

SINGAPORE MYOCARDIAL INFARCTION  
REGISTRY REPORT NO. 2

**TRENDS IN ACUTE  
MYOCARDIAL INFARCTION  
IN SINGAPORE 2007 - 2012**

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# FOREWORD

Ischaemic heart disease, including acute myocardial infarction, is the second leading principle cause of death in Singapore. With ageing of our population, changes in lifestyle and growing prevalence of risk factors such as diabetes and obesity, the burden of heart disease and acute myocardial infarction will continue to be a major challenge for our nation for years ahead. In order to better understand and hence overcome this disease, the Singapore Myocardial Infarct Registry was first established in 1987.

The Singapore Myocardial Infarction Registry (SMIR) is unique, possibly the only nation-wide myocardial infarct registry in the world. Its staff has worked hard to put together data on acute myocardial infarction (AMI), commonly known as heart attacks, in Singapore using a comprehensive protocol that requires meticulous screening of cardiac enzymes, discharge coding and ECGs by a dedicated team of nurses. This second report of SMIR is the collective effort of those who have collected and analysed the data as well as those who have written and commented on report.

The data provided by the SMIR fulfils a critical function for our healthcare service planning, providing insight and understanding of the trends and pattern of myocardial infarction in Singapore. This publication will be invaluable for all of us involved in overcoming this disease, whether cardiologists, epidemiologists or health administrators, and will also serve as a useful reference for both physicians and public health professionals. I would like to express my gratitude to those who have worked on this report.

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Chairman

Singapore Myocardial Infarction Registry

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# TABLE OF CONTENTS

<b>1.</b>	<b>GLOSSARY .....</b>	<b>1</b>
<b>2.</b>	<b>INTRODUCTION .....</b>	<b>2</b>
<b>3.</b>	<b>EXECUTIVE SUMMARY .....</b>	<b>6</b>
<b>4.</b>	<b>AMI INCIDENCE 2007 - 2012: ALL RESIDENTS .....</b>	<b>7</b>
4.1	AMI INCIDENCES, OVERALL, 2007 - 2012 .....	7
	Table 4.1.1 AMI Incidence, Overall, 2007 - 2012 .....	7
	Figure 4.1.1 Crude And Age-Standardised Incidence Rates (Per 100,000 Population) of AMI, Overall, 2007 - 2012 .....	7
	Table 4.1.2 Incident AMI Cases By Age Group, Overall, 2007 - 2012 .....	8
	Table 4.1.3 Age-Specific Incidence Rate of AMI (Per 100,000 Population), Overall, 2007 - 2012 .....	8
	Table 4.1.4 Mean And Median Age, Incident AMI, 2007 - 2012 .....	9
4.2	INCIDENCE OF AMI CASES, BY GENDER, 2007 - 2012 .....	9
	Table 4.2.1 Incident AMI Cases, By Gender, 2007 - 2012 .....	9
	Figure 4.2.1 Crude Incidence Rates (Per 100,000 Population) of AMI, By Gender, 2007 - 2012 .....	9
	Table 4.2.2 Crude Incidence Rates (Per 100,000 Population) of AMI, By Gender, 2007 - 2012 .....	10
	Figure 4.2.2 Age-Standardised Incidence Rates (Per 100,000 Population) of AMI, By Gender, 2007 - 2012 .....	10
	Table 4.2.3 Age-Standardised Incidence Rates (Per 100,000 Population) of AMI, By Gender, 2007 - 2012 .....	10
	Table 4.2.4 Mean And Median Age, Incident AMI, By Gender, 2007 - 2012 .....	11
4.3	INCIDENCE OF AMI CASES, BY ETHNIC GROUP, 2007 - 2012 .....	11
	Table 4.3.1 AMI Cases, By Ethnic Group, 2007 - 2012 .....	11
	Figure 4.3.1 Crude Incidence Rates (Per 100,000 Population) of AMI, By Ethnic Group, 2007 - 2012 .....	11
	Table 4.3.2 Crude Incidence Rates (Per 100,000 Population) of AMI, By Ethnic Group, 2007 - 2012 .....	12
	Figure 4.3.2 Age-Standardised Incidence Rates (Per 100,000 Population) of AMI, By Ethnic Group, 2007 - 2012 .....	12
	Table 4.3.3 Age-Standardised Incidence Rates (Per 100,000 Population) of AMI, By Ethnic Group, 2007 - 2012 .....	12
4.4	INCIDENCE OF AMI CASES, BY AMI TYPE, 2007 - 2012 .....	13
	Table 4.4.1 Incidence of AMI, By AMI Type, 2007 - 2012 .....	13
	Figure 4.4.1 Crude Incidence Rates (Per 100,000 Population) of AMI, By AMI Type, 2007 - 2012 .....	13
	Table 4.4.2 Crude Incidence Rates (Per 100,000 Population) of AMI, By AMI Type, 2007 - 2012 .....	14
	Figure 4.4.2 Age-Standardised Incidence Rates (Per 100,000 Population) of AMI, By AMI Type, 2007 - 2012 .....	14
	Table 4.4.3 Age-Standardised Incidence Rates (Per 100,000 Population) of AMI, By AMI Type, 2007 - 2012 .....	14

<b>5.</b>	<b>AMI MORTALITY 2007 - 2012: ALL RESIDENTS .....</b>	<b>15</b>
5.1	AMI Deaths, Overall, 2007 - 2012 .....	15
	Table 5.1.1 AMI Deaths, Overall, 2007 - 2012 .....	15
	Figure 5.1.1 Crude And Age-Standardised Mortality Rates (Per 100,000 Population) of AMI, Overall, 2007 - 2012 .....	15
	Table 5.1.2 AMI Deaths, By Age Group, 2007 - 2012 .....	16
	Table 5.1.3 Age-Specific AMI Mortality Rate (Per 100,000 Population), Overall, 2007 - 2012 .....	16
	Table 5.1.4 Mean And Median Age At Death, 2007 - 2012 .....	17
5.2	AMI DEATHS, BY GENDER, 2007 - 2012 .....	17
	Table 5.2.1 AMI Deaths, By Gender, 2007 - 2012 .....	17
	Figure 5.2.1 Crude Mortality Rates (Per 100,000 Population) of AMI, By Gender, 2007 - 2012 .....	17
	Table 5.2.2 Crude Mortality Rates (Per 100,000 Population) of AMI, By Gender, 2007 - 2012 .....	18
	Figure 5.2.2 Age-Standardised Mortality Rates (Per 100,000 Population) of AMI, By Gender, 2007 - 2012 .....	18
	Table 5.2.3 Age-Standardised Mortality Rates (Per 100,000 Population) of AMI, By Gender, 2007 - 2012 .....	18
	Table 5.2.4 Mean And Median Age At Death, By Gender, 2007 - 2012 .....	19
5.3	AMI DEATHS, BY ETHNIC GROUP, 2007 - 2012 .....	19
	Table 5.3.1 AMI Deaths, By Ethnic Group, 2007 - 2012 .....	19
	Figure 5.3.1 Crude Mortality Rates (Per 100,000 Population) of AMI, By Ethnic Group, 2007 - 2012 .....	19
	Table 5.3.2 Crude Mortality Rates (Per 100,000 Population) of AMI, By Ethnic Group, 2007 - 2012 .....	20
	Figure 5.3.2 Age-Standardised Mortality Rates (Per 100,000 Population) of AMI, By Ethnic Group, 2007 - 2012 .....	20
	Table 5.3.3 Age-Standardised Mortality Rates (Per 100,000 Population) of AMI, By Ethnic Group, 2007 - 2012 .....	21
5.4	AMI DEATHS, BY AMI TYPE, 2007 - 2012 .....	21
	Table 5.4.1 AMI Deaths, By AMI Type, 2007 - 2012 .....	21
	Figure 5.4.1 Crude Mortality Rates (Per 100,000 Population) of AMI, By AMI Type, 2007 - 2012 .....	21
	Table 5.4.2 Crude Mortality Rates (Per 100,000 Population) of AMI, By AMI Type, 2007 - 2012 .....	22
	Figure 5.4.2 Age-Standardised Mortality Rates (Per 100,000 Population) of AMI, By AMI Type, 2007 - 2012 .....	22
	Table 5.4.3 Age-Standardised Mortality Rates (Per 100,000 Population) of AMI, By AMI Type, 2007 - 2012 .....	22
<b>6</b>	<b>AMI 28-DAY CASE-FATALITY 2007 - 2012: ALL RESIDENTS .....</b>	<b>23</b>
6.1	AMI 28-DAY CASE-FATALITY, OVERALL, 2007 - 2012 .....	23
	Table 6.1.1 AMI 28-Day Case-Fatality, Overall, 2007 - 2012 .....	23
	Table 6.1.2 AMI 28-Day Case-Fatality, By Age Group, 2007 - 2012 .....	23

6.2	AMI 28-DAY CASE-FATALITY, BY GENDER, 2007 - 2012 .....	24
	Table 6.2.1 AMI 28-Day Case-Fatality, By Gender, 2007 - 2012 .....	24
	Table 6.2.2 AMI 28-Day Case-Fatality Rates (%) By Gender, 2007 - 2012 .....	24
6.3	AMI 28-DAY CASE-FATALITY, BY ETHNIC GROUP, 2007 - 2012 .....	24
	Table 6.3.1 AMI 28-Day Case-Fatality, By Ethnic Group, 2007 - 2012 .....	24
	Table 6.3.2 AMI 28-Day Case-Fatality Rates (%), By Ethnic Group, 2007 - 2012 .....	25
6.4	AMI 28-DAY CASE-FATALITY, BY AMI TYPE, 2007 - 2012 .....	25
	Table 6.4.1 AMI 28-Day Case-Fatality, By AMI Type, 2007 - 2012 .....	25
	Table 6.4.2 AMI 28-Day Case-Fatality Rates (%), By AMI Type, 2007 - 2012 .....	25
<b>7.</b>	<b>RISK FACTOR PROFILE OF INCIDENT AMI (%), 2007 - 2012 .....</b>	<b>26</b>
7.1	RISK FACTOR PROFILE OF INCIDENT AMI (%), OVERALL, 2007 - 2012 .....	26
	Table 7.1.1 Risk Factor Profile of Incident AMI (%), Overall, 2007 - 2012 .....	26
7.2	RISK FACTOR PROFILE OF INCIDENT AMI (%), GENDER, 2007 - 2012 .....	26
	Table 7.2.1A Risk Factor Profile of Incident AMI (%), Male, 2007 - 2012 .....	26
	Table 7.2.1B Risk Factor Profile of Incident AMI (%), Female, 2007 - 2012 .....	27
7.3	RISK FACTOR PROFILE OF INCIDENT AMI (%), ETHNIC GROUP, 2007 - 2012 .....	27
	Table 7.3.1 Risk Factor Profile of Incident AMI (%), Ethnic Group, 2007 - 2012 .....	27
7.4	RISK FACTOR PROFILE OF INCIDENT AMI (%), AMI TYPE, 2007 - 2012 .....	28
	Table 7.4.1 Risk Factor Profile of Incident AMI (%), AMI Type, 2007 - 2012 .....	28
<b>8.</b>	<b>SYMPTOMS, 2007 - 2012: ALL RESIDENTS .....</b>	<b>28</b>
8.1	SYMPTOMS OF AMI PATIENTS, OVERALL, 2007 - 2012 .....	28
	Table 8.1.1 Symptoms of AMI Patients (%), Overall, 2007 - 2012 .....	28
8.2	SYMPTOMS OF AMI PATIENTS, GENDER, 2007 - 2012 .....	29
	Table 8.2.1 Symptoms of AMI Patients (%), Gender, 2007 - 2012 .....	29
8.3	SYMPTOMS OF AMI PATIENTS, ETHNIC GROUP, 2007 - 2012 .....	29
	Table 8.3.1 Symptoms of AMI Patients (%), Ethnic Group, 2007 - 2012 .....	29-30
8.4	SYMPTOMS OF AMI PATIENTS, AMI TYPE, 2007 - 2012 .....	30
	Table 8.4.1 Symptoms of AMI Patients (%), AMI Type, 2007 - 2012 .....	30
<b>9.</b>	<b>MEDICATION (%) 2007 - 2012: ALL RESIDENTS .....</b>	<b>31</b>
9.1	MEDICATION (%), 2007 - 2012 .....	31
	Figure 9.1.1 Medication on Arrival (Stat Doses) (%), Overall, 2007 - 2012 .....	31
	Figure 9.1.2 Medication During Hospitalisation (%), Overall, 2007 - 2012 .....	32
	Figure 9.1.3 Medication Upon Discharge (%), Overall, 2007 - 2012 .....	32
<b>10.</b>	<b>IN-PATIENT COMPLICATIONS AND EVENTS (%) 2007 - 2012: ALL RESIDENTS .....</b>	<b>33</b>
10.1	IN-PATIENT COMPLICATIONS AND EVENTS (%), 2007 - 2012 .....	33
	Figure 10.1.1 In-Patient Complications And Events (%), Overall, 2007 - 2012 .....	33

## 1. GLOSSARY

<b>AMI</b>	Acute Myocardial Infarction
<b>CCPS</b>	Central Claims Processing Systems
<b>CPK</b>	Creatinine Phosphokinase
<b>DOS</b>	Department of Statistics
<b>ECG</b>	Electrocardiogram
<b>EMR</b>	Electronic Medical Records
<b>ICD-9 410</b>	International Classification of Diseases 9th Revision (ICD-9 Clinical Modification) code of 410
<b>ICD-10 I21, I22</b>	International Classification of Diseases 10th Revision ICD-10 codes I21 and I22
<b>GP</b>	General Practitioner
<b>HIDS</b>	Hospital In-patient Discharge Summary
<b>HSA</b>	Health Sciences Authority
<b>MOH</b>	Ministry of Health
<b>MONICA</b>	Monitoring Trends and Determinants in Cardiovascular Disease, World Health Organization
<b>NRDO</b>	National Registry of Diseases Office
<b>NSTEMI</b>	Non-ST-Segment Elevation Myocardial Infarction
<b>SCDB</b>	Singapore Cardiac Databank
<b>SMIR</b>	Singapore Myocardial Infarction Registry
<b>STEMI</b>	ST-Segment Elevation Myocardial Infarction
<b>UICC</b>	Union for International Cancer Control

## 2. INTRODUCTION

Globally, cardiovascular diseases, which include coronary heart diseases (heart attacks, also known as AMI), cerebrovascular diseases (stroke), hypertension (raised blood pressure) and heart failure are the world's largest killer, claiming 17.3 million lives in 2008, representing 30% of all global deaths. Of these deaths, about 7.3 million and 6.2 million were caused by coronary heart disease and stroke respectively (Fact Sheet, World Health Organization). In Singapore, ischaemic heart diseases were the 3rd leading cause of death (16.1%) and 3rd leading cause of hospitalisation (3.6%) in 2012 (Health Facts Singapore, Ministry of Health).

The Acute Myocardial Infarction Registry was established by MOH in 1988, transferred to the Singapore Cardiac Databank (SCDB) in 2002 and subsequently to NRDO in April 2007. Data for AMI cases diagnosed prior to 2007 has been collected by SCDB. After the transfer to NRDO, it was re-named the Singapore Myocardial Infarction Registry (SMIR). SMIR continues to collect epidemiological data on AMI cases diagnosed in all the restructured hospitals<sup>1</sup> and a small number of AMI deaths that occur at home that are certified by medical practitioners in Singapore. AMI cases occurring in private hospitals<sup>2</sup> have also been included in the report since 2012.

All records in the SMIR undergo the processes of registration, verification, matching and classification before they are finalised.

As the number of patients with acute myocardial infarction increases year by year, it becomes more and more imperative to have data dealing with various aspects of the disease and maintaining this data in one central place in Singapore. Such an attempt to gather data at a national level will be time consuming and the cooperation of various healthcare professionals involved in the management of AMI patients from all the hospitals will be crucial to the success of the Registry.

The data contained in this document are from the period of 2007 to 2012 finalised in the SMIR as of 5<sup>th</sup> November 2013. Availability of such national statistics on AMI will enable planning and projection for our future needs. Such data will be helpful for identification of useful trends to provide the basis for correct decision making. On the other hand, the emergence of early signs of unfavourable trends will forewarn decision makers and allow suitable preventive measures to be taken.

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

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1 Includes the National Heart Centre (NHC) / Singapore General Hospital (SGH), Changi General Hospital (CGH), Tan Tock Seng Hospital (TTSH), Alexandra Hospital (AH), National University Hospital (NUH), Kandang Kerbau Hospital (KKH) and Khoo Teck Puat Hospital (KTPH).  
2 Includes Gleneagles Hospital, Mount Alvernia Hospital, Mount Elizabeth Hospital, Mount Elizabeth Novena Hospital, Parkway East Hospital and Raffles Hospital.

## Legislation

In 2007, the National Registry of Diseases Act was enacted to provide legislative cover for national disease registries including the SMIR. The Act establishes the National Registry of Diseases and provides for compilation of information on disease incidence of selected diseases for purposes of disease prevention and control. Legislation also mandated notification from private hospitals from September 2012 onwards.

## Sources of data

The sources of data included the cardiac biomarkers (creatinine phosphokinase (CPK), CKMB mass; and Troponins T and I) listing generated by the laboratories in the restructured hospitals, Mediclaims listing, Hospital In-patient Discharge Summary (HIDS) and data from the Death Registry of the Ministry of Home Affairs (MHA). Mediclaims, which was formally known as the Central Claims Processing Systems (CCPS), has consistently been the main source of case finding from 2007 to 2012. All cases with the mention of AMI in hospital discharge forms and Mediclaims and death information documented in casenotes are included. Death information is also verified with the Death Registry to attain up-to-date status of registered patients in the Registry.

In addition, the letters are sent to the medical practitioners to confirm AMI as the cause of death for the small number of cases that appears in the Death Registry before registering these cases i.e. for patients who died at home. These medical practitioners notify the registry in the form of hardcopy notification.

Over the years, enzyme listing has increasingly become an important source of case finding due to the use of more sensitive enzyme assays i.e. increase in the use of Troponin T and Troponin I in the diagnosis of AMI in patients in addition to CPK. Import of information on necropsies (HSA) conducted on AMI patients began from 2007.

## Data processing and coding

### a) Identification Key

The primary identification key for our Singapore residents is the National Registration Identity Card (NRIC) number. For non-residents, their passport numbers or foreign identification (FIN) numbers are used. There are unique numbers assigned to avoid duplication of records in our database, especially when we update our data from multiple sources. A master patient list is created by merging data from all sources using the patient NRIC numbers as identifiers.

### b) Verification of information

All information from listings is extracted from clinical medical records. Registry Coordinators extract detailed information from the case-notes at the medical records offices of hospitals. For unmatched cases (single source which are mainly either the enzyme or HIDS), Registry Coordinators confirm diagnosis of AMI by viewing patients'

electronic medical records (EMR), before extracting relevant clinical information from case-notes.

c) Coding

International Classification of Diseases 9<sup>th</sup> Revision (ICD-9 Clinical Modification) code of 410 was used to identify acute myocardial infarction (AMI) cases in the data sources from 2008 - 2011 while ICD-10 codes I21 and I22 were used for AMI cases diagnosed in 2012. The MONICA (Monitoring Trends and Determinants in Cardiovascular Disease, World Health Organization) criteria were used for defining episodes. Recurrence of AMI after 28 days of a recorded AMI episode was counted as another episode.

d) AMI Definition

For the computation of the incidence of AMI, the population of AMI patients for a particular year was extracted based on the date AMI episode occurred. AMI episodes included in this report were diagnosed as:

1) Definitive AMI –

- Definite ECG, or
- Symptoms (typical or atypical), together with probable ECG and abnormal enzymes suggestive of myocardial necrosis, or
- Typical symptoms and abnormal enzymes with ischaemic/ non-codable/ unavailable ECG.

2) Clinical AMI –

- ECG changes suggestive of AMI but not supported with raised cardiac enzymes or typical symptoms, or
- At least 2 of the following criteria: clinical history of prolonged chest pain >20mins; raised biochemical markers of myocardial necrosis or serial ECG tracings showing ST-T changes from baseline or Q waves duration that are 0.03 secs in 2 or more contiguous leads).

3) Death cases signed up by pathologists stating AMI as cause of death with necropsy report reflecting pinpoint or total occlusion of the coronary arteries.

4) Death cases signed by pathologists or GPs as AMI but, without necropsy done.

e) Follow-up

All records are updated with date and cause of death information received from MHA.

- f) Most of the data management is on an electronic platform. In 2004, the National Disease Registries System (NRDS) was developed to provide full support for the operations of AMI registry; merging the data from varied sources, ensuring valid data capture, data security and generation of timely reports. Electronic transmission of data has been established between hospitals and the registry to ensure safe transmission of data. Registry Coordinators from the AMI registry visit the medical records offices of the hospitals to collect additional information in their laptops.

Information submitted by medical practitioners who continue to notify AMI cases using hard copy notifications (i.e. AMI home death cases) are entered into the NRDS. The hardcopy forms are subsequently scanned and stored in an electronic repository.

- g) Data requests

The data in the Singapore Myocardial Infarction Registry is a resource for epidemiological studies, public health research and policy making. Data request forms can be downloaded from NRDO's website. Upon approval, the information is usually released as aggregate data or key-coded records.

The data in the Registry is updated regularly and hence there may be differences in the figures presented in this report when compared to previous reports. The information contained within this report should be considered to be more reliable where differences exist.

### **Denominators for AMI statistics**

In this report, we are presenting population denominators from the Ministry of Health, which were in turn obtained from the Department of Statistics, Singapore to calculate incidence and mortality rates. This set of denominators is used by most government agencies and by adopting these denominators; we align our report with other official publications. In this report, only Singapore citizens and permanent residents (i.e. "Singapore residents") are included and age standardization is obtained by direct method using the UICC "World population".

Department of Statistics (DOS) releases mid-year population estimates annually and these population denominators obtained from DOS (termed as "DOS population denominators" in this publication) in the calculation of AMI overall; and age-specific incidence and mortality rates.

## Calculation of rates

### Incidence rate

For the computation of the incidence of AMI, the population of AMI patients for a particular year was extracted based on the date AMI episode occurred.

### Death rate

Deaths were reported and updated till February 2013 for all patients registered in the SMIR within the period of analysis by matching the patients' NRIC with death information imported from the Death Registry, Ministry of Home Affairs.

### Case fatality rate

Case fatalities were calculated for AMI episodes which resulted in death from AMI within 28 days after presentation with AMI, regardless if the death occurred in the hospital or elsewhere.

## 3. EXECUTIVE SUMMARY

The overall age-standardised incidence rates have increased significantly from 2009 to 2012 while the overall age-standardised mortality rates have decreased from 2008 to 2012.

The increase in ASIR is mainly due to the increase in age-specific rates among persons aged 70 years and above. The ASIR of males is more than twice that of females while the ASMR of males is less than twice that of females. Males had higher age-standardised prevalences of risk factors compared to females.

Malays had been having the highest ASIR and ASMR since 2010. The ASIR among all ethnicities have increased since 2010.

The higher incidence of AMI among Malays is likely to be due to their higher proportions of hypertension and high cholesterol compared to the other ethnic groups<sup>3</sup>. Malays also had a higher proportion of undiagnosed hypertension as well as more severe hypertension, compared to the other ethnic groups.

The overall case fatality rate has dropped from 16.5% in 2008 to 9.8% in 2012, suggesting better management of patients diagnosed with AMI. Chinese have had the highest case fatality rates among the ethnic groups.

Hypertension and hyperlipidemia were the two most common risk factors among AMI patients. The top three symptoms reported by patients with AMI were chest pain, breathlessness and diaphoresis, respectively. The proportion of patients given medication has improved and exceeded 95% in 2012. Arrhythmic complications were found to be the most common complication after an AMI, whereas left ventricular systolic dysfunction was the more common occurrence after a patient was hospitalised.

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3 National Health Survey 2010. Epidemiology & Disease Control Division. Ministry of Health, Singapore.

#### 4. AMI INCIDENCE 2007 - 2012: ALL RESIDENTS

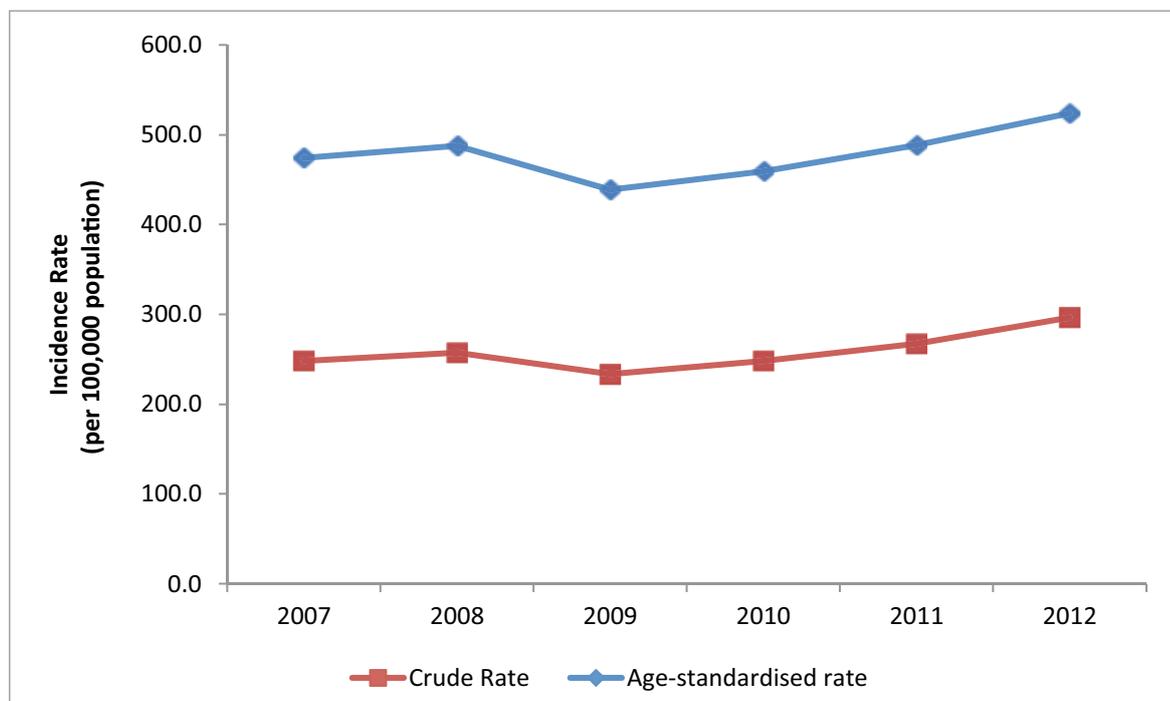
##### 4.1 AMI Incidences, Overall, 2007 - 2012

The average number of AMI episodes from 2007 to 2012 has been approximately 7,531 a year. (Table 4.1.1). The crude AMI incidence rates ranged from 233.5 per 100,000 population to 296.4 per 100,000 population during the 6-year period. The overall age-standardised AMI incidence rate has increased significantly from 2009 to 2012 ( $p=0.02$ ) and is approximately 222.3 per 100,000 population annually (Table 4.1.1, Figure 4.1.1).

**Table 4.1.1 AMI INCIDENCE, OVERALL, 2007 - 2012**

Year	2007	2008	2009	2010	2011	2012
No. of cases	6817	7245	6790	7340	7997	8998
Crude rate	247.9 (242.0-253.8)	257.5 (251.6-263.4)	233.5 (227.9-239.0)	248.0 (242.4-253.7)	266.9 (261.1-272.8)	296.4 (290.2-302.5)
Age-standardised rate	226.7 (221.2-232.1)	230.2 (224.8-235.6)	205.4 (200.4-210.3)	210.9 (206.0-215.8)	221.6 (216.6-226.6)	238.9 (233.9-243.9)

**Figure 4.1.1 CRUDE AND AGE-STANDARDISED INCIDENCE RATES (PER 100,000 POPULATION) OF AMI, OVERALL, 2007 - 2012**



The number and rate of AMI episodes increases as age increases. (Tables 4.1.2 and 4.1.3). The mean and median ages of incident AMI episodes remained stable and ranged from 67.5 to 68.4 years and 68.5 to 69.2 years respectively during the 6-year period (Table 4.1.4).

**Table 4.1.2 INCIDENT AMI CASES BY AGE GROUP, OVERALL, 2007 - 2012**

Age Group	2007	2008	2009	2010	2011	2012
18-19	0	0	1	0	0	0
20-24	0	3	0	3	3	3
25-29	10	7	12	9	10	10
30-34	25	26	28	25	25	31
35-39	92	94	84	92	101	107
40-44	234	227	224	218	212	230
45-49	470	415	425	458	496	491
50-54	642	695	651	749	686	821
55-59	710	766	757	813	849	973
60-64	646	785	785	814	1004	1127
65-69	810	822	721	669	775	951
70-74	857	879	828	904	983	1107
75-79	894	946	907	921	1024	1073
80-84	672	787	685	805	896	1000
>=85	755	793	682	860	933	1074

**Table 4.1.3 AGE-SPECIFIC INCIDENCE RATE OF AMI (PER 100,000 POPULATION), OVERALL, 2007 - 2012**

Age Group	2007	2008	2009	2010	2011	2012
18-19	0.0	0.0	1.0	0.0	0.0	0.0
20-24	0.0	1.3	0.0	1.2	1.2	1.1
25-29	3.9	2.7	4.4	3.3	3.8	3.9
30-34	8.5	9.0	9.4	8.4	8.4	10.5
35-39	30.5	30.6	26.5	28.8	31.9	34.1
40-44	72.9	71.5	71.6	70.4	69.1	74.5
45-49	149.0	130.5	131.8	141.5	153.1	153.0
50-54	230.0	240.3	218.9	247.1	222.7	264.5
55-59	321.4	333.9	315.4	326.9	325.9	358.0
60-64	476.8	512.4	462.6	424.2	482.5	526.9
65-69	711.8	714.2	620.5	601.1	689.5	737.8
70-74	1090.3	1081.2	947.4	976.2	983.0	1060.3
75-79	1573.9	1606.1	1472.4	1414.7	1530.6	1587.3
80-84	2126.6	2328.4	1841.4	2022.6	2123.2	2267.6
>=85	3044.4	2992.5	2462.1	2925.2	3009.7	3206.0

**Table 4.1.4 MEAN AND MEDIAN AGE, INCIDENT AMI, 2007 - 2012**

Year	2007	2008	2009	2010	2011	2012
Median Age	68.6	68.9	68.5	69.0	69.2	68.5
Mean Age	67.8	68.0	67.5	67.9	68.4	68.4

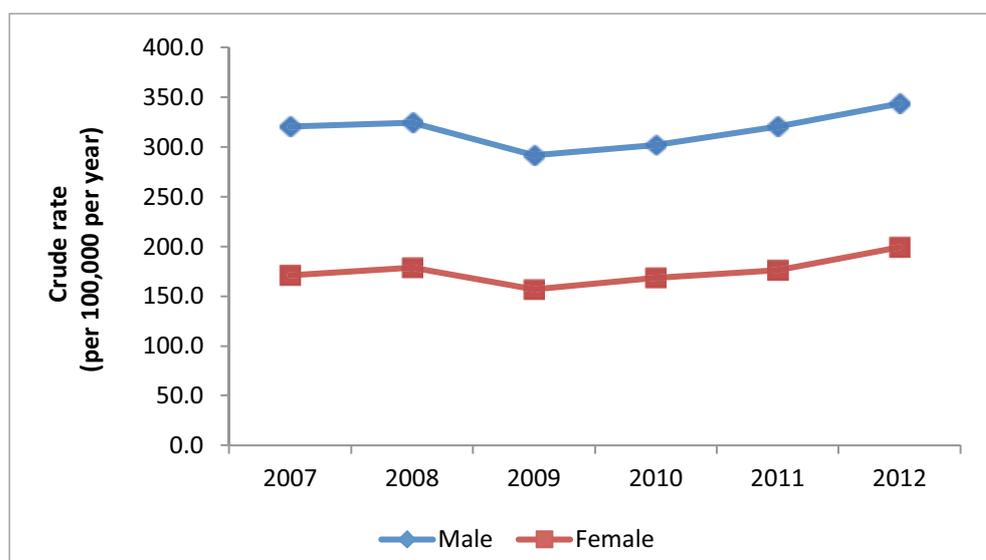
**4.2 Incidence of AMI Cases, By Gender, 2007 - 2012**

Approximately, twice more men than women suffer from AMI each year as observed in the crude numbers and incidence rates (Table 4.2.1, Figure 4.2.1, Table 4.2.2). The age-standardised incidence rate among males seemed to have increased to a greater extent compared to females (Figure 4.2.2, Table 4.2.3).

**Table 4.2.1 INCIDENT AMI CASES, BY GENDER, 2007 - 2012**

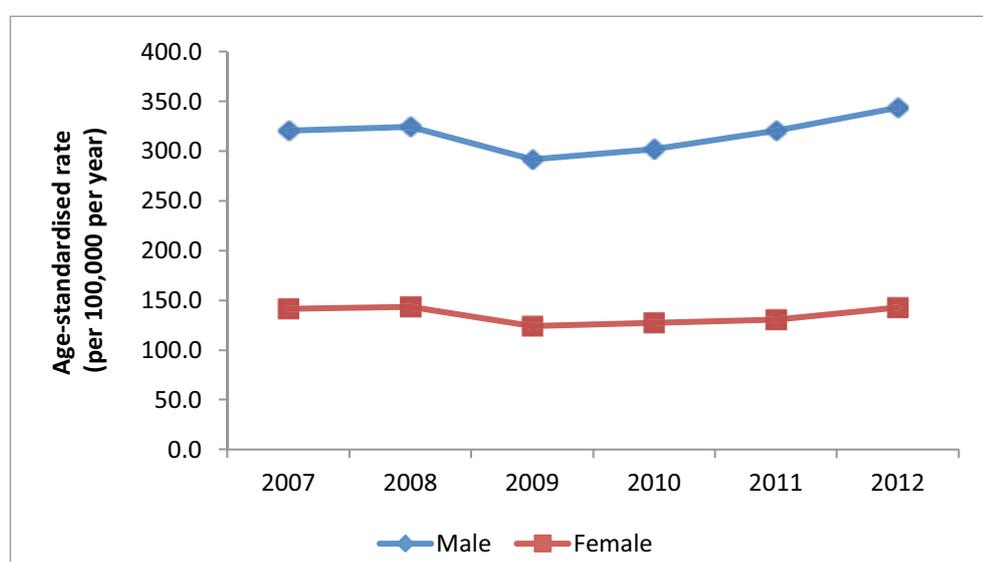
Gender	2007	2008	2009	2010	2011	2012
Male	4420	4681	4460	4795	5295	5896
Female	2397	2564	2330	2545	2702	3102

**Figure 4.2.1 CRUDE INCIDENCE RATES (PER 100,000 POPULATION) OF AMI, BY GENDER, 2007 - 2012**



**Table 4.2.2 CRUDE INCIDENCE RATES (PER 100,000 POPULATION) OF AMI, BY GENDER, 2007 - 2012**

Gender	2007	2008	2009	2010	2011	2012
Male	327.9 (318.3-337.6)	339.7 (329.9-349.4)	313.5 (304.3-322.7)	331.5 (322.2-340.9)	361.9 (352.1-371.6)	398.1 (388.0-408.3)
Female	171.0 (164.2-177.8)	178.6 (171.7-185.5)	156.8 (150.5-163.2)	168.2 (161.7-174.8)	176.3 (169.6-182.9)	199.4 (192.4-206.5)

**Figure 4.2.2 AGE-STANDARDISED INCIDENCE RATES (PER 100,000 POPULATION) OF AMI, BY GENDER, 2007 - 2012****Table 4.2.3 AGE-STANDARDISED INCIDENCE RATES (PER 100,000 POPULATION) OF AMI, BY GENDER, 2007 - 2012**

Gender	2007	2008	2009	2010	2011	2012
Male	320.5 (310.9-330.2)	324.7 (315.3-334.1)	291.4 (282.8-300.1)	301.6 (293.0-310.3)	320.3 (311.6-329.1)	343.5 (334.6-352.3)
Female	141.2 (135.4-147.0)	143.5 (137.8-149.3)	124.1 (118.9-129.3)	127.2 (122.1-132.3)	130.6 (125.5-135.8)	142.7 (137.5-147.9)

**Table 4.2.4 MEAN AND MEDIAN AGE, INCIDENT AMI, BY GENDER, 2007 - 2012**

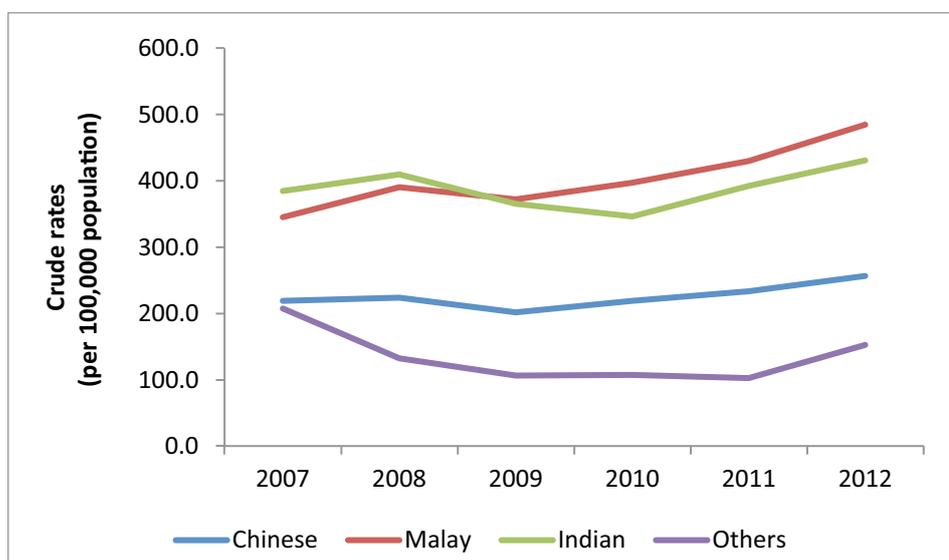
Gender	Year	2007	2008	2009	2010	2011	2012
Male	Median Age	64.6	64.3	62.8	63.3	64.0	64.2
	Mean Age	64.6	64.7	63.9	64.5	65.0	65.1
Female	Median Age	75.4	75.6	76.0	76.1	76.3	76.0
	Mean Age	73.5	74.0	74.4	74.4	74.9	74.5

### 4.3 Incidence of AMI Cases, By Ethnic Group, 2007 - 2012

Indians had the highest ASIR of AMI between 2007 – 2009 but this was surpassed by the Malays in 2010 (Figure 4.3.2, Table 4.3.3). The Chinese had a significantly increasing trend in ASIR from 2009 ( $p < 0.01$ ) onwards while the ASIR among Malays started showing a significant upward trend since 2010 ( $p < 0.01$ ).

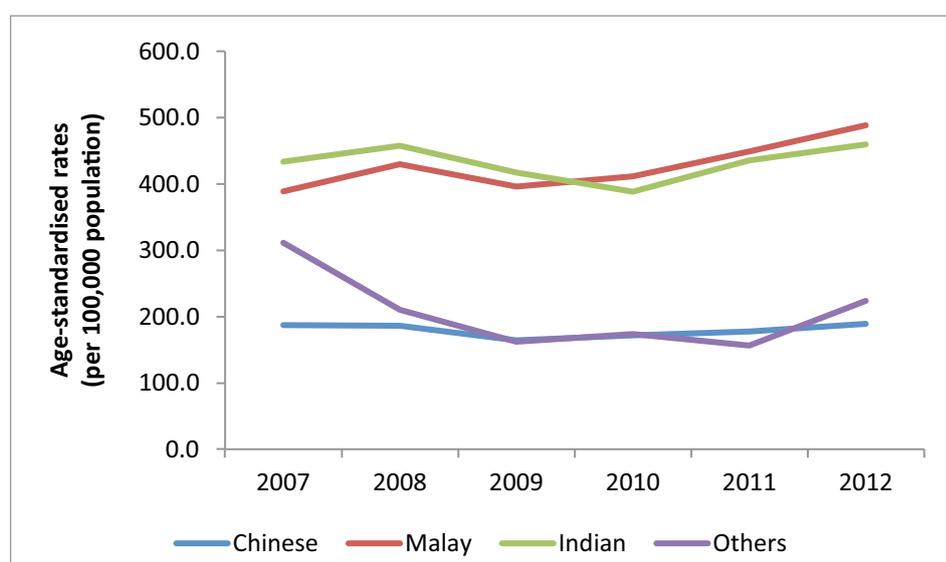
**Table 4.3.1 AMI CASES, BY ETHNIC GROUP, 2007 - 2012**

Ethnic Group	2007	2008	2009	2010	2011	2012
Chinese	4630	4820	4448	4903	5290	5893
Malay	1169	1352	1318	1439	1583	1819
Indian	879	974	930	898	1028	1142
Others	139	99	94	100	96	144

**Figure 4.3.1 CRUDE INCIDENCE RATES (PER 100,000 POPULATION) OF AMI, BY ETHNIC GROUP, 2007 - 2012**

**Table 4.3.2 CRUDE INCIDENCE RATES (PER 100,000 POPULATION) OF AMI, BY ETHNIC GROUP, 2007 - 2012**

Ethnic Group	2007	2008	2009	2010	2011	2012
Chinese	187.3 (181.8-192.8)	186.3 (181.0-191.6)	164.2 (159.3-169.1)	171.5 (166.6-176.4)	177.1 (172.3-182.0)	189.1 (184.2-194.0)
Malay	388.8 (365.8-411.8)	429.8 (406.2-453.4)	396.0 (373.9-418.1)	411.5 (389.4-433.5)	448.6 (425.7-471.6)	488.4 (465.4-511.5)
Indian	433.5 (403.7-463.2)	457.7 (428.0-487.4)	417.0 (389.3-444.7)	388.4 (362.2-414.6)	435.3 (407.8-462.9)	459.4 (432.0-486.7)
Others	311.5 (256.9-366.2)	210.0 (166.4-253.6)	162.3 (126.7-197.9)	173.7 (136.6-210.8)	156.0 (122.2-189.8)	224.1 (185.0-263.2)

**Figure 4.3.2 AGE-STANDARDISED INCIDENCE RATES (PER 100,000 POPULATION) OF AMI, BY ETHNIC GROUP, 2007 - 2012****Table 4.3.3 AGE-STANDARDISED INCIDENCE RATES (PER 100,000 POPULATION) OF AMI, BY ETHNIC GROUP, 2007 - 2012**

Ethnic Group	2007	2008	2009	2010	2011	2012
Chinese	218.9 (212.6-225.2)	223.7 (217.4-230.0)	201.2 (195.3-207.1)	218.5 (212.4-224.6)	232.9 (226.6-239.2)	256.0 (249.5-262.6)
Malay	344.6 (324.9-364.4)	390.0 (369.2-410.8)	371.8 (351.7-391.8)	397.4 (376.9-418.0)	429.6 (408.4-450.8)	485.1 (462.8-507.4)
Indian	384.4 (359.0-409.9)	409.9 (384.1-435.6)	365.4 (341.9-388.8)	346.2 (323.5-368.8)	392.2 (368.2-416.2)	430.6 (405.6-455.6)
Others	207.5 (173.0-242.0)	132.2 (106.2-158.3)	105.8 (84.4-127.2)	106.9 (85.9-127.8)	102.2 (81.8-122.7)	152.9 (128.0-177.9)

#### 4.4 Incidence of AMI Cases, By AMI Type, 2007 - 2012

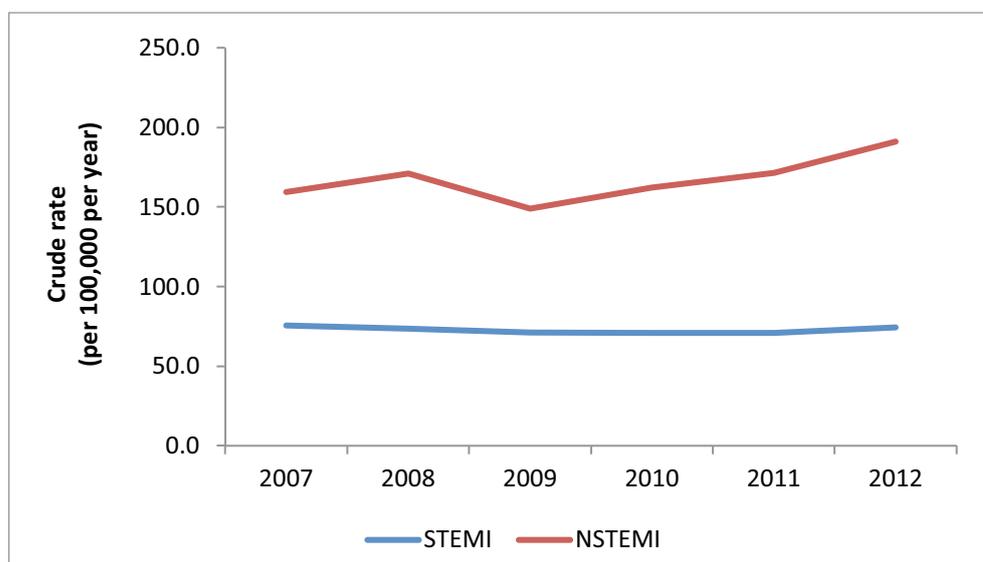
Number of Non-ST Segment Elevation Myocardial Infarction (NSTEMI) has consistently been approximately twice that of ST Segment Elevation Myocardial Infarction (STEMI) (Table 4.4.1). The incident number of STEMI episodes has increased yearly since 2008, while NSTEMI numbers increased from 2009 onwards leading to the yearly increases in overall AMI numbers.

The ASIR of NSTEMI is about twice that of STEMI (Figure 4.4.2, Table 4.4.3). There is a decreasing trend in the STEMI ASIR, though in most years, this decrease was non-significant. The NSTEMI ASIR has been increasing significantly since 2009.

**Table 4.4.1 INCIDENCE OF AMI, BY AMI TYPE, 2007 - 2012**

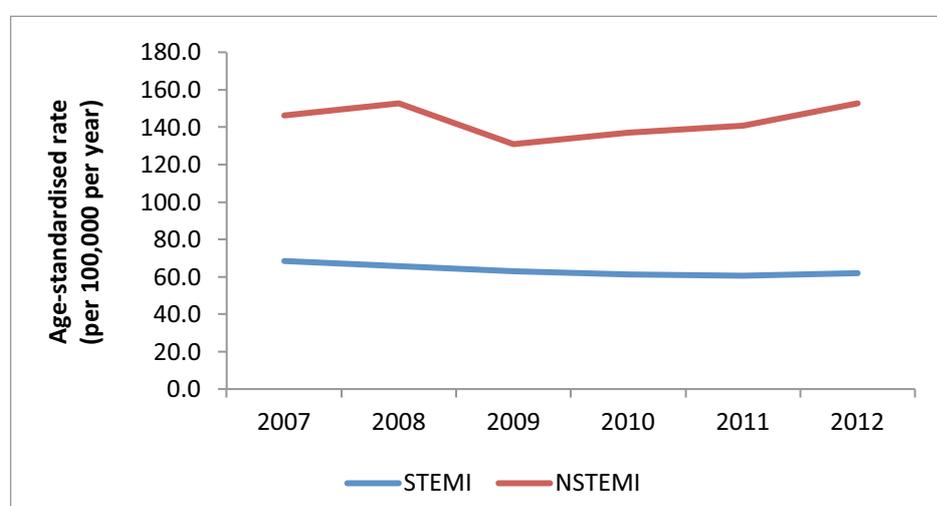
Subtype	2007	2008	2009	2010	2011	2012
<b>STEMI</b>	2077	2068	2070	2099	2124	2261
<b>NSTEMI</b>	4379	4807	4333	4800	5133	5796
<b>“Unknown”</b>	361	370	387	441	740	941

**Figure 4.4.1 CRUDE INCIDENCE RATES (PER 100,000 POPULATION) OF AMI, BY AMI TYPE, 2007 - 2012**



**Table 4.4.2 CRUDE INCIDENCE RATES (PER 100,000 POPULATION) OF AMI, BY AMI TYPE, 2007 - 2012**

Subtype	2007	2008	2009	2010	2011	2012
<b>STEMI</b>	75.5 (72.3-78.8)	73.5 (70.3-76.7)	71.2 (68.1-74.2)	70.9 (67.9-74.0)	70.9 (67.9-73.9)	74.5 (71.4-77.5)
<b>NSTEMI</b>	159.3 (154.5-164.0)	170.9 (166.0-175.7)	149.0 (144.5-153.4)	162.2 (157.6-166.8)	171.3 (166.6-176.0)	190.9 (186.0-195.8)

**Figure 4.4.2 AGE-STANDARDISED INCIDENCE RATES (PER 100,000 POPULATION) OF AMI, BY AMI TYPE, 2007 - 2012****Table 4.4.3 AGE-STANDARDISED INCIDENCE RATES (PER 100,000 POPULATION) OF AMI, BY AMI TYPE, 2007 - 2012**

Subtype	2007	2008	2009	2010	2011	2012
<b>STEMI</b>	68.5 (65.5-71.5)	65.9 (63.0-68.7)	62.9 (60.1-65.6)	61.3 (58.6-64.0)	60.5 (57.9-63.2)	61.8 (59.2-64.4)
<b>NSTEMI</b>	146.2 (141.8-150.6)	152.6 (148.3-157.0)	130.9 (127.0-134.9)	137.1 (133.2-141.1)	140.9 (136.9-144.8)	152.6 (148.6-156.6)

## 5. AMI MORTALITY 2007 - 2012: ALL RESIDENTS

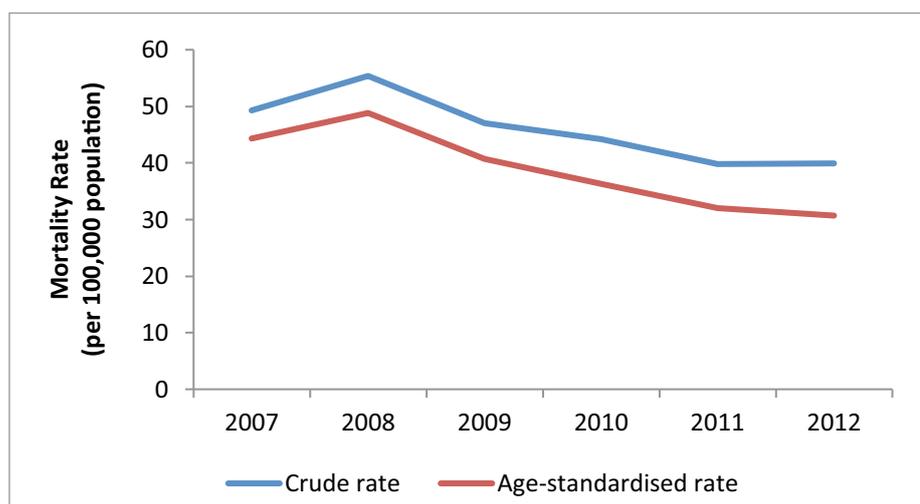
### 5.1 AMI Deaths, Overall, 2007 - 2012

The number of deaths among AMI patients decreased from 1,356 in 2007 to 1,210 in 2012 (Table 5.1.1). Correspondingly, the crude AMI mortality rates decreased from 49.3 per 100,000 population in 2007 to 39.9 per 100,000 population in 2012 (Table 5.1.1, Figure 5.1.1). The overall age-standardised death rates decreased from 44.3 in 2007 to 30.7 in 2012.

**Table 5.1.1 AMI DEATHS, OVERALL, 2007 - 2012**

Year	2007	2008	2009	2010	2011	2012
No. of deaths	1356	1559	1369	1307	1191	1210
Crude rate	49.3 (46.7-51.9)	55.4 (52.7-58.2)	47.1 (44.6-49.6)	44.2 (41.8-46.6)	39.8 (37.5-42.0)	39.9 (37.6-42.1)
Age-standardised rate	44.3 (41.9-46.7)	48.9 (46.4-51.4)	40.7 (38.5-42.9)	36.3 (34.3-38.3)	32.0 (30.1-33.8)	30.7 (28.9-32.4)

**Figure 5.1.1 CRUDE AND AGE-STANDARDISED MORTALITY RATES (PER 100,000 POPULATION) OF AMI, OVERALL, 2007 - 2012**



The largest number of deaths occurred amongst patients at the age of 85 years and older (Table 5.1.2). The mean and median ages at death after suffering from an AMI ranged from 74.0 to 75.6 years and 75.8 to 77.1 years respectively during the 6-year period (Table 5.1.4).

**Table 5.1.2 AMI DEATHS, BY AGE GROUP, 2007 - 2012**

Age Group	2007	2008	2009	2010	2011	2012
18-19	0	0	0	0	0	0
20-24	0	0	0	1	0	0
25-29	1	1	1	1	0	4
30-34	2	3	1	2	2	0
35-39	10	8	5	1	6	6
40-44	18	31	15	14	14	10
45-49	47	46	35	40	46	29
50-54	73	81	87	61	50	64
55-59	104	109	90	58	73	71
60-64	83	128	116	122	114	112
65-69	139	177	144	110	105	103
70-74	205	195	174	152	142	135
75-79	234	239	259	213	169	180
80-84	200	228	170	251	192	192
>=85	240	313	272	281	278	304

**Table 5.1.3 AGE-SPECIFIC AMI MORTALITY RATE (PER 100,000 POPULATION), OVERALL, 2007 - 2012**

Age Group	2007	2008	2009	2010	2011	2012
18-19	0.0	0.0	0.0	0.0	0.0	0.0
20-24	0.0	0.0	0.0	0.4	0.0	0.0
25-29	0.4	0.4	0.4	0.4	0.0	1.6
30-34	0.7	1.0	0.3	0.7	0.7	0.0
35-39	3.3	2.6	1.6	0.3	1.9	1.9
40-44	5.6	9.8	4.8	4.5	4.6	3.2
45-49	14.9	14.5	10.9	12.4	14.2	9.0
50-54	26.2	28.0	29.3	20.1	16.2	20.6
55-59	47.1	47.5	37.5	23.3	28.0	26.1
60-64	61.3	83.6	68.4	63.6	54.8	52.4
65-69	122.1	153.8	123.9	98.8	93.4	79.9
70-74	260.8	239.9	199.1	164.1	142.0	129.3
75-79	412.0	405.8	420.5	327.2	252.6	266.3
80-84	632.9	674.6	457.0	630.7	455.0	435.4
>=85	967.7	1,181.1	981.9	955.8	896.8	907.5

**Table 5.1.4 MEAN AND MEDIAN AGE AT DEATH, 2007 - 2012**

Year	2007	2008	2009	2010	2011	2012
Median Age	75.8	75.9	76.1	76.8	77.1	76.9
Mean Age	74.0	74.3	74.6	75.2	75.2	75.6

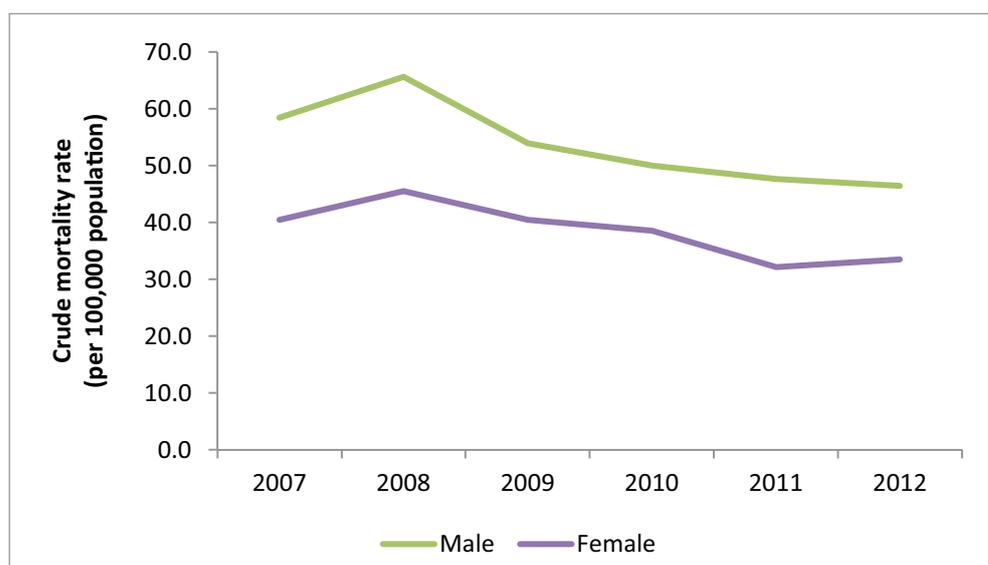
## 5.2 AMI Deaths, By Gender, 2007 - 2012

Although twice more men than women suffer from AMI each year, the mortality ratio of men to women ranged from 1.24:1 to 1.42:1 over the 6-year period (Table 5.2.1).

**Table 5.2.1 AMI DEATHS, BY GENDER, 2007 - 2012**

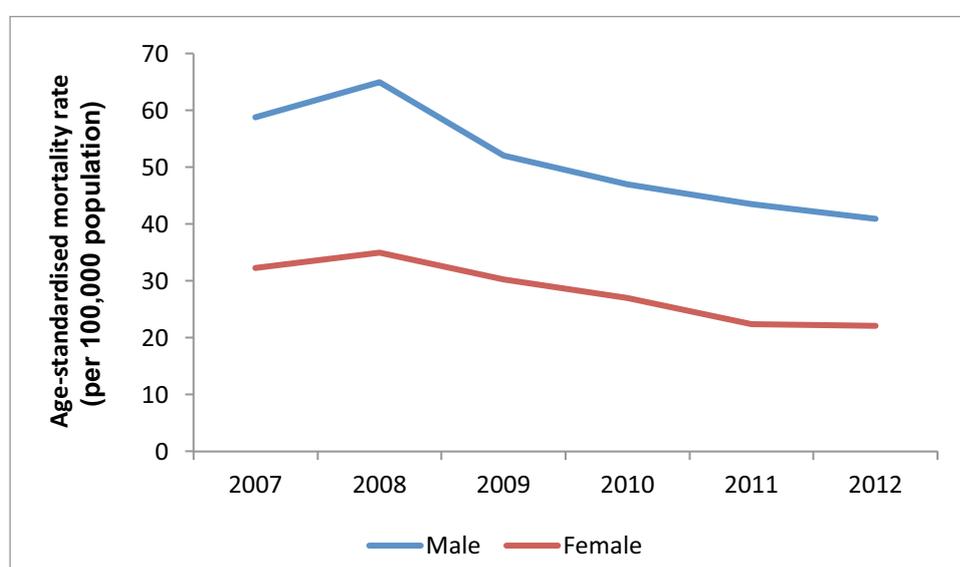
Gender	2007	2008	2009	2010	2011	2012
Male	788	905	767	724	698	688
Female	568	654	602	583	493	522

The age-standardised mortality rates have declined in both genders from 2008 - 2012 (Figure 5.2.2).

**Figure 5.2.1 CRUDE MORTALITY RATES (PER 100,000 POPULATION) OF AMI, BY GENDER, 2007 - 2012**

**Table 5.2.2 CRUDE MORTALITY RATES (PER 100,000 POPULATION) OF AMI, BY GENDER, 2007 - 2012**

Gender	2007	2008	2009	2010	2011	2012
Male	58.5 (54.4-62.5)	65.7 (61.4-69.9)	53.9 (50.1-57.7)	50.1 (46.4-53.7)	47.7 (44.2-51.2)	46.5 (43.0-49.9)
Female	40.5 (37.2-43.9)	45.6 (42.1-49.1)	40.5 (37.3-43.8)	38.5 (35.4-41.7)	32.2 (29.3-35.0)	33.6 (30.7-36.4)

**Figure 5.2.2 AGE-STANDARDISED MORTALITY RATES (PER 100,000 POPULATION) OF AMI, BY GENDER, 2007 - 2012****Table 5.2.3 AGE-STANDARDISED MORTALITY RATES (PER 100,000 POPULATION) OF AMI, BY GENDER, 2007 - 2012**

Gender	2007	2008	2009	2010	2011	2012
Male	58.8 (54.6-63.0)	65.0 (60.7-69.3)	52.1 (48.3-55.8)	47.0 (43.5-50.5)	43.5 (40.2-46.7)	40.9 (37.8-44.0)
Female	32.3 (29.5-35.0)	35.0 (32.2-37.8)	30.3 (27.8-32.8)	27.0 (24.7-29.3)	22.4 (20.3-24.5)	22.1 (20.1-24.1)

**Table 5.2.4 MEAN AND MEDIAN AGE AT DEATH, BY GENDER, 2007 - 2012**

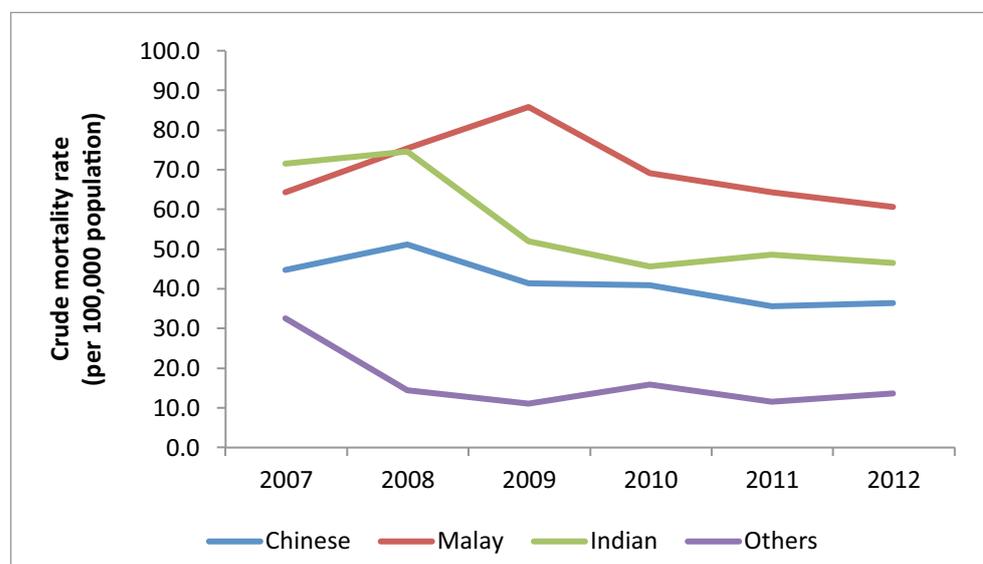
Gender	Year	2007	2008	2009	2010	2011	2012
Male	Median Age	73.3	73.0	73.0	74.3	74.6	74.3
	Mean Age	71.6	71.4	71.6	72.6	72.8	73.2
Female	Median Age	78.7	79.5	79.3	80.2	80.1	80.5
	Mean Age	77.6	77.9	78.0	78.7	78.4	78.7

### 5.3 AMI Deaths, By Ethnic Group, 2007 - 2012

There was no discernible trend in the absolute number of deaths among the various ethnic groups (Table 5.3.1).

**Table 5.3.1 AMI DEATHS, BY ETHNIC GROUP, 2007 - 2012**

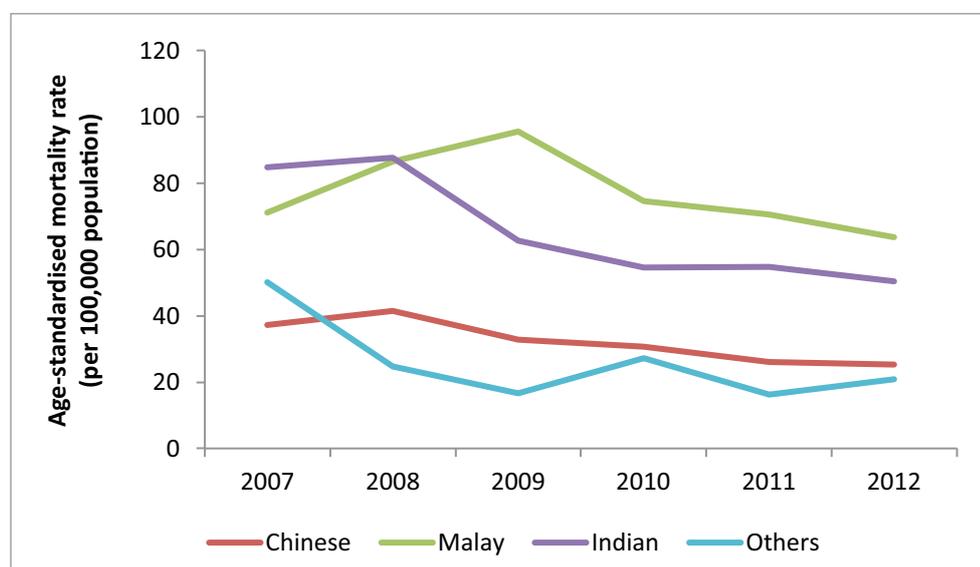
Ethnic Group	2007	2008	2009	2010	2011	2012
Chinese	951	1108	921	922	814	845
Malay	219	262	305	251	238	228
Indian	164	178	133	119	128	124
Others	22	11	10	15	11	13

**Figure 5.3.1 CRUDE MORTALITY RATES (PER 100,000 POPULATION) OF AMI, BY ETHNIC GROUP, 2007 - 2012**

**Table 5.3.2 CRUDE MORTALITY RATES (PER 100,000 POPULATION) OF AMI, BY ETHNIC GROUP, 2007 - 2012**

Ethnic Group	2007	2008	2009	2010	2011	2012
<b>Chinese</b>	45.0 (42.1-47.8)	51.4 (48.4-54.5)	41.7 (39.0-44.4)	41.1 (38.4-43.7)	35.8 (33.4-38.3)	36.7 (34.2-39.2)
<b>Malay</b>	64.6 (56.0-73.1)	75.6 (66.4-84.7)	86.0 (76.4-95.7)	69.3 (60.7-77.9)	64.6 (56.4-72.8)	60.8 (52.9-68.7)
<b>Indian</b>	71.7 (60.8-82.7)	74.9 (63.9-85.9)	52.3 (43.4-61.1)	45.9 (37.6-54.1)	48.8 (40.4-57.3)	46.8 (38.5-55.0)
<b>Others</b>	32.8 (19.1-46.6)	14.7 (6.0-23.4)	11.3 (4.3-18.2)	16.0 (7.9-24.1)	11.7 (4.8-18.6)	13.8 (6.3-21.3)

Indians had the highest ASMR in 2007 and 2008 but this was surpassed by the Malays from 2009. The ASMR of Malays was about 2.5 times that of Chinese in 2012 (Figure 5.3.2, Table 5.3.3).

**Figure 5.3.2 AGE-STANDARDISED MORTALITY RATES (PER 100,000 POPULATION) OF AMI, BY ETHNIC GROUP, 2007 - 2012**

**Table 5.3.3 AGE-STANDARDISED MORTALITY RATES (PER 100,000 POPULATION) OF AMI, BY ETHNIC GROUP, 2007 - 2012**

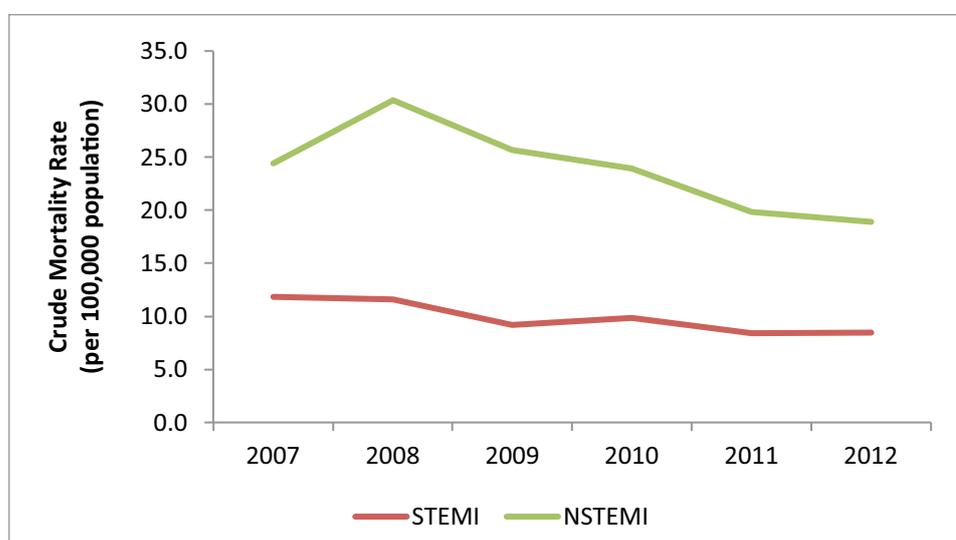
Ethnic Group	2007	2008	2009	2010	2011	2012
<b>Chinese</b>	37.3 (34.9-39.7)	41.5 (39.0-44.0)	32.8 (30.6-34.9)	30.7 (28.7-32.8)	26 (24.2-27.9)	25.3 (23.6-27.1)
<b>Malay</b>	71.2 (61.5-80.9)	86.6 (75.8-97.5)	95.6 (84.5-106.7)	74.6 (65.0-84.3)	70.5 (61.2-79.9)	63.7 (55.1-72.2)
<b>Indian</b>	84.7 (71.3-98.2)	87.7 (74.4-101.0)	62.7 (51.7-73.8)	54.5 (44.4-64.6)	54.8 (44.9-64.7)	50.4 (41.3-59.4)
<b>Others</b>	50.2 (28.4-72.1)	24.7 (9.6-39.8)	16.6 (6.2-27.1)	27.3 (12.6-42.1)	16.2 (6.1-26.3)	20.8 (8.9-32.7)

**5.4 AMI Deaths, By AMI Type, 2007 - 2012**

The number of deaths amongst AMI patients diagnosed with NSTEMI is approximately twice the number of deaths amongst patients diagnosed with STEMI (Table 5.4.1).

**Table 5.4.1 AMI DEATHS, BY AMI TYPE, 2007 - 2012**

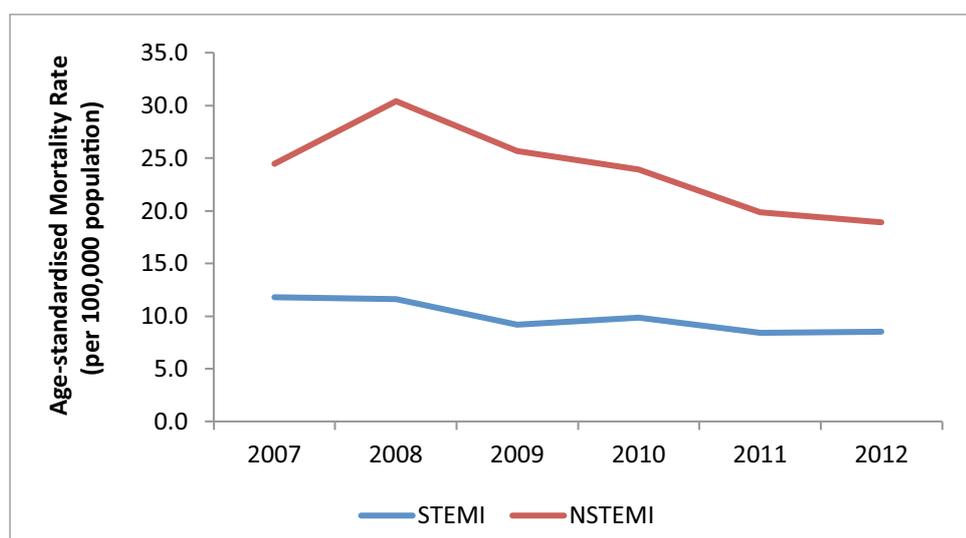
Subtype	2007	2008	2009	2010	2011	2012
<b>STEMI</b>	325	327	268	291	252	258
<b>NSTEMI</b>	672	855	747	708	595	574
<b>“Unknown”</b>	359	377	354	308	344	378

**Figure 5.4.1 CRUDE MORTALITY RATES (PER 100,000 POPULATION) OF AMI, BY AMI TYPE, 2007 - 2012**

**Table 5.4.2 CRUDE MORTALITY RATES (PER 100,000 POPULATION) OF AMI, BY AMI TYPE, 2007 - 2012**

Subtype	2007	2008	2009	2010	2011	2012
STEMI	11.8 (10.5-13.1)	11.6 (10.4-12.9)	9.2 (8.1-10.3)	9.8 (8.7-11.0)	8.4 (7.4-9.5)	8.5 (7.5-9.5)
NSTEMI	24.4 (22.6-26.3)	30.4 (28.4-32.4)	25.7 (23.8-27.5)	23.9 (22.2-25.7)	19.9 (18.3-21.5)	18.9 (17.4-20.5)

After age-standardisation, the mortality rates amongst patients with STEMI and NSTEMI decreased from 2008 to 2012 (Figure 5.4.2, Table 5.4.3).

**Figure 5.4.2 AGE-STANDARDISED MORTALITY RATES (PER 100,000 POPULATION) OF AMI, BY AMI TYPE, 2007 - 2012****Table 5.4.3 AGE-STANDARDISED MORTALITY RATES (PER 100,000 POPULATION) OF AMI, BY AMI TYPE, 2007 - 2012**

Subtype	2007	2008	2009	2010	2011	2012
STEMI	10.7 (9.5-11.9)	10.3 (9.1-11.4)	8.0 (7.0-8.9)	8.1 (7.2-9.1)	6.9 (6.0-7.7)	6.6 (5.7-7.4)
NSTEMI	21.7 (20.0-23.3)	26.7 (24.9-28.6)	22.1 (20.5-23.8)	19.3 (17.8-20.7)	15.5 (14.3-16.8)	14.3 (13.1-15.4)

## 6 AMI 28-DAY CASE-FATALITY 2007 - 2012: ALL RESIDENTS

### 6.1 AMI 28-Day Case-Fatality, Overall, 2007 - 2012

The number of AMI patients dying within 28 days after suffering from an AMI decreased from 1,193 in 2008 to 886 in 2012 (Table 6.1.1). The overall case fatality rate has dropped from 16.5% in 2008 to 9.8% in 2012, indicating a possible drop in the severity of the disease or an improvement in the management of patients diagnosed with AMI.

The number of AMI deaths amongst patients within 28 days of an AMI onset was consistently highest amongst patients aged 85 years and above during the 6-year period except in 2009 (Table 6.1.2).

**Table 6.1.1 AMI 28-DAY CASE-FATALITY, OVERALL, 2007 - 2012**

	2007	2008	2009	2010	2011	2012
<b>No. of cases</b>	1088	1193	1032	966	860	886
<b>Case fatality rate (%)</b>	16.0	16.5	15.2	13.2	10.8	9.8

**Table 6.1.2 AMI 28-DAY CASE-FATALITY, BY AGE GROUP, 2007 - 2012**

Age Group	2007	2008	2009	2010	2011	2012
<b>18-19</b>	0	0	0	0	0	0
<b>20-24</b>	0	0	0	1	0	0
<b>25-29</b>	1	1	1	1	0	1
<b>30-34</b>	2	3	1	2	2	0
<b>35-39</b>	10	8	5	1	6	5
<b>40-44</b>	16	28	14	13	8	9
<b>45-49</b>	41	37	32	33	39	24
<b>50-54</b>	64	68	73	52	42	47
<b>55-59</b>	85	88	78	47	60	57
<b>60-64</b>	73	103	90	93	84	84
<b>65-69</b>	111	131	100	75	80	80
<b>70-74</b>	163	149	125	111	104	94
<b>75-79</b>	178	180	193	157	117	132
<b>80-84</b>	153	170	131	169	132	139
<b>&gt;=85</b>	191	227	189	211	186	214

## 6.2 AMI 28-Day Case-Fatality, By Gender, 2007 - 2012

The ratio of AMI deaths within 28 days of an AMI onset amongst males to females ranged from 1.33:1 to 1.51:1 during the 6-year period (Table 6.2.1). Contrary to the higher incidence and mortality rates, the case-fatality rates amongst females were consistently higher than males during the 6-year period. This is likely because the median age of AMI diagnosis among females is more than 10 years older compared to males (Table 4.2.4).

The trend of case fatality rates by each gender corresponds to the overall trends, with a decreasing trend observed from 2008 onwards. (Table 6.2.2)

**Table 6.2.1 AMI 28-DAY CASE-FATALITY, BY GENDER, 2007 - 2012**

Gender	2007	2008	2009	2010	2011	2012
Male	653	708	604	554	518	505
Female	435	485	428	412	342	381

**Table 6.2.2 AMI 28-DAY CASE-FATALITY RATES (%) by Gender, 2007 - 2012**

Gender	2007	2008	2009	2010	2011	2012
Male	14.8	15.1	13.5	11.6	9.8	8.6
Female	18.1	18.9	18.4	16.2	12.7	12.3

## 6.3 AMI 28-Day Case-Fatality, By Ethnic Group, 2007 - 2012

The Chinese had the highest case-fatality rates over the years, except for 2009, where the Malays had the highest rates. The case-fatality rates for all ethnicities have been decreasing since 2009 (Table 6.3.2).

**Table 6.3.1 AMI 28-DAY CASE-FATALITY, BY ETHNIC GROUP, 2007 - 2012**

Ethnic Group	2007	2008	2009	2010	2011	2012
Chinese	768	858	705	686	591	637
Malay	168	203	217	187	177	153
Indian	133	128	101	82	85	82
Others	19	4	9	11	7	14

**Table 6.3.2 AMI 28-DAY CASE-FATALITY RATES (%), BY ETHNIC GROUP, 2007 - 2012**

Ethnic Group	2007	2008	2009	2010	2011	2012
Chinese	16.6	17.8	15.8	14.0	11.2	10.8
Malay	14.4	15.0	16.5	13.0	11.2	8.4
Indian	15.1	13.1	10.9	9.1	8.3	7.2
Others	13.7	4.0	9.6	11.0	7.3	9.7

**6.4 AMI 28-Day Case-Fatality, By AMI Type, 2007 - 2012**

The number of AMI deaths within 28 days amongst patients diagnosed with NSTEMI has decreased from 556 in 2008 to 319 in 2012 (Table 6.4.1). The case-fatality rates have consistently been higher amongst patients suffering from STEMI as compared to NSTEMI, although the trend of the case-fatality rate for STEMI has decreased over the 6-year period (Table 6.4.2).

**Table 6.4.1 AMI 28-DAY CASE-FATALITY, BY AMI TYPE, 2007 - 2012**

Subtype	2007	2008	2009	2010	2011	2012
STEMI	282	280	227	248	207	211
NSTEMI	466	556	452	412	322	319
“Unknown”	340	357	353	306	331	356

**Table 6.4.2 AMI 28-DAY CASE-FATALITY RATES (%), BY AMI TYPE, 2007 - 2012**

Subtype	2007	2008	2009	2010	2011	2012
STEMI	13.6	13.5	11.0	11.8	9.7	9.3
NSTEMI	10.6	11.6	10.4	8.6	6.3	5.5

## 7. RISK FACTOR PROFILE OF INCIDENT AMI (%), 2007 - 2012

### 7.1 Risk Factor Profile of Incident AMI (%), Overall, 2007 - 2012

Hypertension and hyperlipidemia were the two most common risk factors among AMI patients. The proportion of AMI patients with hypertension and hyperlipidemia has increased slightly since 2009 while the other risk factors have remained stable over time (Table 7.1.1).

**Table 7.1.1 RISK FACTOR PROFILE OF INCIDENT AMI (%), OVERALL, 2007 - 2012**

Risk Factors (%)	Overall					
	2007	2008	2009	2010	2011	2012
Smoker	45.5	46.1	46.1	46.2	46.4	45.8
Hypertension	72.8	72.5	71.5	71.9	74.4	75.0
Diabetes	50.4	51.2	50.3	48.6	50.4	50.7
Hyperlipidemia	84.3	68.4	67.1	67.6	69.1	70.0
Past AMI Event	23.2	26.0	26.7	26.6	27.2	27.8
BMI $\geq$ 23	61.3	60.2	61.5	61.2	60.3	61.9

### 7.2 Risk Factor Profile of Incident AMI (%), Gender, 2007 - 2012

There were higher proportions of women with hypertension, diabetes, hyperlipidemia and a past AMI event compared to men. Smoking and being overweight were more common among men. There were 6 times more smokers among male AMI patients compared to female AMI patients (Tables 7.2.1A and 7.2.1B).

**Table 7.2.1A RISK FACTOR PROFILE OF INCIDENT AMI (%), MALE, 2007 - 2012**

Risk Factors (%)	2007	2008	2009	2010	2011	2012
Smoker	63.5	65.1	64.2	64.5	64.9	64.1
Hypertension	67.2	66.9	65.6	66.6	68.6	70.3
Diabetes	45.8	46.3	45.5	43.8	45.8	47.0
Hyperlipidemia	86.1	69.2	66.6	66.2	67.9	68.8
Past AMI Event	22.6	24.8	25.4	25.2	26.5	27.7
BMI $\geq$ 23	61.3	60.2	61.5	61.2	60.3	61.9

**Table 7.2.1B RISK FACTOR PROFILE OF INCIDENT AMI (%), FEMALE, 2007 - 2012**

Risk Factors (%)	2007	2008	2009	2010	2011	2012
Smoker	13.2	11.7	11.9	11.8	10.7	11.1
Hypertension	82.8	82.7	82.5	81.8	85.5	84.1
Diabetes	58.7	60.0	59.3	57.5	59.3	57.7
Hyperlipidemia	81.0	67.1	68.3	70.1	71.3	72.3
Past AMI Event	24.2	28.2	29.3	29.3	28.7	28.1
BMI $\geq$ 23	46.7	47.9	48.6	48.9	49.8	49.8

### 7.3 Risk Factor Profile of Incident AMI (%), Ethnic Group, 2007 - 2012

Hypertension was most common among the Chinese. Indians had the highest proportion of patients with diabetes, hyperlipidemia and a past AMI event while Malays had the highest proportion of smokers (Table 7.3.1).

**Table 7.3.1 RISK FACTOR PROFILE OF INCIDENT AMI (%), ETHNIC GROUP, 2007 - 2012**

Risk Factor	Chinese						Malay					
	2007	2008	2009	2010	2011	2012	2007	2008	2009	2010	2011	2012
Smoker	44.5	44.6	44.2	44.2	44.0	43.9	48.8	50.9	49.4	52.9	52.8	50.9
Hypertension	74.2	73.4	72.5	72.9	75.3	75.6	71.4	70.0	70.1	69.8	72.7	74.4
Diabetes	46.6	46.6	46.4	44.2	45.9	45.5	56.8	59.0	54.1	54.1	56.4	59.0
Hyperlipidemia	82.5	65.1	65.0	65.2	66.4	68.1	87.8	75.1	69.6	71.9	73.0	73.3
Past AMI Event	21.7	24.1	25.2	24.6	25.0	25.7	24.4	28.8	28.4	29.6	30.1	31.2
BMI $\geq$ 23	52.7	51.8	52.3	52.8	51.7	52.6	65.2	64.9	67.2	65.2	66.9	68.0
Risk Factor	Indian						Others					
	2007	2008	2009	2010	2011	2012	2007	2008	2009	2010	2011	2012
Smoker	45.5	46.7	49.1	45.5	48.6	48.0	53.0	48.0	57.1	53.6	52.1	44.3
Hypertension	68.5	72.0	68.5	71.1	72.5	74.1	65.2	68.4	69.2	61.9	70.2	68.6
Diabetes	63.0	63.3	64.1	64.7	64.5	63.6	43.2	45.9	42.9	40.2	46.8	53.6
Hyperlipidemia	89.2	76.0	73.4	74.1	76.3	75.2	83.3	67.3	72.5	63.9	74.5	64.3
Past AMI Event	29.8	31.3	31.0	33.5	35.0	34.4	22.7	28.6	33.0	22.7	22.3	20.7
BMI $\geq$ 23	65.6	64.8	65.8	65.9	67.8	66.7	60.0	58.6	74.6	65.9	58.0	64.5

#### 7.4 Risk Factor Profile of Incident AMI (%), AMI Type, 2007 - 2012

Risk factors were more common amongst patients diagnosed with NSTEMI as compared to patients diagnosed with STEMI, except for smoking (Table 7.4.1).

**Table 7.4.1 RISK FACTOR PROFILE OF INCIDENT AMI (%), AMI TYPE, 2007 - 2012**

Risk Factor	STEMI						NSTEMI					
	2007	2008	2009	2010	2011	2012	2007	2008	2009	2010	2011	2012
Smoker	54.1	57.1	56.7	56.6	58.3	55.6	42.2	41.7	41.7	42.2	42.9	43.6
Hypertension	59.8	60.1	56.6	56.9	58.4	59.4	78.7	77.9	78.1	78.3	80.1	80.1
Diabetes	41.6	42.5	40.6	39.7	39.3	38.4	54.6	54.9	54.5	52.4	54.3	54.9
Hyperlipidemia	87.8	69.1	60.7	60.0	60.5	61.7	83.5	68.6	70.6	71.1	72.4	73.4
Past AMI Event	10.5	14.5	12.1	14.4	12.6	14.2	29.1	30.9	33.8	32.0	33.0	33.2
BMI $\geq$ 23	8.8	9.3	9.4	9.5	9.0	9.9	8.0	8.0	9.4	10.0	10.0	10.2

## 8. SYMPTOMS, 2007 - 2012: ALL RESIDENTS

### 8.1 Symptoms of AMI Patients, Overall, 2007 - 2012

The top three symptoms reported by patients with AMI were chest pain, breathlessness and diaphoresis at proportions of 58.4%, 55.8% and 31.5% in 2012 respectively (Table 8.1.1).

**Table 8.1.1 SYMPTOMS OF AMI PATIENTS (%), OVERALL, 2007 - 2012**

Symptoms	Overall					
	2007	2008	2009	2010	2011	2012
Chest Pain	59.4	57.8	59.7	59.9	58.0	58.4
Breathlessness	53.8	51.8	52.0	54.9	55.1	55.8
Diaphoresis	31.5	30.5	32.6	33.5	31.7	31.5
Syncope	1.6	2.9	1.7	1.9	1.4	1.9
Back Pain	4.1	4.8	5.2	5.0	5.8	5.3
Epigastric Pain	6.5	5.5	5.4	5.7	5.8	4.8
Jaw Pain	2.1	2.6	2.9	3.0	2.7	3.0
Shoulder Pain	3.5	3.9	4.3	4.0	4.0	4.7

\*The proportions of symptoms reported are not mutually exclusive.

## 8.2 Symptoms of AMI Patients, Gender, 2007 - 2012

Symptoms of chest pain, diaphoresis and jaw pain were more common among men whereas epigastric pain was more common among women suffering from an AMI (Table 8.2.1).

**Table 8.2.1 SYMPTOMS OF AMI PATIENTS (%), GENDER, 2007 - 2012**

Symptoms	Male						Female					
	2007	2008	2009	2010	2011	2012	2007	2008	2009	2010	2011	2012
Chest Pain	64.4	64.0	65.9	65.7	63.9	64.1	50.1	46.3	47.9	49.0	46.5	47.7
Breathlessness	52.6	52.3	52.6	54.8	55.3	56.6	56.1	50.9	51.0	55.0	54.7	54.4
Diaphoresis	35.9	36.3	37.9	39.4	37.5	36.7	23.4	20.0	22.6	22.4	20.2	21.8
Syncope	1.8	3.0	1.7	2.3	1.7	2.0	1.3	2.6	1.6	1.1	0.9	1.6
Back Pain	3.8	4.9	5.5	4.8	6.2	5.3	4.6	4.6	4.6	5.4	4.9	5.2
Epigastric Pain	6.0	5.3	4.8	4.9	5.3	4.3	7.3	6.1	6.4	7.2	6.8	5.8
Jaw Pain	2.5	3.1	3.4	3.2	3.3	3.4	1.5	1.6	2.1	2.5	1.4	2.1
Shoulder Pain	3.8	4.4	4.8	4.5	4.5	4.7	3.1	3.1	3.3	3.1	3.0	4.8

## 8.3 Symptoms of AMI Patients, Ethnic Group, 2007 - 2012

Symptoms of chest pain were more prevalent amongst Indians with a proportion of 68.6% in 2012, compared to Chinese or Malays. Symptoms of breathlessness were more common amongst the Malay ethnic group (Table 8.3.1).

**Table 8.3.1 SYMPTOMS OF AMI PATIENTS (%), ETHNIC GROUP, 2007 - 2012**

Symptoms	Chinese						Malay					
	2007	2008	2009	2010	2011	2012	2007	2008	2009	2010	2011	2012
Chest Pain	56.8	54.4	56.9	56.3	55.6	55.2	61.6	61.9	61.4	64.2	58.2	61.7
Breathlessness	53.4	50.0	51.3	54.1	53.9	55.2	56.7	56.3	53.6	57.2	58.1	59.1
Diaphoresis	32.9	30.2	29.7	31.2	30.6	30.4	34.0	31.3	32.1	36.3	32.2	31.9
Syncope	1.8	2.9	1.7	2.0	1.5	2.2	1.3	2.9	1.4	1.7	1.6	1.6
Back Pain	3.2	3.9	3.9	3.5	4.4	4.3	3.2	3.9	3.9	3.5	4.4	4.3
Epigastric Pain	6.0	5.2	4.7	5.5	6.0	4.3	6.0	5.2	4.7	5.5	6.0	4.3
Jaw Pain	1.7	2.1	2.7	2.8	2.5	2.8	1.7	2.1	2.7	2.8	2.5	2.8
Shoulder Pain	2.7	3.1	3.7	3.2	2.9	3.8	3.5	3.6	5.1	3.8	4.0	5.1

**Table 8.3.1 SYMPTOMS OF AMI PATIENTS (%), ETHNIC GROUP, 2007 - 2012**

Symptoms	Indian						Others					
	2007	2008	2009	2010	2011	2012	2007	2008	2009	2010	2011	2012
Chest Pain	68.9	68.3	70.1	72.0	69.8	68.6	66.9	58.6	69.1	66.0	62.5	69.4
Breathlessness	53.4	52.9	52.6	55.6	56.7	55.4	43.9	62.6	58.5	52.0	55.2	45.1
Diaphoresis	34.9	33.3	39.7	39.5	35.7	37.4	32.4	32.3	40.4	35.0	37.5	29.2
Syncope	1.1	2.3	1.8	1.7	0.9	0.7	3.6	5.1	2.1	1.0	2.1	1.4
Back Pain	6.7	8.9	8.7	10.0	10.4	8.8	5.8	7.1	8.5	4.0	8.3	6.9
Epigastric Pain	5.6	6.1	5.2	5.5	4.8	5.5	7.2	5.1	10.6	4.0	4.2	4.9
Jaw Pain	4.2	4.8	4.9	5.6	4.6	4.5	3.6	4.0	5.3	4.0	1.0	3.5
Shoulder Pain	7.6	8.4	6.5	8.8	8.9	9.2	5.8	5.1	3.2	6.0	7.3	4.9

**8.4 Symptoms of AMI Patients, AMI Type, 2007 - 2012**

Symptoms of chest pain and diaphoresis were more prevalent amongst patients diagnosed with STEMI with a proportion of 80.8% and 55.6% in 2012 respectively, while breathlessness was more common amongst patients diagnosed with NSTEMI with a proportion of 58.1% in 2012 (Table 8.4.1).

**Table 8.4.1 SYMPTOMS OF AMI PATIENTS (%), AMI TYPE, 2007 - 2012**

Symptoms	STEMI						NSTEMI					
	2007	2008	2009	2010	2011	2012	2007	2008	2009	2010	2011	2012
Chest Pain	78.4	80.1	81.7	80.7	80.2	80.8	53.3	50.7	53.1	54.0	54.1	55.6
Breathlessness	53.1	51.4	53.3	53.4	54.5	56.2	56.9	53.9	54.3	57.3	57.8	58.1
Diaphoresis	52.8	53.5	56.8	56.7	56.5	55.6	23.5	22.3	23.5	25.4	24.3	25.8
Syncope	3.6	5.1	2.1	1.0	2.1	1.4	1.2	2.4	1.4	1.4	1.3	1.6
Back Pain	5.2	7.1	6.8	6.6	7.9	7.8	3.8	4.1	4.8	4.7	5.4	4.9
Epigastric Pain	7.3	6.6	5.9	5.6	6.4	5.1	6.4	5.3	5.5	6.0	5.9	5.0
Jaw Pain	2.9	3.8	4.2	4.8	4.0	3.9	4.2	4.8	4.9	5.6	4.6	4.5
Shoulder Pain	4.4	5.5	5.4	5.7	4.4	5.5	3.4	3.6	4.2	3.6	4.2	5.1

## 9. MEDICATION (%) 2007 - 2012: ALL RESIDENTS

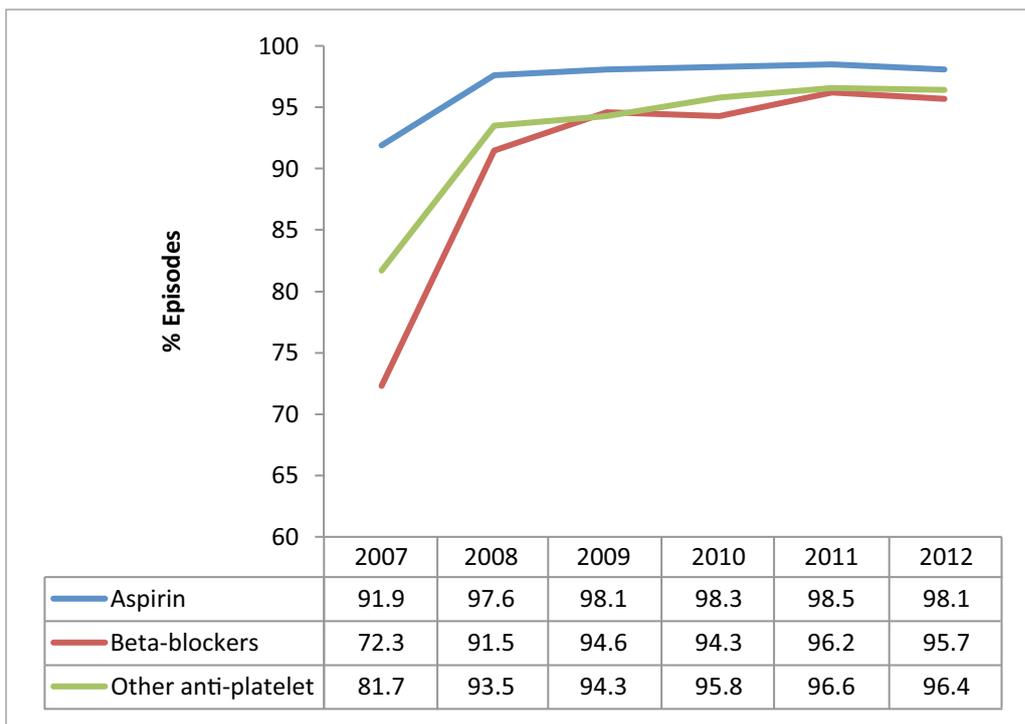
### 9.1 Medication (%), 2007 - 2012

Transfer cases, GP cases, cases brought in dead and cases with medication contraindications were excluded from the calculations of stat dose medications and medications given in hospital.

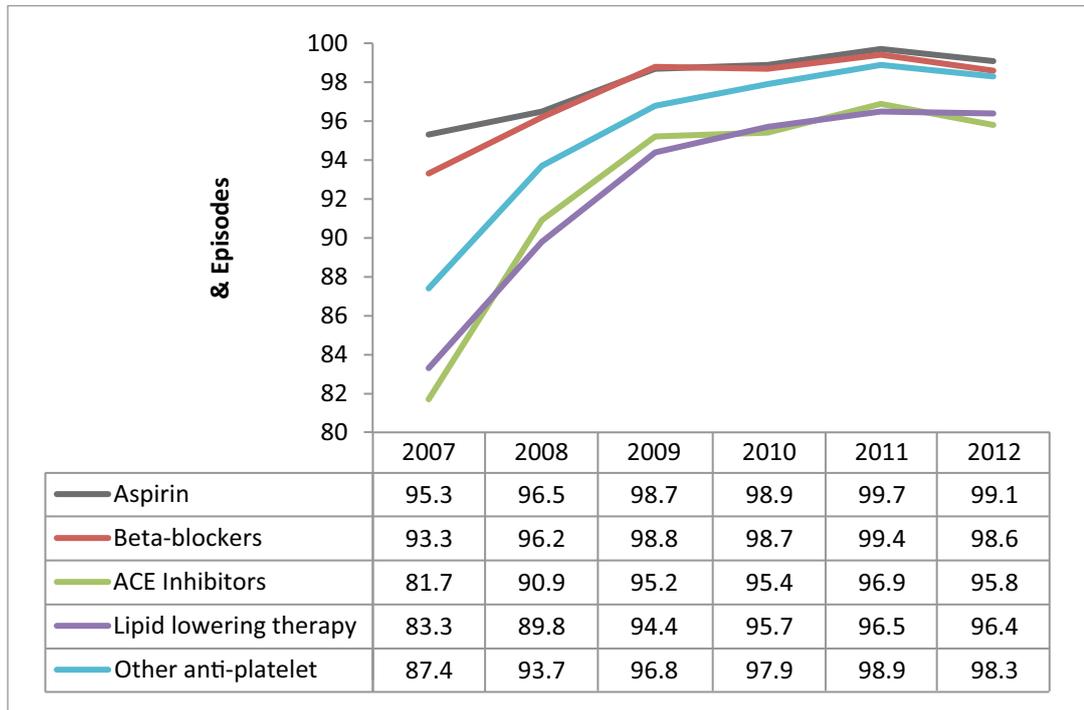
In addition, cases that died at EMD or in hospital were excluded from calculations of medications given upon hospital discharge.

Over the 6-year period, the proportion of patients given medication such as aspirin, beta blockers, ace inhibitors, lipid lowering therapy and other anti-platelet agents have improved and exceeded 95.0% in 2012 (Figures 9.1.1, 9.1.2 and 9.1.3).

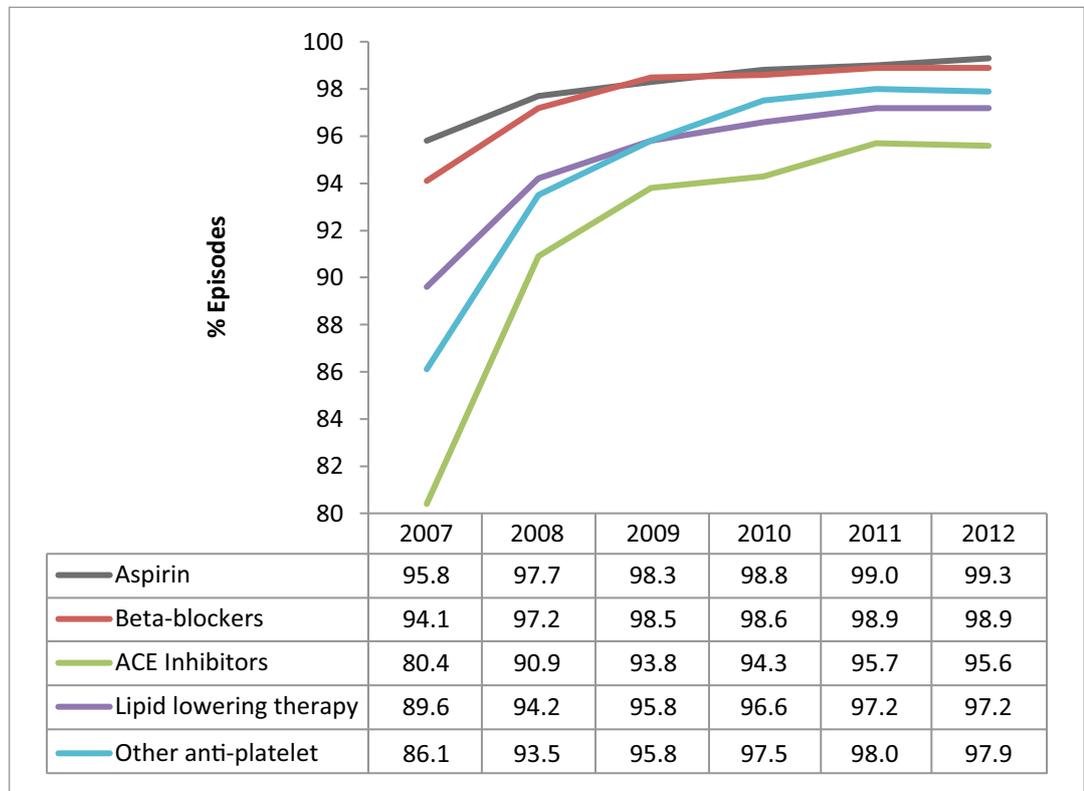
**Figure 9.1.1 MEDICATION ON ARRIVAL (STAT DOSES) (%), OVERALL, 2007 - 2012**



**Figure 9.1.2 MEDICATION DURING HOSPITALISATION (%), OVERALL, 2007 - 2012**



**Figure 9.1.3 MEDICATION UPON DISCHARGE (%), OVERALL, 2007 - 2012**



## 10. IN-PATIENT COMPLICATIONS AND EVENTS (%) 2007 - 2012: ALL RESIDENTS

### 10.1 In-Patient Complications And Events (%), 2007 - 2012

The SMIR collects in-hospital complication and events of patients who have been hospitalised post-AMI. Transfer patients, patients with unknown AMI subtype, as well as those who were admitted with complete heart failure were excluded from the calculations.

Arrhythmic complications were found to be the most common complication after an AMI, whereas left ventricular systolic dysfunction was the more common occurrence after a patient was hospitalised.

The proportion of AMI episodes with heart failure or reinfarction has been decreasing since 2007, that with acute renal failure has been decreasing since 2008, that with cardiogenic shock or complete heart block has been decreasing since 2009, and that with arrhythmic complications has been decreasing since 2010 (Figure 10.1.1).

**Figure 10.1.1 IN-PATIENT COMPLICATIONS AND EVENTS (%), OVERALL, 2007 - 2012**

