2006	2007	2008	2009	2010	2011	2012
Male	Ischaemic	4.7 (3.5-5.9)	4.0 (3.0-5.1)	3.9 (2.9-5.0)	4.3 (3.3-5.4)	2.9 (2.0-3.8)	2.4 (1.7-3.2)	3.0 (2.2-3.9)	2.3 (1.6-3.0)
	Haemorrhagic	10.1 (8.3-11.8)	11.3 (9.5-13.1)	11.3 (9.6-13.1)	11.5 (9.8-13.2)	10.1 (8.5-11.7)	12.7 (10.9-14.4)	10.5 (8.9-12.0)	10.5 (9.0-12.1)
	Unknown	36.4 (33.0-39.8)	28.8 (25.8-31.8)	30.0 (27.1-33.0)	25.1 (22.5-27.8)	25.0 (22.5-27.5)	24.0 (21.5-26.4)	27.2 (24.7-29.7)	29.0 (26.4-31.5)
Female	Ischaemic	4.6 (3.6-5.6)	4.7 (3.7-5.7)	4.7 (3.7-5.7)	3.5 (2.7-4.4)	2.2 (1.6-2.8)	2.9 (2.2-3.6)	2.1 (1.5-2.7)	2.1 (1.5-2.6)
	Haemorrhagic	9.5 (8.0-11.0)	8.3 (6.9-9.7)	8.1 (6.7-9.4)	8.7 (7.3-10.1)	6.7 (5.5-7.8)	7.3 (6.1-8.5)	7.6 (6.4-8.8)	6.6 (5.5-7.7)
	Unknown	33.4 (30.7-36.1)	27.7 (25.3-30.1)	24.3 (22.2-26.5)	23.5 (21.4-25.6)	22.6 (20.6-24.6)	20.3 (18.5-22.1)	23.3 (21.4-25.3)	23.9 (22.0-25.8)

The mortality rate of haemorrhagic stroke was 3 – 5 times that of ischaemic stroke. However, it is important to note the high percentage of stroke deaths with unknown etiology at 65 - 70% as we did not have information on subtype from the source (MHA). (Table 5.4.1, 5.4.4).

## 6. STROKE 30-DAY CASE - FATALITY 2005 - 2012

### 6.1 Stroke 30-Day Case - Fatality, Overall, 2005 - 2012

The 30-day case fatality refers to the percentage of stroke patients who died of stroke within 30 days of stroke onset, regardless if the death occurred within or outside the hospital. This can be affected by several factors such as case severity, timing of presentation and treatment administered.

The number of stroke patients who died of stroke within 30 days had increased from 513 in 2005 to 571 in 2012. (Table 6.1.1) The crude case-fatality rates (CFR) have remained stable, ranging from 8.4% to 10.5% in 2005 - 2012. The age-standardised rates have also remained stable, ranging from 8.3% to 10.5% in 2005 - 2012.

**Table 6.1.1 STROKE 30-DAY CASE - FATALITY, OVERALL, 2005 - 2012**

	2005	2006	2007	2008	2009	2010	2011	2012
No. of cases	513	528	553	576	483	571	643	571
Crude rate	9.4 (8.6-10.2)	9.8 (8.9-10.6)	9.9 (9.1-10.7)	10.3 (9.5-11.2)	8.4 (7.6-9.1)	9.7 (8.9-10.5)	10.5 (9.7-11.3)	9.1 (8.3-9.8)
Age-standardised rate	9.3 (8.5-10.1)	9.8 (9.0-10.6)	9.9 (9.1-10.7)	10.2 (9.4-11.0)	8.3 (7.6-9.0)	9.6 (8.9-10.4)	10.5 (9.7-11.2)	9.0 (8.3-9.7)

### 6.2 Stroke 30-Day Case - Fatality, by Gender, 2005 - 2012

**Table 6.2.1 STROKE 30-DAY CASE - FATALITY CASES, BY GENDER, 2005 - 2012**

Gender	2005	2006	2007	2008	2009	2010	2011	2012
Male	237	234	273	277	234	288	316	281
Female	276	294	280	299	249	283	327	290



**Table 6.2.2 STROKE 30-DAY CASE - FATALITY RATE, BY GENDER, 2005 - 2012**

Gender	2005	2006	2007	2008	2009	2010	2011	2012
Male	8.0 (7.0-9.1)	7.8 (6.8-8.8)	8.9 (7.8-9.9)	9.0 (8.0-10.1)	7.3 (6.3-8.2)	8.7 (7.7-9.7)	9.0 (8.0-10.0)	7.9 (7.0-8.8)
Female	11.0 (9.7-12.3)	12.2 (10.8-13.6)	11.2 (9.9-12.5)	11.9 (10.6-13.3)	9.8 (8.6-11.0)	10.9 (9.6-12.2)	12.4 (11.1-13.8)	10.7 (9.4-11.9)

Similar to crude mortality rates, the CFR for females was greater than that for males (Table 6.2.2).

**Table 6.2.3 AGE-STANDARDISED STROKE 30-DAY CASE - FATALITY RATE, BY GENDER, 2005 - 2012**

Gender	2005	2006	2007	2008	2009	2010	2011	2012
Male	8.4 (7.3-9.4)	8.0 (7.0-9.0)	9.6 (8.5-10.7)	9.6 (8.5-10.7)	7.7 (6.7-8.7)	9.4 (8.3-10.5)	9.8 (8.7-10.8)	8.5 (7.5-9.4)
Female	10.3 (9.1-11.5)	11.7 (10.4-13.0)	10.6 (9.4-11.8)	10.8 (9.6-12.1)	8.8 (7.7-9.8)	9.8 (8.6-10.9)	11.2 (10.0-12.4)	9.6 (8.5-10.7)

Also, the age-standardised case fatality rate was greater for females than males (Table 6.2.3). The higher case fatality rate among females was due to higher number of older patients and higher number of patients having risk factors such as hypertension and hyperlipidemia.

### 6.3 Stroke 30-Day Case - Fatality, by Ethnicity, 2005 - 2012

Chinese and Malays had similar case fatality rate, which were higher than Indians.

**Table 6.3.1 STROKE 30-DAY CASE - FATALITY CASES, BY ETHNICITY, 2005 - 2012**

Ethnicity	2005	2006	2007	2008	2009	2010	2011	2012
Chinese	409	407	423	453	370	442	504	460
Malay	74	75	99	80	75	89	100	81
Indian	20	31	24	27	32	30	25	23
Others	10	15	7	16	6	10	14	7

**Table 6.3.2 STROKE 30-DAY CASE - FATALITY RATE, BY ETHNICITY, 2005 - 2012**

Ethnicity	2005	2006	2007	2008	2009	2010	2011	2012
Chinese	9.5 (8.6-10.4)	9.6 (8.6-10.5)	9.9 (8.9-10.8)	10.5 (9.6-11.5)	8.3 (7.4-9.1)	9.8 (8.9-10.7)	10.8 (9.9-11.8)	9.6 (8.7-10.5)
Malay	11.1 (8.6-13.7)	11.1 (8.6-13.6)	12.6 (10.1-15.1)	9.9 (7.8-12.1)	9.1 (7.0-11.2)	9.7 (7.6-11.7)	10.2 (8.2-12.2)	7.7 (6.0-9.4)
Indian	5.6 (3.1-8.1)	9.0 (5.8-12.1)	6.2 (3.7-8.6)	7.2 (4.5-9.9)	8.3 (5.4-11.2)	7.9 (5.1-10.7)	6.2 (3.8-8.6)	6.6 (3.9-9.2)
Others	7.7 (2.9-12.5)	11.7 (5.8-17.6)	6.0 (1.6-10.5)	14.5 (7.4-21.7)	8.0 (1.6-14.4)	11.4 (4.3-18.4)	14.3 (6.8-21.8)	7.1 (1.9-12.4)

**Table 6.3.3 STROKE 30-DAY CASE - FATALITY CASES, BY GENDER AND ETHNICITY, 2005 - 2012**

Gender	Ethnicity	2005	2006	2007	2008	2009	2010	2011	2012
Male	Chinese	183	174	205	217	175	224	243	223
	Malay	36	33	46	36	34	40	53	41
	Indian	16	18	17	19	23	20	13	13
	Others	2	9	5	5	2	4	7	4
Female	Chinese	226	233	218	236	195	218	261	237
	Malay	38	42	53	44	41	49	47	40
	Indian	4	13	7	8	9	10	12	10
	Others	8	6	2	11	4	6	7	3

**Table 6.3.4 STROKE 30-DAY CASE - FATALITY RATE, BY GENDER AND ETHNICITY, 2005 - 2012**

Gender	Ethnicity	2005	2006	2007	2008	2009	2010	2011	2012
Male	Chinese	8.0 (6.9-9.2)	7.5 (6.4-8.6)	8.7 (7.5-9.9)	9.1 (7.9-10.3)	7.0 (6.0-8.0)	9.0 (7.8-10.1)	9.2 (8.1-10.4)	8.2 (7.1-9.2)
	Malay	9.9 (6.7-13.1)	8.9 (5.9-12.0)	11.3 (8.0-14.5)	8.8 (5.9-11.7)	7.7 (5.1-10.3)	7.9 (5.4-10.3)	9.3 (6.8-11.8)	7.4 (5.1-9.6)
	Indian	7.1 (3.6-10.6)	7.8 (4.2-11.3)	7.1 (3.7-10.5)	8.3 (4.5-12.0)	10.0 (5.9-14.1)	8.5 (4.8-12.3)	5.3 (2.4-8.2)	6.0 (2.7-9.2)
	Others	2.6 (0-6.1)	11.1 (3.9-18.4)	6.5 (0.8-12.2)	9.3 (1.1-17.4)	4.8 (0-11.4)	7.5 (0.2-14.9)	13.5 (3.5-23.4)	6.6 (0.1-13.0)
Female	Chinese	11.2 (9.7-12.6)	12.0 (10.5-13.6)	11.3 (9.8-12.8)	12.3 (10.8-13.9)	9.9 (8.5-11.3)	10.9 (9.5-12.4)	12.9 (11.4-14.5)	11.5 (10.1-13.0)
	Malay	12.7 (8.6-16.7)	13.7 (9.5-17.8)	14.0 (10.2-17.7)	11.1 (7.8-14.4)	10.7 (7.4-13.9)	11.8 (8.5-15.1)	11.5 (8.2-14.8)	8.1 (5.6-10.6)
	Indian	3.0 (0.1-6.0)	11.5 (5.3-17.8)	4.6 (1.2-8.1)	5.6 (1.7-9.4)	5.8 (2.0-9.6)	6.8 (2.6-11.1)	7.6 (3.3-12.0)	7.5 (2.9-12.2)
	Others	15.4 (4.7-26.0)	12.8 (2.6-23.0)	5.1 (0-12.2)	19.6 (8.0-31.3)	12.1 (0.2-24.0)	17.1 (3.4-30.9)	15.2 (3.9-26.5)	8.1 (0-17.3)

The 30-day CFR of haemorrhagic stroke was 4 – 5 times that of ischaemic stroke (Table 6.4.1, 6.4.2). However, unlike the mortality rate which had a large proportion of unknown subtypes, less than 2% of the in-hospital deaths were of unknown subtype.

#### 6.4 Stroke 30-Day Case - Fatality, by Subtype, 2005 - 2012

**Table 6.4.1 STROKE 30-DAY CASE - FATALITY CASES, BY SUBTYPE, 2005 - 2012**

Subtype	2005	2006	2007	2008	2009	2010	2011	2012
Ischaemic	251	249	282	285	239	257	311	274
Haemorrhagic	253	270	259	282	235	308	309	282
Unknown	9	9	12	9	9	6	23	15

**Table 6.4.2 STROKE 30-DAY CASE - FATALITY RATE, BY SUBTYPE, 2005 - 2012**

Subtype	2005	2006	2007	2008	2009	2010	2011	2012
Ischaemic	5.6 (4.9-6.3)	5.7 (5.0-6.4)	6.2 (5.5-6.9)	6.4 (5.7-7.1)	5.2 (4.5-5.8)	5.4 (4.8-6.1)	6.4 (5.6-7.1)	5.4 (4.8-6.0)
Haemorrhagic	26.5 (23.3-29.8)	27.1 (23.9-30.4)	25.7 (22.5-28.8)	25.7 (22.7-28.7)	21.5 (18.8-24.3)	27.4 (24.3-30.5)	25.5 (22.7-28.4)	23.9 (21.1-26.6)

**Table 6.4.3 STROKE 30-DAY CASE - FATALITY CASES, BY GENDER AND SUBTYPE, 2005 - 2012**

Gender	Subtype	2005	2006	2007	2008	2009	2010	2011	2012
Male	Ischaemic	115	104	132	130	105	112	147	122
	Haemorrhagic	118	127	134	144	127	176	161	153
	Unknown	4	3	7	3	2	0	8	6
Female	Ischaemic	136	145	150	155	134	145	164	152
	Haemorrhagic	135	143	125	138	108	132	148	129
	Unknown	5	6	5	6	7	6	15	9

**Table 6.4.4 STROKE 30-DAY CASE - FATALITY RATE, BY GENDER AND SUBTYPE, 2005 - 2012**

Gender	Subtype	2005	2006	2007	2008	2009	2010	2011	2012
Male	Ischaemic	4.8 (3.9-5.6)	4.3 (3.4-5.1)	5.2 (4.3-6.1)	5.3 (4.4-6.2)	4.1 (3.3-4.8)	4.2 (3.4-5.0)	5.2 (4.4-6.1)	4.2 (3.5-4.9)
	Haemorrhagic	23.3 (19.1-27.5)	23.7 (19.6-27.9)	25.0 (20.8-29.3)	23.6 (19.8-27.5)	20.7 (17.1-24.3)	28.3 (24.2-32.5)	23.8 (20.1-27.5)	23.6 (19.8-27.3)
Female	Ischaemic	6.7 (5.5-7.8)	7.5 (6.3-8.7)	7.4 (6.2-8.6)	7.7 (6.5-9.0)	6.5 (5.4-7.7)	7.0 (5.8-8.1)	7.9 (6.7-9.1)	7.0 (5.9-8.1)
	Haemorrhagic	30.1 (25.1-35.2)	31.1 (26.0-36.2)	26.4 (21.7-31.0)	28.3 (23.6-33.0)	22.6 (18.3-26.9)	26.2 (21.8-30.7)	27.7 (23.3-32.2)	24.2 (20.0-28.4)

## 7. RISK FACTOR PROFILE OF INCIDENT STROKE (%), 2005 - 2012

### 7.1 Risk Factor Profile of Incident Stroke (%), Overall, 2005 - 2012

The risk factor profile of first incident stroke was defined as either having a history of or being newly diagnosed with the risk factor. The risk factor of smoker includes both ex and current smoker.

Hypertension and hyperlipidaemia were the two most common risk factors among the stroke patients (Table 7.1.1). The proportion of first-ever stroke patients with hyperlipidaemia has increased over time while that of other risk factors has remained stable.

**Table 7.1.1 RISK FACTOR PROFILE OF INCIDENT STROKE (%), OVERALL, 2005 - 2012**

Risk Factors (%)	Overall							
	2005	2006	2007	2008	2009	2010	2011	2012
Smoker	33.1	36.3	35.9	35.2	35.0	35.4	37.4	36.5
Hypertension	75.5	75.9	78.3	79.2	79.4	78.1	78.7	79.1
Diabetes Mellitus	39.2	38.2	40.1	39.4	38.5	39.0	39.1	38.2
Hyperlipaemia	64.5	69.5	75.4	78.0	80.2	80.7	80.0	81.0
Atrial Fibrillation	11.7	12.3	13.4	15.1	13.7	15.0	16.3	16.5

There were higher proportions of women with diabetes, hypertension and atrial fibrillation compared to men (Table 7.1.2). Hyperlipidaemia and smoking were more common among men compared to women. There were 5 times more smokers among male stroke patients compared to female stroke patients.

**Table 7.1.2 RISK FACTOR PROFILE OF INCIDENT STROKE (%),  
BY GENDER, 2005 - 2012**

Risk Factors (%)	Male							
	2005	2006	2007	2008	2009	2010	2011	2012
Smoker	52.3	56.4	57.4	56.2	55.5	55.3	57.4	57.5
Hypertension	72.9	73.9	76.9	78.0	76.6	76.3	77.0	77.5
Diabetes Mellitus	35.8	37.8	37.7	38.0	37.0	37.5	37.3	37.0
Hyperlipaemia	64.8	71.0	76.9	79.3	81.2	82.1	81.5	81.5
Atrial Fibrillation	9.7	9.2	11.9	13.3	12.1	11.4	13.8	12.4

Risk Factors (%)	Female							
	2005	2006	2007	2008	2009	2010	2011	2012
Smoker	10.3	11.9	9.4	9.3	8.7	9.4	9.4	8.6
Hypertension	78.6	78.4	80.1	80.8	83.0	80.5	81.0	81.1
Diabetes Mellitus	43.3	38.8	43.0	41.1	40.3	40.9	41.7	39.9
Hyperlipaemia	64.2	67.7	73.6	76.4	79.0	78.8	77.8	80.3
Atrial Fibrillation	14.1	16.1	15.1	17.3	15.7	19.7	19.7	21.9

Indians had the highest proportion of patients with diabetes and hyperlipidaemia, and the lowest proportion of patients with atrial fibrillation (Table 7.1.3). Hypertension was more common among Malay and Indian patients compared to Chinese patients.

**Table 7.1.3 RISK FACTOR PROFILE OF INCIDENT STROKE (%),  
BY ETHNICITY, 2005 - 2012**

Risk Factors (%)	Chinese							
	2005	2006	2007	2008	2009	2010	2011	2012
Smoker	32.5	35.7	35.3	35.4	34.5	34.6	36.3	36.0
Hypertension	75.9	75.8	78.4	78.3	78.9	78.0	78.3	78.6
Diabetes Mellitus	36.0	35.5	36.2	36.3	35.2	35.7	35.1	34.4
Hyperlipaemia	62.6	67.9	73.5	77.0	79.1	79.8	78.9	79.4
Atrial Fibrillation	11.9	12.6	14.3	15.8	14.4	15.5	17.3	16.6

Risk Factors (%)	Malay							
	2005	2006	2007	2008	2009	2010	2011	2012
Smoker	35.5	37.1	35.3	32.5	37.8	37.6	41.4	36.6
Hypertension	74.2	78.5	79.2	83.3	82.1	78.4	79.6	82.9
Diabetes Mellitus	49.0	46.6	51.9	46.0	47.0	47.5	49.7	49.8
Hyperlipaemia	71.3	76.6	81.2	80.9	83.2	82.8	83.0	85.5
Atrial Fibrillation	12.1	14.9	12.2	14.0	13.7	14.9	13.4	18.2

Risk Factors (%)	Indian							
	2005	2006	2007	2008	2009	2010	2011	2012
Smoker	33.5	41.8	42.2	40.9	34.5	36.4	40.6	41.8
Hypertension	74.6	75.8	77.5	82.9	78.8	80.1	81.2	74.9
Diabetes Mellitus	54.8	54.7	59.2	60.7	57.9	57.5	59.7	57.8
Hyperlipaemia	71.4	73.4	83.7	84.8	87.8	88.9	84.6	89.2
Atrial Fibrillation	6.0	4.3	5.9	9.7	6.1	9.6	10.2	10.8

Risk Factors (%)	Others							
	2005	2006	2007	2008	2009	2010	2011	2012
Smoker	37.5	37.4	41.3	26.4	42.0	42.3	36.3	39.4
Hypertension	72.1	67.0	73.9	73.6	78.0	74.4	80.0	73.2
Diabetes Mellitus	47.1	35.2	34.8	41.4	36.0	41.0	41.3	36.6
Hyperlipaemia	70.2	72.5	75.0	73.6	78.0	73.1	83.8	80.3
Atrial Fibrillation	16.3	12.1	12.0	12.6	8.0	12.8	18.8	12.7

Among all the ethnic groups, there were higher percentages of hypertensives, diabetics and patients with atrial fibrillation among females compared to males (Table 7.1.4). Conversely, there were higher percentages of smokers and patients with hyperlipidaemia among males compared to females.

**Table 7.1.4A RISK FACTOR PROFILE OF INCIDENT STROKE (%), BY MALE AND ETHNICITY, 2005 - 2012**

Risk Factors (%)	Chinese Male							
	2005	2006	2007	2008	2009	2010	2011	2012
Smoker	50.6	54.8	55.3	55.0	53.9	53.4	55.0	55.6
Hypertension	74.2	74.1	77.5	77.5	75.9	76.6	76.7	77.7
Diabetes Mellitus	32.6	35.1	34.5	35.1	34.2	34.6	33.9	33.9
Hyperlipaemia	63.1	70.4	75.4	78.9	80.1	81.2	80.7	80.4
Atrial Fibrillation	10.0	9.2	12.7	13.5	12.2	11.7	14.6	12.4

Risk Factors (%)	Malay Male							
	2005	2006	2007	2008	2009	2010	2011	2012
Smoker	60.8	63.7	63.8	61.6	63.0	63.5	65.4	63.5
Hypertension	69.4	74.7	74.4	79.5	80.2	74.7	77.2	79.8
Diabetes Mellitus	42.1	46.2	45.9	41.4	42.3	43.9	44.6	43.6
Hyperlipaemia	68.7	75.5	81.3	79.8	84.7	83.9	84.3	84.5
Atrial Fibrillation	9.4	12.8	10.6	14.0	15.0	12.0	12.8	14.0

Risk Factors (%)	Indian Male							
	2005	2006	2007	2008	2009	2010	2011	2012
Smoker	52.4	62.7	65.9	62.9	57.2	57.1	66.7	65.4
Hypertension	68.3	74.5	76.1	83.0	75.9	77.6	79.5	71.2
Diabetes Mellitus	53.8	52.8	55.7	62.9	59.0	56.5	56.7	61.5
Hyperlipaemia	71.7	72.7	83.5	84.3	87.3	90.1	85.4	90.4
Atrial Fibrillation	4.8	3.7	6.3	10.1	6.0	6.2	7.0	9.0

Risk Factors (%)	Others Male							
	2005	2006	2007	2008	2009	2010	2011	2012
Smoker	59.4	52.5	58.1	44.4	58.1	56.3	50.0	63.4
Hypertension	65.6	64.4	74.2	68.9	74.2	70.8	78.6	73.2
Diabetes Mellitus	50.0	33.9	32.3	40.0	32.3	31.3	40.5	36.6
Hyperlipaemia	73.4	64.4	75.8	71.1	77.4	75.0	78.6	73.2
Atrial Fibrillation	14.1	8.5	12.9	13.3	3.2	12.5	16.7	9.8



**Table 7.1.4B RISK FACTOR PROFILE OF INCIDENT STROKE (%), BY FEMALE AND ETHNICITY, 2005 - 2012**

Risk Factors (%)	Chinese Female							
	2005	2006	2007	2008	2009	2010	2011	2012
Smoker	11.6	13.1	11.2	10.7	9.7	10.5	10.4	9.3
Hypertension	77.8	77.8	79.4	79.4	82.7	79.7	80.4	79.9
Diabetes Mellitus	40.0	36.1	38.2	37.9	36.6	37.0	36.7	35.1
Hyperlipaemia	61.9	65.0	71.3	74.5	77.8	77.9	76.3	78.1
Atrial Fibrillation	14.2	16.5	16.2	18.8	17.1	20.3	21.1	22.4

Risk Factors (%)	Malay Female							
	2005	2006	2007	2008	2009	2010	2011	2012
Smoker	5.6	7.4	2.5	4.3	6.6	5.1	5.2	7.7
Hypertension	79.9	82.8	84.8	87.0	84.5	83.1	83.2	86.3
Diabetes Mellitus	57.3	47.1	58.8	50.5	52.8	52.1	57.4	56.5
Hyperlipaemia	74.4	77.9	81.2	82.1	81.4	81.5	81.1	86.5
Atrial Fibrillation	15.4	17.2	14.1	14.0	12.1	18.5	14.4	22.7

Risk Factors (%)	Indian Female							
	2005	2006	2007	2008	2009	2010	2011	2012
Smoker	6.8	6.3	5.3	5.1	0.9	3.0	4.1	3.2
Hypertension	83.5	77.9	79.6	82.7	83.0	84.0	83.6	81.1
Diabetes Mellitus	56.3	57.9	64.6	57.1	56.3	59.0	63.9	51.6
Hyperlipaemia	70.9	74.7	84.1	85.7	88.4	87.0	83.6	87.4
Atrial Fibrillation	7.8	5.3	5.3	9.2	6.3	15.0	14.8	13.7

Risk Factors (%)	Others Female							
	2005	2006	2007	2008	2009	2010	2011	2012
Smoker	2.5	9.4	6.7	7.1	15.8	20.0	21.1	6.7
Hypertension	82.5	71.9	73.3	78.6	84.2	80.0	81.6	73.3
Diabetes Mellitus	42.5	37.5	40.0	42.9	42.1	56.7	42.1	36.7
Hyperlipaemia	65.0	87.5	73.3	76.2	78.9	70.0	89.5	90.0
Atrial Fibrillation	20.0	18.8	10.0	11.9	15.8	13.3	21.1	16.7

Diabetes and hyperlipidaemia were about twice as common among ischaemic stroke patients than among haemorrhagic stroke patients while atrial fibrillation was more than three times as common (Table 7.1.5).

**Table 7.1.5 RISK FACTOR PROFILE OF INCIDENT STROKE (%), BY SUBTYPE, 2005 - 2012**

Risk Factors (%)	Ischaemic							
	2005	2006	2007	2008	2009	2010	2011	2012
Smoker	35.5	38.7	38.4	38.0	38.1	38.1	40.4	38.7
Hypertension	75.6	75.6	77.9	79.1	79.3	78.2	79.6	79.7
Diabetes Mellitus	43.4	42.4	44.1	43.7	42.5	43.0	43.4	42.3
Hyperlipaemia	73.1	78.6	84.2	87.8	89.0	88.7	88.9	89.3
Atrial Fibrillation	12.8	13.8	15.1	17.2	15.6	17.2	19.0	18.9

Risk Factors (%)	Haemorrhagic							
	2005	2006	2007	2008	2009	2010	2011	2012
Smoker	23.3	25.9	25.8	24.5	22.5	23.9	25.8	27.3
Hypertension	75.0	77.9	80.3	79.9	79.4	77.8	75.2	76.4
Diabetes Mellitus	21.7	20.0	23.3	23.1	21.8	22.1	22.2	21.0
Hyperlipaemia	28.1	31.1	38.9	40.9	44.2	47.5	45.3	46.0
Atrial Fibrillation	6.6	6.0	6.0	7.0	5.7	6.0	5.6	6.5

**Table 7.1.6A RISK FACTOR PROFILE OF INCIDENT STROKE (%), BY MALE AND SUBTYPE, 2005 - 2012**

Risk Factors (%)	Ischaemic Male							
	2005	2006	2007	2008	2009	2010	2011	2012
Smoker	56.0	60.0	60.9	60.5	60.6	59.3	61.4	60.5
Hypertension	72.2	73.1	75.4	77.0	75.3	75.4	77.1	77.8
Diabetes Mellitus	39.5	41.3	41.0	41.8	40.9	41.8	41.1	40.5
Hyperlipaemia	72.9	79.7	85.4	88.7	90.4	89.7	89.8	89.8
Atrial Fibrillation	10.5	9.9	12.9	15.0	13.4	12.8	15.9	14.1

Risk Factors (%)	Haemorrhagic Male							
	2005	2006	2007	2008	2009	2010	2011	2012
Smoker	36.8	41.1	42.0	39.1	34.3	38.4	41.4	44.4
Hypertension	76.0	78.7	83.7	82.0	81.6	79.8	76.7	76.7
Diabetes Mellitus	20.2	21.3	23.1	23.5	20.6	18.9	21.2	21.3
Hyperlipaemia	29.9	33.2	38.8	42.9	43.7	50.1	48.1	45.2
Atrial Fibrillation	5.9	6.7	7.8	6.6	6.4	5.5	5.5	4.8

**Table 7.1.6B RISK FACTOR PROFILE OF INCIDENT STROKE (%), BY FEMALE AND SUBTYPE, 2005 - 2012**

Risk Factors (%)	Ischaemic Female							
	2005	2006	2007	2008	2009	2010	2011	2012
Smoker	10.9	12.5	9.9	10.0	9.1	10.3	10.3	9.2
Hypertension	79.6	78.8	81.1	81.8	84.5	81.8	83.2	82.4
Diabetes Mellitus	48.1	43.6	48.0	46.2	44.4	44.6	46.7	44.8
Hyperlipaemia	73.4	77.2	82.5	86.6	87.3	87.5	87.8	88.7
Atrial Fibrillation	15.6	18.7	18.0	20.0	18.4	22.9	23.5	25.2

Risk Factors (%)	Haemorrhagic Female							
	2005	2006	2007	2008	2009	2010	2011	2012
Smoker	7.7	8.5	7.8	7.1	7.6	5.8	5.7	6.4
Hypertension	74.0	77.1	76.5	77.5	76.6	75.2	73.2	76.0
Diabetes Mellitus	23.4	18.5	23.5	22.5	23.4	26.1	23.4	20.6
Hyperlipaemia	26.0	28.8	38.9	38.5	44.8	44.3	41.6	47.1
Atrial Fibrillation	7.4	5.3	4.1	7.6	4.9	6.6	5.7	8.6

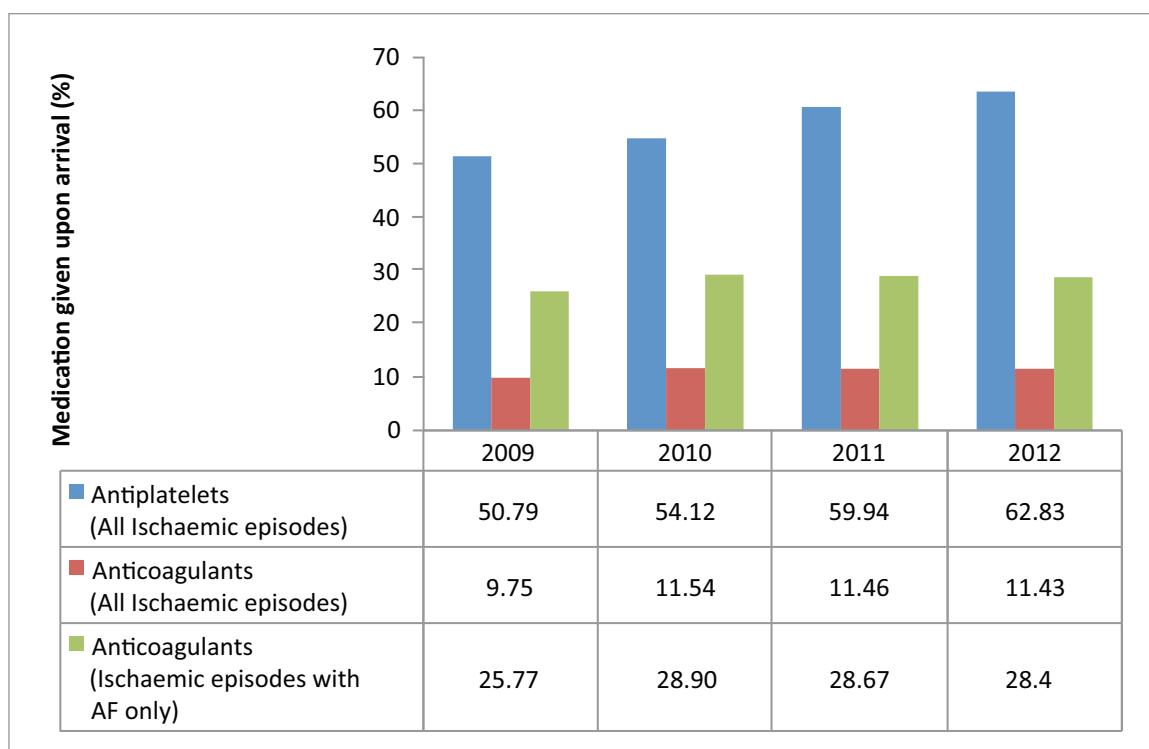
Diabetes and hyperlipidaemia were about twice as common among ischaemic stroke patients than among haemorrhagic stroke patients while atrial fibrillation was more than three times as common (Table 7.1.5).

## 8. MEDICATION (%) 2005 - 2012: ISCHAEMIC STROKE PATIENTS

### 8.1 Medication (%), 2005 - 2012

The percentage of patients given anticoagulants upon arrival and upon discharge had increased from 2009 to 2010 (Figure 8.1.1, 8.1.3). The percentage of patients given antiplatelets upon arrival had increased from 2009 to 2012 (Figure 8.1.1). While there was no discernible trend in the medication given to stroke patients during hospitalisation, the percentage of stroke patients given antiplatelets during hospitalisation has exceeded 90% since 2009 (Figure 8.1.2).

**Figure 8.1.1 MEDICATION ON ARRIVAL (STAT DOSES) (%), 2009 - 2012**



Information about medication on discharge and arrival was collected from 2009 onwards.

Figure 8.1.2 MEDICATION DURING HOSPITALISATION (%), 2005 - 2012

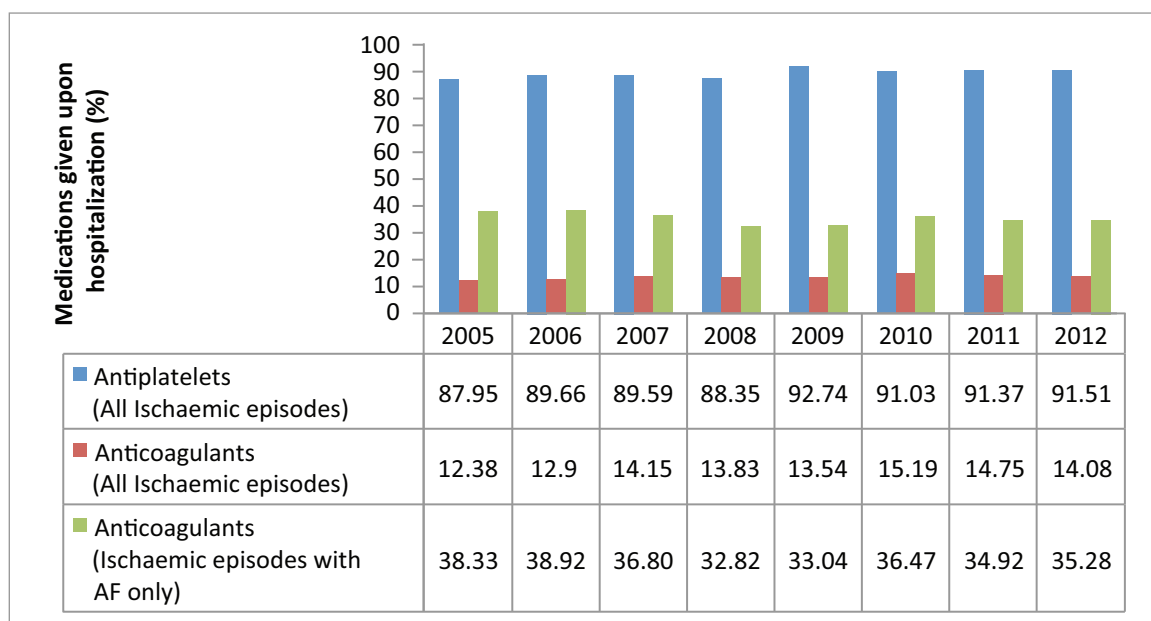
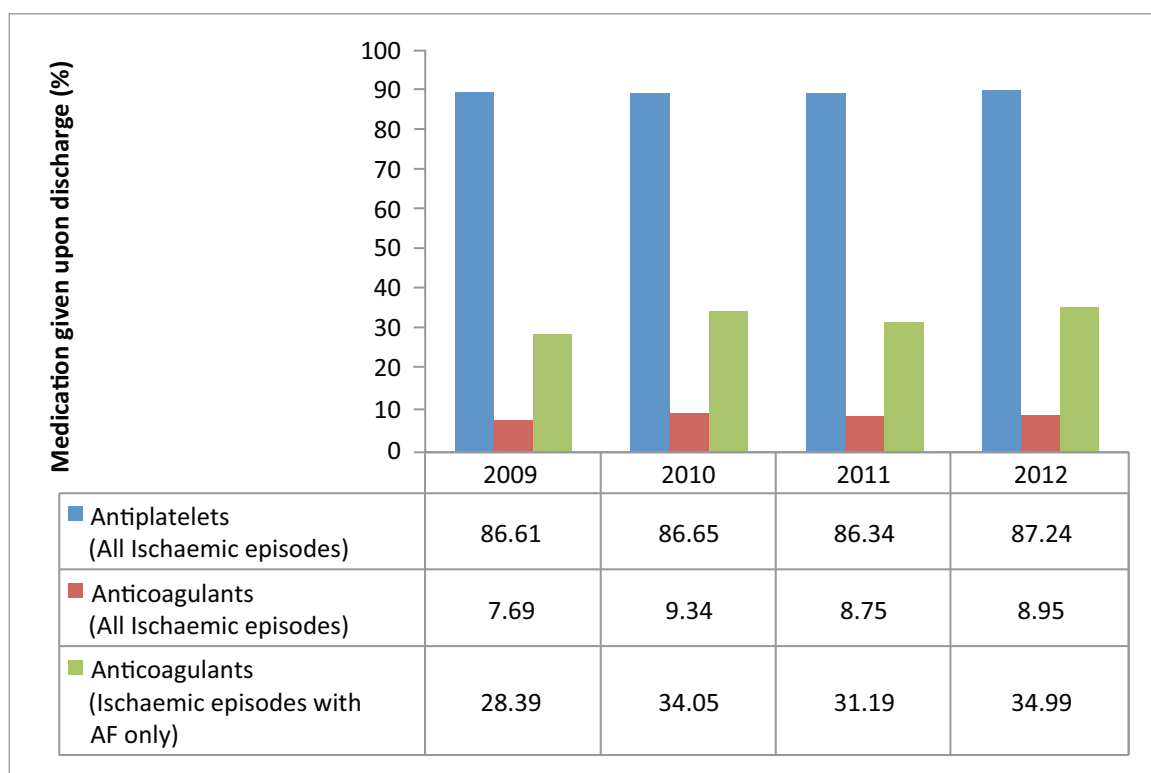


Figure 8.1.3 MEDICATION UPON DISCHARGE (%), 2009 - 2012



## 9. INPATIENT EVENTS / COMPLICATIONS (%), 2005 - 2012

The two most common complications seen in stroke cases were urinary tract infections (UTI) and pneumonia (Figure 9.1.1). As there were no discernible trends in specific complication rates over the 8-year period, they are not presented here. The percentage of stroke patients without these common complications has remained above 80% since 2005.

**Figure 9.1.1 INPATIENT EVENTS / COMPLICATIONS (%), 2005 – 2012**

