Ph.D. Dissertation of Public Health

# Trends in Incidence and Case Fatality Rates by Heart Disease and its subtypes in Korea, 2006-2015.

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August 2021

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March 2021

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# Abstract

Objectives:

This study aimed to provide an overview of the national trends in incidence and case-fatality rates for heart disease (HD) and HD subtypes, ischemic heart disease (IHD) and its subtype, and cardiac arrhythmia and its subtypes (2006-2015).

Methods:

Using records from the National Health Insurance Service claims database (2003-2015) and data on causes of death from Statistics Korea (2006-2017), we calculated crude and age-standardized incidence rates (2006-2015) and case-fatality rates (2006-2017) for HD and its subtypes according to sex, age, and residential area.

Results :

Between 2006 and 2015, crude incidence rates for overall HD did not change meaningfully, though age-standardized incidence of HD declined markedly. Reductions in IHD rates have contributed to this. However, incidence rates have increased for cardiac arrhythmia, miscellaneous (other) HD diagnoses, pulmonary HD, and case-fatality rates have increased for HF, valvular HD, and miscellaneous (other) HD diagnoses.

Crude and age-standardized incidence rates of IHD, stable angina pectoris (AP), unstable AP, and myocardial infarction (MI) decreased during the study period. However, the incidence of non-ST elevation myocardial infarction (NSTEMI), ST elevation myocardial infarction (STEMI), and variant AP increased, and the incidence of NSTEMI increased dramatically over the last 10 years.

Incidence, crude incidence rates, and the age-standardized

incidence of cardiac arrhythmia in the total population as well as in men and women (when stratifying by sex) have increased significantly over the last 10 years. The Incidence and crude rates of atrial fibrillation (AF) and flutter more than two-fold, and the incidence of both tachycardia and miscellaneous (other) arrhythmia diagnoses increased. However, case-fatality rates of cardiac arrhythmia and its subtypes have changed little over the last 10 years.

Conclusions :

It is essential to continuously monitor the incidence and case-fatality rates for HD and its subtypes, IHD and its subtypes, and cardiac arrhythmia, and its subtypes according to the same criteria. Our observations will help physicians and public health officials modify public health priorities and recommend strategies for managing the spread of cardiovascular disease in Korea.

Keywords: trends, heart disease, subtypes of heart disease, incidence, case-fatality

Student Number : 2004-30773

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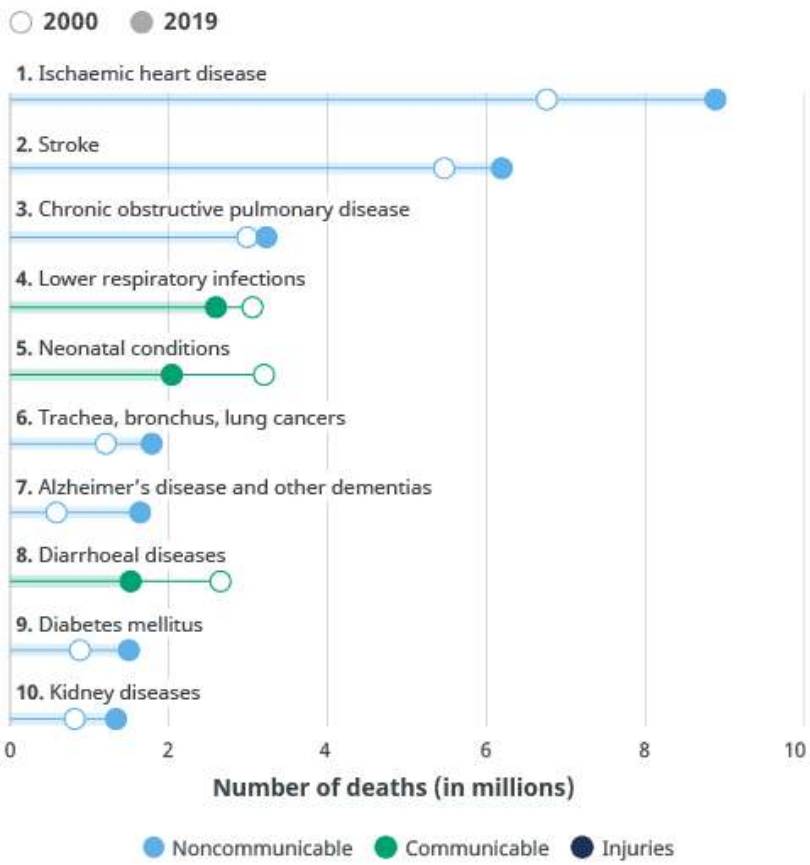
# Chapter 1. Introduction

## 1.1. Study Background

Cardiovascular diseases (CVDs) are the leading cause of global mortality and a major contributor to disability (Figure 1-1) (Roth et al. 2020). The world's major cause of mortality is ischemic heart disease (IHD), which accounts for 16% of the total deaths worldwide (WHO 2020).

Figure 1-1. Leading causes of mortality globally.




Source: www.who.int/news-room/fact-sheets/detail/the-top-10-causes-of-death

Large increases in rate of heart disease (HD) mortality occurred in the early 20th century, peaked in the late 1960s, and began to decrease thereafter in Western countries (Virani et al. 2021). Mortality rates for coronary heart disease (CHD) decreased in the US, UK, and central and eastern European countries in the last 30 years (Figure 1-2 and 1-3) (Virani et al. 2021; Benjamin et al. 2019; Bhatnagar et al. 2016; Townsend et al. 2016; Ford et al. 2014).

Figure 1-2. Trends in crude mortality rates by cause of death (1900-2020) in the US.

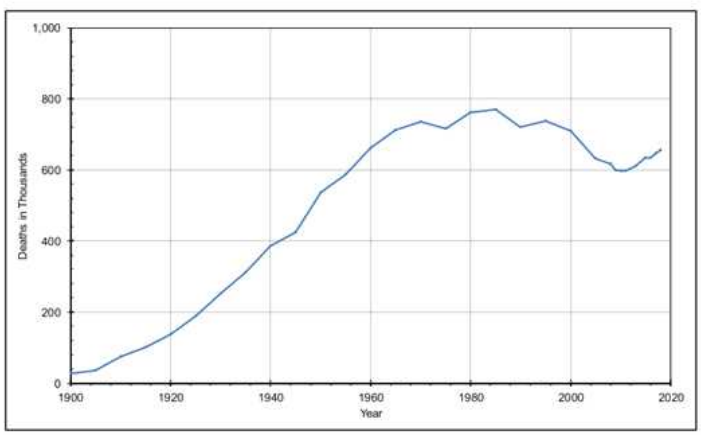
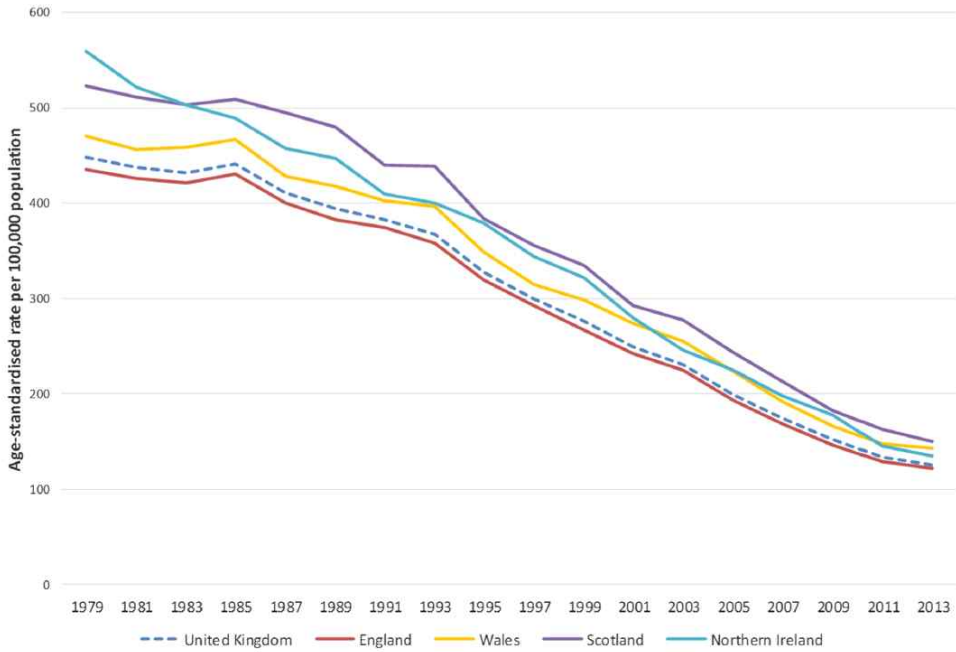



**Chart 14-2. Deaths attributable to diseases of the heart, United States, 1900 to 2018.**
See Glossary (Chapter 29) for an explanation of diseases of the heart. In the years 1900 to 1920, the *International Classification of Diseases* codes were 77 to 80; for 1925, 87 to 90; for 1930 to 1945, 90 to 95; for 1950 to 1960, 402 to 404 and 410 to 443; for 1965, 402 to 404 and 410 to 443; for 1970 to 1975, 390 to 398 and 404 to 429; for 1980 to 1995, 390 to 398, 402, and 404 to 429; and for 2000 to 2018, I00 to I09, I11, I13, and I20 to I51. Before 1933, data are for a death registration area, not the entire United States. In 1900, only 10 states were included in the death registration area, and this increased over the years, so part of the increase in numbers of deaths is attributable to an increase in the number of states.
Source: Unpublished National Heart, Lung, and Blood Institute tabulation using National Vital Statistics System.[35]

Source: Virani et al. Heart disease and stroke statistics-2021 update.

Figure 1-3. Age-standardised death rates (per 100,000 persons) from coronary heart disease for all ages in UK and England, Wales, Scotland, Northern Ireland (1979-2013).




Source: Bhatnagar et al. Trends in the epidemiology of cardiovascular disease in the UK. 2016.

In Western countries (such as in Europe), a number of studies have been conducted on CHD since the 1950s, including the Framingham Heart Study in the US, and the Whitehall study in the UK (Luepker 2012; Hugh et al. 2003). Despite 30 years of CVD research, information on mortality, morbidity, and risk factors is currently inaccurate and it is difficult to make international comparisons due to regional variations in factors such as disease definitions and population inconsistency (Hugh et al. 2003).

The World Health Organization (WHO) conducted the Multinational Monitoring of Trends and Determinants in Cardiovascular Disease (MONICA) project across 21 countries on four continents in the 1980s and the 1990s. The factors measured by MONICA included disease incidence rates, case-fatality rates,

risk factors (e.g., cholesterol, blood pressure, weight and exercise, smoking, diet), and medical care; the study was mainly focused on CHD and stroke (Tables 1-1 and 1-3).

Tables 1-1. MONICA measures and hypotheses.

| MONICA Measurements | |
|---|---|
| A | Incidence rates (fatal [=morality] and nonfatal events) over ten years |
| B | Case fatality (percentage fatal at 28 days from onset) over ten years |
| C | Risk factor level and trends through repeated population surveys (2 or 3) |
| D | Medical care on two occasions during surveillance, continuous in some centers |
| **Potential Associations of Trends in These Measurements** | |
| A | Risk factors and incidence (subject of first null hypothesis on tends) |
| B | Medical care and case fatality (subject of second null hypothesis on trends) |
| C | Incidence and case fatality (explored cross-sectionally) |
| D | Medical care and incidence (incorporated in analyses for second null hypothesis) |
| E | Risk factors and case fatality (not analyzed so far but now historical data) |
| F | Medical care and risk factors (not analyzed so far but now historical data) |

Source: Luepker, WHO MONICA Project: What have we learned and where to go from here? 2012. P.376

Tables 1−2. MONICA centers.

| Country (21) | MONICA Centers (33) |
|---|---|
|  |  |
| Australia | Newcastle (AUS-NEW, AN) |
| | Perth (AUS-PER, AP) |
| Belgium | Ghent/Charleroi (BEL-GCH, BE) |
| Canada | Halifax (CAN-HAL, CA) |
| China | Beijing (CHN-BEI, CN) |
| Czech Republic | (CZE-CZE, CZ) |
| Denmark | Glostrup (DEN-GLO, DN) |
| Finland | (FIN-FIN, FI) |
| France | Country Coordinating Center |
| | Lille (FRA-LIL, FL) |
| | Strasbourg (FRA-STR, FS) |
| | Toulouse (FRA-TOU, FT) |
| German | Augsburg (GER-AUG, GA) |
| | Bremen (GER-BRE, GB) |
| | East Germany (GER-EGE, GE) |
| Iceland | (ICE-ICE, IC) |
| Italy | Country Coordinating Center |
| | Brianza (ITA-BRI, IT) |
| | Friuli (ITA-FRI, IF) |
| Lithuania | Kaunas (LTU-KAU, LT) |
| New Zealand | Auckland (NEZ-AUC, NZ) |

Source: Luepker, WHO MONICA Project: What have we learned and where to go from here? 2012. P.378

Tables 1–3. MONICA centers (continued).

| **Country** (21) | **MONICA Centers** (33) |
|---|---|
| Poland | Tarnobrzeg Voivodship (POL-TAR, PT) |
| | Warsas (POL-WAR, PW) |
| Russia | Moscow (RUS-MOS, RM) |
| | Novosibirsk (RUS-NOV, RN) |
| Spain | Catalonia (SPA-CAT, SP) |
| Sweden | Gothenburg (SWE-GOT, SG) |
| | Northern Sweden (SWE-NSW, SN) |
| Switzerland | (SWI-SWI, SW) |
| United Kingdom | Belfast (UNK-BEL, UB) |
| | Glasgow (UNK-GLA) |
| United States | Stanford (USA-STA, US) |
| Yugoslavia | Novi Sad (YUG-NOS, YU) |

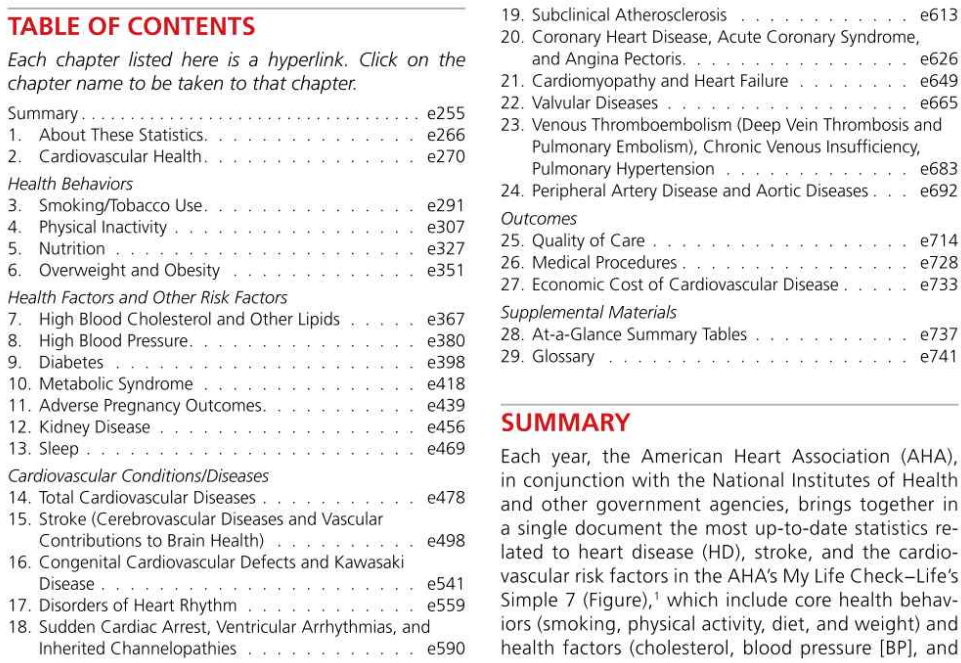
Source: Luepker, WHO MONICA Project: What have we learned and where to go from here? 2012. P.379

The American Heart Association (AHA) published an annual report on heart disease and stroke (based on rates since 2006) in 2021 (Thom et al. 2006; Virani et al. 2021). This report includes up–to–date information on health behaviors, health factors, and other risk factors, cardiovascular disease (including total cardiovascular disease, stroke, heart rhythm disorders, cardiac arrest, CHD, cardiomyopathy, heart failure, valvular disease), and health outcomes (quality of care, medical procedures, economic costs).

The AHA data also included information on epidemiologic indicators, such as HD prevalence, incidence, trends in incidence, mortality, temporal trends in mortality, awareness of warning signs and risk, time of symptom onset and arrival at the hospital, complications, rehospitalizations, cardiac rehabilitation, hospital

discharges and ambulatory visits, operations and procedures, costs, global burden, and social determinants (Figure 1−4).

Figure 1−4. Contents of heart disease and stroke statistics—2021 update.



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## SUMMARY


Each year, the American Heart Association (AHA), in conjunction with the National Institutes of Health and other government agencies, brings together in a single document the most up-to-date statistics related to heart disease (HD), stroke, and the cardiovascular risk factors in the AHA's My Life Check–Life's Simple 7 (Figure),[1] which include core health behaviors (smoking, physical activity, diet, and weight) and health factors (cholesterol, blood pressure [BP], and

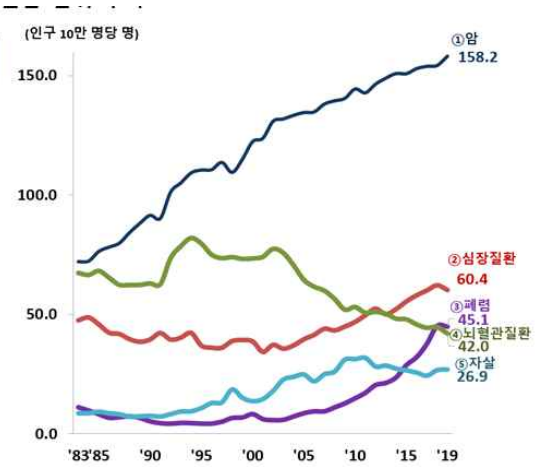

Source: Virani et al, Heart disease and stroke statistics-2021 update: A report from the American Heart Association. Circulation. 2021;143(8):e254-e743.

However, studies conducted within countries in the Asia−Pacific region, such as Korea, Japan, Singapore, and China, have revealed different trends (Lee et al. 2015; Ogata et al. 2019; Khoo et al. 2014; Zhang et al. 2016). According to cause of death data in 2019 from Statistics Korea, the crude mortality rate for HD is 60.4 per 100,000 persons, thus ranking second after malignant neoplasms and showing a steadily increasing trend since 2000 (Figure 1−5) (Statistics Korea 2019).

Figure 1-5. Trends of crude mortality rates in Korea by cause of death (1983-2019).

(단위: 인구 10만 명당 명)

| 순위 | 사망원인 | 사망률 | '18년 순위 대비 |
|---|---|---|---|
| 1 | 악성신생물(암) | 158.2 | - |
| 2 | 심장 질환 | 60.4 | - |
| 3 | 폐렴 | 45.1 | - |
| 4 | 뇌혈관 질환 | 42.0 | - |
| 5 | 고의적 자해(자살) | 26.9 | - |
| 6 | 당뇨병 | 15.8 | - |
| 7 | 알츠하이머병 | 13.1 | ⬆(+2) |
| 8 | 간 질환 | 12.7 | ⬇(-1) |
| 9 | 만성 하기도 질환 | 12.0 | ⬇(-1) |
| 10 | 고혈압성 질환 | 11.0 | - |




Source: Statistics Korea. Results of the cause of death statistics in 2019.

Changes in HD mortality may be related to changes in incidence, changes in case-fatality, or both.

In this report, research to date was thoruoughly examined through a scoping review. HD encompasses a wide range of heart conditions and includes various subtypes, such as IHD, heart failure (HF), hypertensive heart disease (HHD), valvular HD, arrhythmia, pulmonary HD, and miscellaneous (other) HD diagnoses (Benjamin et al. 2019; Ritchey et al. 2014; Sidney et al. 2017). Several studies in the US have analyzed trends in mortality rates for HD and its subtypes (Ritchey et al. 2014; Sidney et al. 2017), but few have investigated incidence trends. In Korea, there have been studies on 30-year mortality rates for HD, but there are not enough studies currently to examine trends in incidence and mortality rates, including for overall HD and its subtypes, for the representative general population; the exceptions to this are studies on acute myocardial infarction and IHD rates in Korea (Hong et al. 2009; Kim et al. 2013; Kim et al. 2019; Gwon et al. 2020).

Studies examining incidence emphasize the need to prioritize health-critical diseases in the future by examining the factors and

trends that have had a greater influence on increases in HD mortality. Because HD includes a variety of subtypes, understanding long-term trends for incidence and fatality for each major subtype of HD is necessary to evaluate the results of relevant health policies and to provide feedback, reset health priorities, and provide insight into allocating resources.

Effective public health and health care strategies, require comprehensive evaluating and weighing of risks and benefits, with the goal of reducing the incidence of chronic disease, facilitating early detection, and enabling proper management to reduce complications, disabilities, and early mortality. It is also important to clearly identify the current status and characteristics of HD and HD disease dynamics in Korea.

## 1.2. Purpose

This study aimed to provide an overview of national trends in incidence and case-fatality for overall HD and its subtypes from 2006 to 2015 in Korea (Tables 1-4).

The specific objectives of the study were as follows. First, we characterized national trends for incidence and case-fatality rates for HD and its subtypes in Korea, including IHD, HF, cardiac arrhythmia, HHD, valvular HD, and pulmonary HD. Second, we identified the changing trends in incidence and case-fatality rates for IHD and its subtypes in Korea, including angina pectoris (AP) and AP subtypes (stable AP, unstable AP, variant AP), myocardial infarction (MI) and MI subtypes (ST elevation MI (STEMI), non-ST elevation MI (NSTEMI), other MI diagnoses, and other IHD diagnoses. Third, we examined changing patterns in incidence and case-fatality rates for cardiac arrhythmia and its subtypes in Korea, including AF and flutter, tachycardia, and arrhythmia.

Tables 1−4. Classifications of heart disease (HD) and HD subtypes.

| Heart Diseases | Ischemic HD | Cardiac Arrhythmia |
|---|---|---|
| Ischemic HD | Stable AP | AF & Flutter |
| Cardiac Arrhythmia | Unstable AP | Tachycardia |
| Heart Failure | Variant AP | Arrhythmia-others |
| HD-others* | STEMI | |
| HHD | NSTEMI | |
| Pulmonary HD | MI-others | |
| Valvular HD | IHD-others | |

MI: myocardial infarction; NSTEMI: non-ST elevation MI; STEMI: ST elevation MI

* HD (others diagnoses) includes acute rheumatic fever, chronic rheumatic heart disease, myocarditis, cardiopathy, cardiac arrest, and conduction disorders.

# Chapter 2. Study Materials and Methods

## 2.1. Ethical approval and informed consent

This study as a whole and the use of National Health Insurance Service (NHIS) data specifically were approved by the relevant Institutional Review Boards of Seoul National University (SNU IRB No. E1901/001-001), and NHIS (NHIS-2019-1-200), respectively. The study used anonymized secondary data from the NHIS; therefore, the requirement for patient consent was waived.

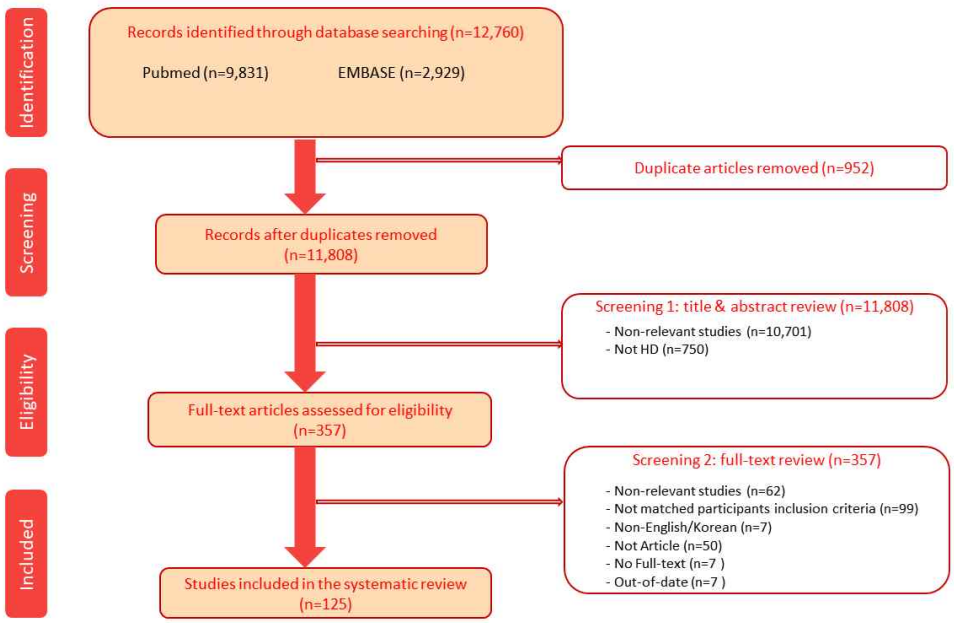
## 2.2. Scoping literature review

For this scoping literature review, we conducted a comprehensive, global literature search using the PubMed and EMBASE databases.

The search terms were: (heart disease OR cardiac disease OR ischemic heart disease OR coronary artery disease OR cardiovascular disease OR stable angina OR variant angina OR acute coronary syndrome OR myocardial infarction OR acute myocardial infarction OR STEMI OR NSTEMI OR atrial fibrillation OR atrial flutter OR heart failure OR tachycardia) AND (population) AND (incidence OR fatality OR mortality) AND (trend OR tendency). We applied additional filters for text availability (full text), publication dates (January 1, 2001 to December 31, 2020), and species (human). A total of 9,831 cases in PubMed and 2,929 articles in EMBASE were searched for these conditions. In total, 952 duplicate journal publications were deleted. We also deleted 11,808 journals that did not contain incidence or fatality keywords in the manuscript titles. A total of 750 journals related to the incidence or fatality of non-heart disease were deleted. After a title and abstract review, 357 reviewed journal publications remained. Among these studies,

99 studies were conducted among non-general population groups, 62 concerned non-related issues, 7 were not written in English or Korean, 50 were non-original articles (i.e., conference abstracts, review papers), seven did not provide full text, and seven were published before 2000. Thus, the current literature review included 125 manuscripts, and excluded a total of 232 manuscripts (Figure 2-1).

Figure 2-1. Flow diagram of the scoping review.




## 2.3. Data collection and HD incidence rates

First, we collected NHIS claims data on inpatients with HD as their primary diagnosis between 2003 and 2015 and HD as a cause of death between 2006 and 2017 from Statistics Korea and used this data to calculate yearly incidence rates for HD. These data included comprehensive information on medical utilization for approximately 52 million people from among the Korean population. The inclusion of only inpatient' primary diagnoses was determined

by the accuracy of the primary or secondary diagnoses and by inpatient or out-of-patient status, the stability of incidence trends, and the opinions of experts from a previous study (Park et al. 2017; Kim et al. 2018). The study by Kim et al. (2018), which examined incidence trends for IHD and MI from 2006 to 2015 using NHIS claims data, recommended defining incidence using primary diagnosis data for inpatients or death within 1 month.

Second, we used the International Classification Disease, 10th Revision (ICD-10) codes I00-I09, I11, I13, and I20-I51 to define HD (Benjamin et al. 2019; Ritchey et al. 2014; Sidney et al. 2017). We excluded individuals who were inpatients prior to the target year to delineate incidence for each year. The incidence of HD until 2015 was analyzed in the same way.

Third, we calculated crude incidence rates by sex and age group. The total population was used as the denominator for calculating the incidence for each year (National Health Insurance Statistical Yearbook, 2006-2015). The age groups were subdivided into those aged < 40 years, 40-49 years, 50-59 years, 60-69 years, 70-79 years, and 80 years or older.

Fourth, we calculated crude incidence rates by residence area in 2015. The residential areas were subdivided into 14 groups (Seoul + Incheon, Gyonggi, Daejeon + Sejong + Chungnam, Busan, Gyeongbuk, Gyeongnam, Jeonnam, Daegu, Jeongbuk, Gangwon, Chungbuk, Gwangju, Ulsan, and Jeju) according to classifications from the Regional Cardiocerebrovascular Center (RCCVC) project.

Fifth, age-standardized incidence was determined from the standard population. This was constructed according to the resident registration central population in 2005 and based on yearly modifications in population age based on age-standardized death rates (Statistics Korea 2018).

## 2.4. Case-fatality rates for HD

First, we collected data on the patient's causes of death from Statistics Korea by linking the patient's personal identification numbers (using a non-identified number for analysis) with yearly incidence data for HD. We only included individuals who died of heart disease.

Second, using the NHIS claims database, we calculated case-fatality rates by considering the date of first admission for HD and the date of death due to heart disease. The case-fatality rates were calculated using the number of deaths from heart disease in a designated period in comparison with the number of new inpatient cases. We classified these data into 7-day, 30-day, 1-year, 3-year, and 5-year cumulative case-fatality rates (Lee et al. 2012; Benjamin et al. 2019; Kim et al. 2019).

Third, we calculated cumulative case-fatality rates based on gender, age groups, and residence area.

## 2.5. Diagnostic accuracy

Although NHIS claims data were easily obtained, this data is considered controversial owing to its dubious diagnostic accuracy. However, several studies in Korea have validated the overall diagnostic accuracy rate in inpatients as 82.0% (Tables 2-1) (Park et al. 2017), with 71.4%-96.8% accuracy for AMI (Park et al. 2017; Kim et al. 2012) and 83.0% accuracy for cerebrovascular diseases (CVD) (Park et al. 2000). The overall accuracy rate for Statistics Korea data for causes of death was 91.9% (Won et al. 2007). Therefore, this was not a significant limitation of the present study.

Tables 2-1. Accuracy rates (%) comparing diagnostic codes from NHIS claims data and hospital medical records.

| ICD-10 codes | Inpatients | | | Out-of-patients | | |
|---|---|---|---|---|---|---|
| | 3 digits | 4 digits | 5 digits | 3 digits | 4 digits | 5 digits |
| Primary Diagnosis | 82.0 | 73.9 | 70.0 | 44.4 | 34.2 | 31.3 |
| Secondary Diagnosis | 56.4 | 53.2 | 46.7 | 33.4 | 27.4 | 25.2 |

Source: Park E et al. The conformity assessment and improvement plan between diagnostic codes of National Health Insurance claims data and hospital medical records. Health Insurance Review & Assessment Service, Yonsei University. 2017.

## 2.6. Statistical analysis

Statistical Analysis System (SAS) software (version 9.4, SAS Institute, Cary, NC, US) was used to analyze incidence and, incidence trends, including via the Cochran-Armitage trend test (Cui et al. 2017). We also evaluated case-fatality rates for HD and its subtypes in the Korean population.

# Chapter 3. Trends in Incidence and Case Fatality Rates for Heart Disease in Korea (2006–2015).

## 3.1. Background

Several studies in the US have analyzed trends in mortality rates for HD and its subtypes (Ritchey et al. 2014; Sidney et al. 2017), but only a few studies have investigated incidence trends. HD is the second most common cause of death in Korea (Statistics Korea 2019). Although studies have assessed trends in the incidence of acute myocardial infarction (AMI) and IHD (Hong et al. 2009; Kim et al. 2013; Kim et al. 2019; Gwon et al. 2020), studies examining incidence trends for HD and its subtypes are scarce in Korea.

HD encompasses a wide range of heart conditions and includes various subtypes, such as IHD, heart failure (HF), HHD, valvular HD, cardiac arrhythmia, pulmonary HD, and miscellaneous (other) HD diagnoses (Benjamin et al. 2019; Ritchey et al. 2014; Sidney et al. 2017). However, there is a lack of national representative data on the incidence of HD and its subtypes. Several studies have examined trends in the incidence and mortality of AMI and IHD in Korea (Hong et al. 2009; Kim et al. 2013; Kim et al. 2019; Gwon et al. 2020). Despite considerable information on IHD incidence and mortality trends, little is known about trends in overall HD and its subtypes. Thus, we examined national trends in incidence and case–fatality rates for HD and its subtypes in Korea between 2006 and 2015.

## 3.2. Methods

We followed the following steps for calculating the yearly incidence of HD and its subtypes. First, we collected data on inpatients with HD as their primary diagnosis between 2003 and 2015 from the NHIS claims database. In addition, people who were not inpatients but had died from HD were added based on death records from Statistics Korea. ICD-10 classifications were used to define HD and a comprehensive index for HD was determined according to ICD-10 codes I00-I09, I11, I13, and I20-I51 (Tables 3-1) (Benjamin et al. 2019; Ritchey et al. 2014; Sidney et al. 2017).

Tables 3-1. Explanations of International Classification of Diseases-10 (ICD-10) codes for heart disease.

| ICD-10 codes | Code name |
|---|---|
| I00~I02 | Acute rheumatic fever |
| I05~I09 | Chronic rheumatic heart diseases |
| I11 | Hypertensive heart disease |
| I13 | Hypertensive heart and chronic kidney disease |
| I20~I25 | Ischemic heart diseases |
| I26~I28 | Pulmonary heart disease and diseases of pulmonary circulation |
| I30~I51 | Other forms of heart disease |

Second, we excluded the person counts for HD inpatients prior to the target year to delineate the incidence for each year. The incidence of HD and its other subtypes was also analyzed in the

same way through 2015.

Third, we calculated crude incidence rates and categorized these rates based on sex, and age group. The total population was used as the denominator for calculating incidence for each year (NHIS Yearbook, 2006–2015). The age groups were subdivided as follows: < 40 years, 40–49 years, 50–59 years, 60–69 years, 70–79 years, and 80 years or older.

Fourth, age-standardized incidence was determined from the standard population and was constructed based on the resident registration central population in 2005 and based on yearly modifications in population age as the age-standardized death rate (Statistics Korea 2018). The method for calculating the age-standardized incidence of HD subtypes was the same as described above. The HD subtypes were classified as IHD (I20–I25), HF (I50), arrhythmia (I47–I49), HHD (I11, I13), valvular HD (I34–I38), pulmonary HD (I26–I28), and others (I00–I09, I30–I33, I40–I46, I51) (Tables 3-2) (Benjamin et al. 2019; Ritchey et al. 2014; Sidney et al. 2017). The incidence rates for overall HD and the sum of incidence rates for various HD subtypes could differ. For example, a person who was admitted for angina pectoris (AP) in 2006 could also be an inpatient for HHD in 2011, and this would be considered a new occurrence of HD in 2006 but not in 2011 (because HD includes AP and HHD). However, when assessed separately, the event could be counted as a new occurrence of IHD (IHD including AP) in 2006 and a new occurrence of HHD in 2011.

Tables 3-2. Classification of International Classification of Diseases (ICD)-10 codes for heart disease (HD) and HD subtypes.

| HD subtypes | ICD-10 codes |
|---|---|
| Ischemic Heart Diseases | I20~I25 |
| Cardiac Arrhythmia | I47~I49 |
| Heart Failure | I50 |
| HD-others | I00~I09, I30~I33, I39, I40~I46, I51 |
| Hypertensive Heart Diseases | I11, I13 |
| Pulmonary Heart Diseases | I26~I28 |
| Valvular Heart Diseases | I34~I38 |

We assessed case-fatality rates from the cause of death and date of death data obtained from Statistics Korea by linking personal identification numbers (using a non-identified number for analysis) with the annual incidence of HD in a given year. Only those who died from HD were included, while those who died from other causes of death were excluded. We used the NHIS claims database to calculate the difference between the date of first admission for HD and the date of death due to HD in order to evaluate case-fatality rates, which were then classified into 7-day, 30-day, 1-year, 3-year, and 5-year cumulative case-fatality rates (Benjamin et al. 2019; Kim et al. 2019). The case-fatality rates were calculated using number of deaths from HD in a designated period per the number of new inpatient cases (except for recurrence). Since death data were considered until 2017, 3-year and 5-year cumulative case-fatality rates were not calculated for 2015 and 2013-2015, respectively, to avoid underestimation. We needed death data in 2018 to calculate 3-tear

case-fatality rates for occurrence in 2015 and we needed death data between 2018 and 2020 to calculate 5-year case-fatality rates between 2013 and 2015.

This NHIS claims database requires additional annual information to construct data and improve its stability and integrity. The aim of this study was to assess trends in case-fatality rates, which required a supplementary observation period to calculate 1-year cumulative case-fatality rates. Thus, we decided to use the NHIS claims database to analyze trends in incidence between 2003 and 2015 as well as cause of death statistics from Statistics Korea to analyze trends in case-fatality between 2006 and 2017.

SAS software (version 9.4, SAS Institute, Cary, UC, US) was used to analyze incidence and incidence trends (via the Cochran-Armitage trend test) (Cui et al. 2017) as well as case-fatality rates for HD in the Korean population.

## 3.3. Results

The incidence of HD and its subtypes were divided into cases who were diagnosed at the hospital and cases who died from the disease (Tables 3-3 to 3-6). Those diagnosed at the hospital were divided into survivors and patients who died. The number of people who died of HD and its subtypes showed a tendency to increase over time in the hospital data.

Tables 3−3. Annual incidence of heart disease (HD) and HD subtypes according to incident types.

| Years | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 |
|---|---|---|---|---|---|---|---|---|---|---|
| **Ischemic Heart Disease (I20~I25)** | | | | | | | | | | |
| In-hospital | | | | | | | | | | |
| Alive | 77,829 | 79,640 | 78,079 | 78,652 | 80,553 | 81,399 | 83,460 | 80,430 | 83,182 | 79,498 |
| Death | 1,804 | 2,144 | 1,774 | 1,683 | 1,692 | 1,687 | 1,693 | 1,551 | 1,565 | 1,587 |
| Out-of-hospital | | | | | | | | | | |
| Death | 407 | 781 | 744 | 847 | 954 | 1,073 | 1,127 | 1,169 | 1,278 | 1,211 |
| **Cardiac Arrhythmia (I47-I49)** | | | | | | | | | | |
| In-hospital | | | | | | | | | | |
| Alive | 12,064 | 13,301 | 13,926 | 15,307 | 16,145 | 17,861 | 19,323 | 19,961 | 21,246 | 21,788 |
| Death | 43 | 57 | 77 | 87 | 93 | 138 | 128 | 136 | 144 | 159 |
| Out-of-hospital | | | | | | | | | | |
| Death | 49 | 118 | 174 | 213 | 247 | 259 | 296 | 327 | 365 | 378 |

Tables 3−4. Annual incidence of heart disease (HD) and HD subtypes according to incident types (continued).

| Years | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 |
|---|---|---|---|---|---|---|---|---|---|---|
| **Heart Failure (I50)** | | | | | | | | | | |
| In-hospital | | | | | | | | | | |
| Alive | 13,068 | 13,500 | 13,871 | 13,576 | 14,211 | 15,081 | 15,455 | 15,325 | 15,996 | 16,797 |
| Death | 229 | 369 | 467 | 504 | 500 | 546 | 529 | 596 | 619 | 735 |
| Out-of-hospital | | | | | | | | | | |
| Death | 54 | 154 | 299 | 379 | 369 | 433 | 410 | 511 | 457 | 591 |
| **HD-others (I00~I09, I30~I33, I39, I40~I46, I51)** | | | | | | | | | | |
| In-hospital | | | | | | | | | | |
| Alive | 9,743 | 10,200 | 10,420 | 10,624 | 11,257 | 12,170 | 12,501 | 12,620 | 13,777 | 14,302 |
| Death | 168 | 263 | 287 | 274 | 342 | 395 | 476 | 441 | 498 | 574 |
| Out-of-hospital | | | | | | | | | | |
| Death | 96 | 190 | 232 | 336 | 339 | 441 | 526 | 548 | 632 | 733 |

Tables 3−5. Annual incidence of heart disease (HD) and HD subtypes according to incident types (continued).

| Years | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 |
|---|---|---|---|---|---|---|---|---|---|---|
| **Hypertensive Heart Disease (I11, I13)** | | | | | | | | | | |
| In-hospital | | | | | | | | | | |
| Alive | 7,930 | 7,687 | 7,337 | 6,577 | 6,158 | 6,414 | 6,220 | 5,666 | 5,384 | 5,506 |
| Death | 184 | 268 | 187 | 158 | 180 | 168 | 146 | 123 | 132 | 151 |
| Out-of-hospital | | | | | | | | | | |
| Death | 236 | 589 | 472 | 407 | 462 | 533 | 613 | 558 | 645 | 660 |
| **Pulmonary Heart Diseases (I26~I28)** | | | | | | | | | | |
| In-hospital | | | | | | | | | | |
| Alive | 1,757 | 2,215 | 2,520 | 2,722 | 3,141 | 3,585 | 3,577 | 3,821 | 4,087 | 4,315 |
| Death | 39 | 49 | 65 | 77 | 94 | 121 | 111 | 112 | 118 | 109 |
| Out-of-hospital | | | | | | | | | | |
| Death | 3 | 13 | 20 | 23 | 42 | 40 | 39 | 33 | 48 | 47 |

Tables 3−6. Annual incidence of heart disease (HD) and HD subtypes according to incident types (continued).

| Years | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 |
|---|---|---|---|---|---|---|---|---|---|---|
| **Valvular Heart Disease (I34~I38)** | | | | | | | | | | |
| In-hospital | | | | | | | | | | |
| Alive | 3,007 | 2,973 | 3,265 | 3,311 | 3,323 | 3,429 | 3,553 | 3,597 | 3,674 | 4,047 |
| Death | 48 | 82 | 91 | 88 | 108 | 116 | 158 | 128 | 166 | 182 |
| Out-of-hospital | | | | | | | | | | |
| Death | 67 | 132 | 153 | 188 | 166 | 204 | 190 | 193 | 208 | 208 |

We found that incidence rates and crude rates for HD increased over the last 10 years in the total population (p for trend < 0.0001) and in the male population (p for trend < 0.0001), though rates decreased among the female population(p for trend < 0.0001) (Tables 3-7 and 3-8). The age-standardized incidence rates for HD decreased in both men and women (Tables 3-7). The mean age of occurrence increased from 63.3 ± 14.2 years in 2006 to 65.1 ± 14.7 years in 2015, thereby increasing by 1.8 year over the course of 10 years. The mean age of occurrence in males and females increased from 59.9 ± 13.9 and 66.8 ± 13.7 years in 2006 to 61.9 ± 14.0 and 69.2 ± 14.7 years in 2015, respectively. The mean age of occurrence of HD in females was approximately seven years later than that in males. This difference in mean age changed little during this 10-year period.

Tables 3-7. Annual incidence and incidence rates for heart disease in Korea (2006-2015).

| Years | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 |
|---|---|---|---|---|---|---|---|---|---|---|
| **Total of Heart Disease** | | | | | | | | | | |
| Populations | 49,238,227 | 49,672,388 | 50,001,057 | 50,290,771 | 50,581,191 | 50,908,645 | 51,169,141 | 51,448,491 | 51,757,146 | 52,034,424 |
| Incidence persons | 115,127 | 117,758 | 115,801 | 116,441 | 119,244 | 123,168 | 126,105 | 122,821 | 127,636 | 125,388 |
| Mean age, year | 63.3±14.2 | 63.6±14.4 | 63.8±14.4 | 63.8±14.4 | 63.9±14.4 | 64.1±14.6 | 64.3±14.5 | 64.3±14.7 | 64.6±14.7 | 65.1±14.7 |
| Total Incidence rate (per 100,000 persons-year) | | | | | | | | | | |
| Crude rate | 233.8 | 237.1 | 231.6 | 231.5 | 235.7 | 241.9 | 246.4 | 238.7 | 246.6 | 241.0 |
| Age-standardized rate | 223.8 | 218.8 | 206.3 | 199.1 | 196.3 | 195.1 | 192.0 | 180.8 | 181.1 | 171.1 |
| **Male** | | | | | | | | | | |
| Incidence persons | 58,631 | 59,820 | 59,826 | 61,612 | 64,406 | 66,760 | 69,293 | 68,315 | 71,067 | 70,725 |
| Male, % | 50.9 | 50.8 | 51.7 | 52.9 | 54.0 | 54.2 | 54.9 | 55.6 | 55.7 | 56.4 |
| Mean age, year | 59.9±13.9 | 60.2±13.9 | 60.4±14.0 | 60.5±13.9 | 60.8±13.9 | 61.0±14.0 | 61.2±14.0 | 61.2±14.1 | 61.5±14.0 | 61.9±14.0 |
| Male Incidence rate (per 100,000 person-years) | | | | | | | | | | |
| Crude rate | 237.1 | 239.8 | 238.3 | 244.1 | 253.8 | 261.4 | 270.2 | 265.0 | 274.0 | 271.3 |
| Age-standardized rate | 255.2 | 248.8 | 238.7 | 235.2 | 236.5 | 235.8 | 235.1 | 223.8 | 224.1 | 214.9 |
| **Female** | | | | | | | | | | |
| Incidence persons | 56,496 | 57,938 | 55,975 | 54,829 | 54,838 | 56,408 | 56,812 | 54,506 | 56,569 | 54,663 |
| Female, % | 49.1 | 49.2 | 48.3 | 47.1 | 46.0 | 45.8 | 45.1 | 44.4 | 44.3 | 43.6 |
| Mean age, year | 66.8±13.7 | 67.1±14.0 | 67.4±13.9 | 67.5±14.1 | 67.6±14.2 | 67.8±14.4 | 68.0±14.3 | 68.2±14.6 | 68.6±14.6 | 69.2±14.7 |
| Female Incidence rate (per 100,000 person-years) | | | | | | | | | | |
| Crude rate | 230.5 | 234.3 | 224.8 | 218.9 | 217.6 | 222.3 | 222.6 | 212.3 | 219.1 | 210.5 |
| Age-standardized rate | 192.9 | 189.0 | 174.9 | 164.3 | 158.3 | 156.5 | 151.2 | 139.8 | 139.5 | 129.0 |

Tables 3-8. Crude incidence rates by age group for heart disease in Korea (2006-2015).

| Years | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 |
|---|---|---|---|---|---|---|---|---|---|---|
| **Total** (per 100,000 person-years) | | | | | | | | | | |
| 0-39 | 20.4 | 21.4 | 21.2 | 21.6 | 22.1 | 23.0 | 23.0 | 23.3 | 23.2 | 22.3 |
| 40-49 | 150.4 | 147.5 | 138.1 | 134.6 | 135.2 | 131.9 | 132.7 | 128.6 | 130.6 | 122.3 |
| 50-59 | 421.3 | 399.6 | 369.4 | 361.4 | 351.4 | 351.7 | 343.6 | 326.5 | 328.4 | 308.4 |
| 60-69 | 846.7 | 821.3 | 777.2 | 746.3 | 741.2 | 728.9 | 721.7 | 657.3 | 652.9 | 601.4 |
| 70-79 | 1,365.5 | 1,331.9 | 1,257.7 | 1,191.5 | 1,165.6 | 1,143.9 | 1,114.6 | 1,044.2 | 1,041.0 | 1,002.6 |
| 80+ | 1,852.8 | 1,877.0 | 1,777.4 | 1,690.3 | 1,639.0 | 1,682.1 | 1,622.5 | 1,531.3 | 1,548.9 | 1,509.9 |
| **Male** (per 100,000 person-years) | | | | | | | | | | |
| 0-39 | 26.4 | 27.3 | 27.4 | 27.6 | 28.5 | 29.3 | 29.3 | 29.9 | 29.8 | 28.4 |
| 40-49 | 200.1 | 194.9 | 186.5 | 185.1 | 188.1 | 181.7 | 186.1 | 183.1 | 185.3 | 176.6 |
| 50-59 | 524.4 | 495.9 | 464.0 | 465.5 | 458.8 | 463.0 | 452.0 | 438.3 | 444.8 | 426.4 |
| 60-69 | 948.8 | 926.4 | 894.6 | 881.6 | 885.0 | 886.9 | 892.6 | 823.0 | 820.7 | 770.7 |
| 70-79 | 1,391.0 | 1,358.8 | 1,292.7 | 1,248.6 | 1,259.7 | 1,234.0 | 1,219.5 | 1,149.4 | 1,142.4 | 1,122.9 |
| 80+ | 1,837.4 | 1,829.4 | 1,804.9 | 1,738.0 | 1,756.7 | 1,781.6 | 1,766.8 | 1,641.2 | 1,624.4 | 1,591.8 |
| **Female** (per 100,000 person-years) | | | | | | | | | | |
| 0-39 | 13.8 | 15.0 | 14.6 | 15.2 | 15.1 | 16.1 | 16.2 | 16.2 | 16.1 | 15.6 |
| 40-49 | 98.3 | 98.1 | 87.9 | 82.1 | 80.2 | 80.0 | 77.2 | 72.3 | 73.9 | 66.2 |
| 50-59 | 317.9 | 302.6 | 274.0 | 256.4 | 243.2 | 239.6 | 234.1 | 213.4 | 210.5 | 188.9 |
| 60-69 | 757.6 | 728.4 | 672.0 | 623.7 | 609.6 | 583.0 | 562.7 | 502.1 | 494.2 | 441.3 |
| 70-79 | 1,349.6 | 1,314.6 | 1,234.6 | 1,153.0 | 1,100.7 | 1,080.4 | 1,038.9 | 967.3 | 965.9 | 912.1 |
| 80+ | 1,859.2 | 1,896.4 | 1,766.2 | 1,670.9 | 1,591.5 | 1,641.8 | 1,563.1 | 1,485.2 | 1,516.4 | 1,473.7 |

The annual incidence of HD subtypes as well as the crude rate of IHD decreased slightly, from 162.6 per 100,000 persons in 2006 to 158.2 per 100,000 persons in 2015; the age-standardized rate of IHD decreased from 155.6 per 100,000 in 2006 to 111.6 per 100,000 in 2015 (Tables 3-9 and 3-10). The difference in the crude rates was small, but the age-standardized rates revealed a relatively larger decrease over the course of 10 years (Tables 3-11 and 3-22). The crude and age-standardized incidence rates for arrhythmia, HD (others diagnoses), and pulmonary HD increased, whereas HHD incidence decreased over the course of 10 years. Incidence trends of arrhythmia, HF, HD (other diagnoses), pulmonary HD, and valvular HD increased, whereas HHD decreased significantly. However, the incidence trend for IHD was not statistically significant (p for trend = 0.1178) (Tables 3-9). The mean age of occurrence differed depending on the HD subtypes; the mean age of occurrence for HF and HHD was in the mid-70s between 2006 and 2015. The mean age of occurrence for the other HD subtypes, including IHD, arrhythmia, pulmonary HD, and valvular HD was in the mid-60s. Hence, the mean age of occurrence for HF and HHD was approximately 10 years later than that of the other HD subtypes, and the mean age of occurrence for overall HD and its subtypes increased over the course of 10 years.

Tables 3-9. Annual incidence and incidence rates for ischemic heart disease in Korea (2006-2015).

| Years | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | P for trend |
|---|---|---|---|---|---|---|---|---|---|---|---|
| IHD (I20-I25) | | | | | | | | | | | |
| Incidence persons | 80,040 | 82,565 | 80,597 | 81,182 | 83,199 | 84,165 | 86,280 | 83,150 | 86,025 | 82,296 | 0.1178 |
| Mean age, year | 62.8±12.1 | 63.2±12.2 | 63.5±12.2 | 63.7±12.2 | 63.8±12.2 | 64.1±12.2 | 64.2±12.2 | 64.4±12.3 | 64.6±12.3 | 64.9±12.3 | |
| Total Incidence rate (per 100,000 persons-year) | | | | | | | | | | | |
| Crude rate | 162.6 | 166.2 | 161.2 | 161.4 | 164.5 | 165.3 | 168.6 | 161.6 | 166.2 | 158.2 | |
| Age-standardized rate | 155.6 | 153.3 | 143.5 | 138.5 | 136.6 | 132.7 | 130.8 | 121.7 | 121.3 | 111.6 | |
| Male | | | | | | | | | | | |
| Incidence persons | 44,342 | 45,658 | 45,288 | 46,744 | 48,569 | 49,585 | 51,394 | 50,220 | 52,388 | 51,118 | |
| Male, % | 55.4 | 55.3 | 56.2 | 57.6 | 58.4 | 58.9 | 59.6 | 60.4 | 60.9 | 62.1 | |
| Mean age, year | 60.3±12.0 | 60.6±12.0 | 60.8±12.0 | 61.0±11.9 | 61.3±12.0 | 61.5±11.9 | 61.8±11.9 | 61.7±11.9 | 61.9±11.9 | 62.3±11.9 | |
| Male Incidence rate (per 100,000 person-years) | | | | | | | | | | | |
| Crude rate | 179.3 | 183.0 | 180.4 | 185.2 | 191.4 | 194.2 | 200.4 | 194.8 | 202.0 | 196.1 | |
| Age-standardized rate | 190.9 | 187.7 | 178.4 | 176.2 | 176.0 | 172.4 | 171.7 | 161.8 | 162.4 | 152.4 | |
| Female | | | | | | | | | | | |
| Incidence persons | 35,698 | 36,907 | 35,309 | 34,438 | 34,630 | 34,580 | 34,886 | 32,930 | 33,637 | 31,178 | |
| Female, % | 44.6 | 44.7 | 43.8 | 42.4 | 41.6 | 41.1 | 40.4 | 39.6 | 39.1 | 37.9 | |
| Mean age, year | 66.1±11.6 | 66.5±11.6 | 67.0±11.5 | 67.3±11.5 | 67.4±11.7 | 67.8±11.7 | 67.9±11.8 | 68.4±11.7 | 68.6±11.9 | 69.2±11.9 | |
| Female Incidence rate (per 100,000 person-years) | | | | | | | | | | | |
| Crude rate | 145.7 | 149.3 | 141.8 | 137.5 | 137.4 | 136.3 | 136.7 | 128.3 | 130.3 | 120.1 | |
| Age-standardized rate | 123.7 | 121.9 | 111.6 | 104.0 | 100.6 | 96.3 | 93.1 | 84.2 | 82.8 | 73.4 | |

Tables 3-10. Crude incidence rates by age group for ischemic heart disease in Korea (2006-2015).

| Years | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 |
|---|---|---|---|---|---|---|---|---|---|---|
| **Total** (per 100,000 person-years) | | | | | | | | | | |
| 0-39 | 8.3 | 8.4 | 7.9 | 7.4 | 7.8 | 7.3 | 7.1 | 7.0 | 7.0 | 6.3 |
| 40-49 | 110.2 | 108.4 | 100.4 | 96.3 | 96.8 | 89.7 | 91.9 | 88.8 | 88.6 | 81.4 |
| 50-59 | 335.6 | 320.0 | 292.3 | 286.8 | 275.5 | 273.8 | 265.6 | 249.8 | 250.5 | 231.7 |
| 60-69 | 661.8 | 648.8 | 612.5 | 586.8 | 583.3 | 565.6 | 562.9 | 507.4 | 503.8 | 452.5 |
| 70-79 | 901.3 | 908.5 | 860.0 | 824.4 | 808.6 | 786.1 | 761.1 | 709.0 | 703.5 | 659.7 |
| 80+ | 878.1 | 898.3 | 851.9 | 842.8 | 833.1 | 830.8 | 819.1 | 774.1 | 779.5 | 737.8 |
| **Male** (per 100,000 person-years) | | | | | | | | | | |
| 0-39 | 12.6 | 12.9 | 12.5 | 11.7 | 12.3 | 11.4 | 11.2 | 11.4 | 11.0 | 10.1 |
| 40-49 | 153.9 | 151.5 | 144.4 | 142.5 | 143.5 | 133.5 | 138.1 | 136.8 | 138.3 | 128.0 |
| 50-59 | 434.9 | 412.5 | 382.4 | 385.4 | 373.7 | 376.9 | 362.5 | 350.8 | 355.2 | 337.4 |
| 60-69 | 774.8 | 764.8 | 737.0 | 725.5 | 727.1 | 719.6 | 728.8 | 665.2 | 665.1 | 612.5 |
| 70-79 | 1,008.2 | 1,011.2 | 957.0 | 931.4 | 938.5 | 904.8 | 894.9 | 827.5 | 830.2 | 794.6 |
| 80+ | 1,039.2 | 1,039.9 | 1,005.3 | 1,016.0 | 1,020.9 | 1,033.1 | 1,024.1 | 937.3 | 939.8 | 904.1 |
| **Female** (per 100,000 person-years) | | | | | | | | | | |
| 0-39 | 3.6 | 3.5 | 3.0 | 2.8 | 2.9 | 2.9 | 2.6 | 2.2 | 2.7 | 2.2 |
| 40-49 | 64.5 | 63.6 | 54.6 | 48.4 | 48.2 | 44.0 | 43.9 | 39.1 | 37.1 | 37.8 |
| 50-59 | 235.9 | 226.8 | 201.4 | 187.3 | 176.6 | 170.0 | 167.9 | 147.5 | 144.6 | 130.3 |
| 60-69 | 563.0 | 546.4 | 501.1 | 461.1 | 451.8 | 423.5 | 408.4 | 359.5 | 351.2 | 322.9 |
| 70-79 | 834.8 | 842.6 | 796.1 | 752.2 | 719.0 | 702.5 | 664.5 | 622.4 | 609.6 | 577.7 |
| 80+ | 811.5 | 840.4 | 789.7 | 772.3 | 757.3 | 748.9 | 734.8 | 705.8 | 710.6 | 682.7 |

Tables 3-11. Annual incidence and incidence rates for cardiac arrhythmia in Korea (2006-2015).

| Years | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | P for trend |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Cardiac Arrhythmia (I47-I49)** | | | | | | | | | | | |
| Incidence persons | 12,156 | 13,476 | 14,177 | 15,607 | 16,485 | 18,258 | 19,747 | 20,424 | 21,755 | 22,325 | <.0001 |
| Mean age, year | 59.7±18.2 | 60.6±18.1 | 61.2±18.1 | 61.1±18.0 | 61.1±17.8 | 61.8±17.8 | 62.4±17.7 | 62.6±17.8 | 63.2±17.7 | 63.9±17.5 | |
| Total Incidence rate (per 100,000 persons-year) | | | | | | | | | | | |
| Crude rate | 24.7 | 27.1 | 28.4 | 31.0 | 32.6 | 35.9 | 38.6 | 39.7 | 42.0 | 42.9 | |
| Age-standardized rate | 23.8 | 25.3 | 25.6 | 27.2 | 27.8 | 29.7 | 30.8 | 30.9 | 31.7 | 31.3 | |
| **Male** | | | | | | | | | | | |
| Incidence persons | 5,943 | 6,442 | 6,633 | 7,584 | 8,189 | 9,082 | 9,895 | 10,283 | 10,826 | 11,373 | |
| Male, % | 48.9 | 47.8 | 46.8 | 48.6 | 49.7 | 49.7 | 50.1 | 50.3 | 49.8 | 50.9 | |
| Mean age, year | 56.2±18.3 | 57.2±18.0 | 57.9±18.3 | 58.3±17.6 | 58.2±17.5 | 58.9±17.5 | 59.4±17.3 | 59.8±17.3 | 60.2±17.4 | 61.2±17.0 | |
| Male Incidence rate (per 100,000 person-years) | | | | | | | | | | | |
| Crude rate | 24.0 | 25.8 | 26.4 | 30.0 | 32.3 | 35.6 | 38.6 | 39.9 | 41.7 | 43.6 | |
| Age-standardized rate | 26.0 | 27.1 | 27.0 | 29.7 | 30.7 | 33.0 | 34.5 | 34.7 | 35.3 | 35.7 | |
| **Female** | | | | | | | | | | | |
| Incidence persons | 6,213 | 7,034 | 7,544 | 8,023 | 8,296 | 9,176 | 9,852 | 10,141 | 10,929 | 10,952 | |
| Female, % | 51.1 | 52.2 | 53.2 | 51.4 | 50.3 | 50.3 | 49.9 | 49.7 | 50.2 | 49.1 | |
| Mean age, year | 63.1±17.3 | 63.7±17.6 | 64.1±17.5 | 63.8±17.8 | 63.9±17.7 | 64.8±17.6 | 65.3±17.6 | 65.4±17.8 | 66.2±17.5 | 66.7±17.6 | |
| Female Incidence rate (per 100,000 person-years) | | | | | | | | | | | |
| Crude rate | 25.4 | 28.4 | 30.3 | 32.0 | 32.9 | 36.2 | 38.6 | 39.5 | 42.3 | 42.2 | |
| Age-standardized rate | 21.7 | 23.5 | 24.3 | 25.1 | 25.0 | 26.6 | 27.4 | 27.4 | 28.3 | 27.3 | |

Tables 3-12. Crude incidence rates by age group for cardiac arrhythmia in Korea (2006-2015).

| Years | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 |
|---|---|---|---|---|---|---|---|---|---|---|
| **Total** (per 100,000 person-years) | | | | | | | | | | |
| 0-39 | 5.7 | 6.1 | 6.3 | 7.1 | 7.3 | 7.7 | 8.1 | 8.4 | 8.4 | 8.0 |
| 40-49 | 17.9 | 18.3 | 18.5 | 20.1 | 20.7 | 21.6 | 22.2 | 21.7 | 22.9 | 22.0 |
| 50-59 | 36.7 | 38.5 | 37.0 | 39.9 | 43.5 | 44.5 | 46.5 | 47.3 | 47.0 | 46.0 |
| 60-69 | 74.8 | 76.0 | 76.7 | 81.7 | 82.7 | 88.3 | 90.9 | 90.5 | 91.4 | 93.4 |
| 70-79 | 134.9 | 147.2 | 150.9 | 151.0 | 150.8 | 162.8 | 170.8 | 168.6 | 179.6 | 177.1 |
| 80+ | 192.8 | 226.4 | 237.2 | 248.5 | 240.2 | 274.4 | 285.3 | 286.7 | 298.1 | 302.5 |
| **Male** (per 100,000 person-years) | | | | | | | | | | |
| 0-39 | 6.9 | 6.9 | 7.0 | 7.9 | 8.1 | 8.9 | 9.0 | 9.1 | 9.4 | 8.7 |
| 40-49 | 21.2 | 21.0 | 20.4 | 22.8 | 24.9 | 24.5 | 26.5 | 26.1 | 26.7 | 27.0 |
| 50-59 | 39.3 | 42.3 | 40.0 | 45.2 | 49.4 | 50.7 | 55.3 | 55.6 | 55.4 | 55.6 |
| 60-69 | 79.1 | 78.3 | 77.9 | 86.1 | 89.8 | 99.0 | 102.4 | 104.2 | 103.6 | 108.5 |
| 70-79 | 136.7 | 151.8 | 148.3 | 153.6 | 160.0 | 174.1 | 178.3 | 177.0 | 186.7 | 190.6 |
| 80+ | 209.2 | 235.3 | 262.1 | 291.6 | 261.1 | 296.7 | 311.1 | 317.7 | 317.5 | 332.4 |
| **Female** (per 100,000 person-years) | | | | | | | | | | |
| 0-39 | 4.4 | 5.2 | 5.5 | 6.2 | 6.4 | 6.5 | 7.1 | 7.5 | 7.3 | 7.2 |
| 40-49 | 14.4 | 15.4 | 16.4 | 17.4 | 16.4 | 18.5 | 17.8 | 17.2 | 18.9 | 16.7 |
| 50-59 | 34.2 | 34.7 | 33.8 | 34.6 | 37.5 | 38.3 | 37.6 | 38.9 | 38.4 | 36.3 |
| 60-69 | 70.9 | 73.9 | 75.6 | 77.6 | 76.3 | 78.4 | 80.2 | 77.6 | 79.7 | 79.2 |
| 70-79 | 133.8 | 144.3 | 152.7 | 149.2 | 144.5 | 154.9 | 165.4 | 162.5 | 174.4 | 167.0 |
| 80+ | 186.0 | 222.7 | 227.1 | 231.0 | 231.8 | 265.3 | 274.7 | 273.6 | 289.8 | 289.3 |

Tables 3-13. Annual incidence and incidence rates for heart failure in Korea (2006-2015).

| Years | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | P for trend |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **HF (I50)** | | | | | | | | | | | |
| Incidence persons | 13,351 | 14,023 | 14,637 | 14,459 | 15,080 | 16,060 | 16,394 | 16,432 | 17,072 | 18,123 | <.0001 |
| Mean age, year | 73.3±12.4 | 73.8±12.6 | 74.0±12.6 | 74.5±12.4 | 74.5±12.7 | 74.9±12.7 | 74.9±12.8 | 75.3±12.7 | 75.4±12.7 | 76.1±12.5 | |
| Total Incidence rate (per 100,000 persons-year) | | | | | | | | | | | |
| Crude rate | 27.1 | 28.2 | 29.3 | 28.8 | 29.8 | 31.5 | 32.0 | 31.9 | 33.0 | 34.8 | |
| Age-standardized rate | 25.6 | 25.4 | 25.1 | 23.4 | 23.3 | 23.5 | 22.7 | 21.6 | 21.3 | 21.4 | |
| **Male** | | | | | | | | | | | |
| Incidence persons | 4,471 | 4,648 | 5,158 | 5,033 | 5,545 | 5,976 | 6,201 | 6,343 | 6,487 | 6,929 | |
| Male, % | 33.5 | 33.1 | 35.2 | 34.8 | 36.8 | 37.2 | 37.8 | 38.6 | 38.0 | 38.2 | |
| Mean age, year | 69.2±13.6 | 69.6±14.1 | 70.0±13.8 | 70.3±13.6 | 70.3±13.7 | 70.5±13.7 | 70.6±13.9 | 71.1±13.7 | 71.4±13.8 | 71.8±13.5 | |
| Male Incidence rate (per 100,000 person-years) | | | | | | | | | | | |
| Crude rate | 18.1 | 18.6 | 20.5 | 19.9 | 21.8 | 23.4 | 24.2 | 24.6 | 25.0 | 26.6 | |
| Age-standardized rate | 22.0 | 21.8 | 22.8 | 21.1 | 22.1 | 22.7 | 22.2 | 21.6 | 20.9 | 21.1 | |
| **Female** | | | | | | | | | | | |
| Incidence persons | 8,880 | 9,375 | 9,479 | 9,426 | 9,535 | 10,084 | 10,193 | 10,089 | 10,585 | 11,194 | |
| Female, % | 66.5 | 66.9 | 64.8 | 65.2 | 63.2 | 62.8 | 62.2 | 61.4 | 62.0 | 61.8 | |
| Mean age, year | 75.4±11.1 | 75.9±11.3 | 76.2±11.3 | 76.8±11.2 | 77.0±11.3 | 77.4±11.3 | 77.5±11.4 | 78.0±11.2 | 78.4±11.1 | 78.7±11.1 | |
| Female Incidence rate (per 100,000 person-years) | | | | | | | | | | | |
| Crude rate | 36.2 | 37.9 | 38.1 | 37.6 | 37.8 | 39.7 | 39.9 | 39.3 | 41.0 | 43.1 | |
| Age-standardized rate | 27.4 | 27.3 | 26.1 | 24.4 | 23.5 | 23.5 | 22.5 | 21.0 | 20.9 | 21.0 | |

Tables 3-14. Crude incidence rates by age group for heart failure in Korea (2006-2015).

| Years | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 |
|---|---|---|---|---|---|---|---|---|---|---|
| **Total** (per 100,000 person-years) | | | | | | | | | | |
| 0-39 | 0.8 | 0.9 | 0.9 | 0.9 | 0.9 | 1.0 | 1.2 | 1.1 | 1.1 | 1.1 |
| 40-49 | 5.7 | 5.8 | 5.7 | 5.1 | 5.9 | 5.7 | 6.1 | 5.5 | 5.8 | 5.5 |
| 50-59 | 18.0 | 16.2 | 16.1 | 15.1 | 14.6 | 15.3 | 14.8 | 14.2 | 13.9 | 14.3 |
| 60-69 | 59.3 | 58.7 | 57.1 | 51.8 | 53.1 | 51.8 | 48.1 | 44.6 | 42.0 | 43.1 |
| 70-79 | 238.4 | 222.1 | 221.9 | 201.0 | 195.5 | 193.4 | 186.5 | 178.7 | 175.1 | 176.5 |
| 80+ | 633.2 | 675.3 | 663.0 | 645.0 | 635.4 | 661.9 | 632.6 | 610.2 | 608.7 | 612.6 |
| **Male** (per 100,000 person-years) | | | | | | | | | | |
| 0-39 | 0.8 | 1.1 | 1.1 | 1.0 | 1.1 | 1.1 | 1.3 | 1.3 | 1.3 | 1.3 |
| 40-49 | 6.8 | 6.9 | 6.9 | 6.1 | 7.3 | 7.2 | 8.0 | 7.4 | 7.4 | 6.9 |
| 50-59 | 20.9 | 17.4 | 18.7 | 18.0 | 17.6 | 18.7 | 18.8 | 17.5 | 17.8 | 18.1 |
| 60-69 | 53.8 | 56.1 | 57.0 | 51.2 | 55.9 | 57.9 | 51.1 | 51.0 | 47.7 | 49.8 |
| 70-79 | 186.6 | 169.6 | 185.6 | 167.2 | 172.9 | 171.9 | 167.5 | 166.9 | 158.8 | 163.3 |
| 80+ | 506.3 | 542.0 | 559.6 | 534.9 | 553.7 | 576.5 | 568.8 | 547.8 | 534.7 | 531.8 |
| **Female** (per 100,000 person-years) | | | | | | | | | | |
| 0-39 | 0.7 | 0.8 | 0.8 | 0.7 | 0.8 | 0.8 | 1.0 | 0.8 | 0.8 | 0.8 |
| 40-49 | 4.6 | 4.6 | 4.6 | 4.1 | 4.1 | 4.2 | 4.1 | 3.5 | 4.1 | 4.0 |
| 50-59 | 15.2 | 15.0 | 13.6 | 12.2 | 11.6 | 11.9 | 10.7 | 10.8 | 10.0 | 10.4 |
| 60-69 | 64.2 | 61.0 | 57.1 | 52.4 | 50.6 | 46.2 | 45.2 | 38.6 | 36.7 | 36.8 |
| 70-79 | 270.7 | 255.8 | 245.8 | 223.7 | 211.2 | 208.6 | 200.2 | 187.3 | 187.2 | 186.4 |
| 80+ | 685.6 | 729.8 | 705.0 | 689.8 | 668.3 | 696.4 | 658.9 | 636.4 | 640.6 | 648.4 |

Tables 3-15. Annual incidence and incidence rates for other heart disease diagnoses in Korea (2006-2015).

| Years | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | P for trend |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **HD-other diagnoses (I00-I09, I30-I33, I39, I40-I46, I51)** | | | | | | | | | | | |
| Incidence persons | 10,007 | 10,653 | 10,939 | 11,234 | 11,938 | 13,006 | 13,503 | 13,609 | 14,907 | 15,609 | <.0001 |
| Mean age, year | 60.2±18.1 | 61.1±18.6 | 61.5±18.3 | 61.7±18.5 | 62.6±18.3 | 62.6±18.4 | 63.3±18.3 | 63.8±18.6 | 64.4±18.3 | 65.4±18.2 | |
| Total Incidence rate (per 100,000 persons-year) | | | | | | | | | | | |
| Crude rate | 20.3 | 21.4 | 21.9 | 22.3 | 23.6 | 25.5 | 26.4 | 26.5 | 28.8 | 30.0 | |
| Age-standardized rate | 19.6 | 20.0 | 19.7 | 19.5 | 20.0 | 21.0 | 20.9 | 20.4 | 21.5 | 21.6 | |
| **Male** | | | | | | | | | | | |
| Incidence persons | 4,722 | 4,935 | 5,171 | 5,387 | 5,885 | 6,477 | 6,864 | 6,924 | 7,655 | 8,028 | |
| Male, % | 47.2 | 46.3 | 47.3 | 48.0 | 49.3 | 49.8 | 50.8 | 50.9 | 51.4 | 51.4 | |
| Mean age, year | 56.6±18.0 | 57.4±18.7 | 57.9±18.3 | 58.2±18.5 | 58.8±18.4 | 59.0±18.3 | 59.8±18.3 | 60.2±18.5 | 61.0±18.1 | 61.6±18.2 | |
| Male Incidence rate (per 100,000 person-years) | | | | | | | | | | | |
| Crude rate | 19.1 | 19.8 | 20.6 | 21.3 | 23.2 | 25.4 | 26.8 | 26.9 | 29.5 | 30.8 | |
| Age-standardized rate | 20.7 | 20.9 | 21.1 | 21.2 | 22.4 | 23.8 | 24.2 | 23.6 | 25.1 | 25.4 | |
| **Female** | | | | | | | | | | | |
| Incidence persons | 5,285 | 5,718 | 5,768 | 5,847 | 6,053 | 6,529 | 6,639 | 6,685 | 7,252 | 7,581 | |
| Female, % | 52.8 | 53.7 | 52.7 | 52.0 | 50.7 | 50.2 | 49.2 | 49.1 | 48.6 | 48.6 | |
| Mean age, year | 63.4±17.5 | 64.3±17.8 | 64.7±17.7 | 65.0±17.9 | 66.3±17.4 | 66.3±17.9 | 67.0±17.6 | 67.4±17.9 | 67.9±17.8 | 69.4±17.4 | |
| Female Incidence rate (per 100,000 person-years) | | | | | | | | | | | |
| Crude rate | 21.6 | 23.1 | 23.2 | 23.3 | 24.0 | 25.7 | 26.0 | 26.0 | 28.1 | 29.2 | |
| Age-standardized rate | 18.4 | 19.0 | 18.4 | 18.0 | 17.7 | 18.5 | 17.9 | 17.4 | 18.1 | 17.9 | |

Tables 3-16. Crude incidence rates by age group for other heart disease diagnoses in Korea (2006~2015).

| Years | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 |
|---|---|---|---|---|---|---|---|---|---|---|
| **Total** (per 100,000 person-years) | | | | | | | | | | |
| 0-39 | 4.6 | 4.9 | 4.9 | 5.2 | 5.2 | 5.5 | 5.6 | 5.7 | 5.7 | 5.7 |
| 40-49 | 14.7 | 14.2 | 13.7 | 13.6 | 13.4 | 15.3 | 14.1 | 13.2 | 14.6 | 14.3 |
| 50-59 | 29.9 | 29.1 | 28.1 | 26.8 | 26.4 | 28.1 | 27.8 | 26.7 | 28.9 | 27.9 |
| 60-69 | 59.9 | 58.6 | 58.5 | 55.7 | 57.6 | 57.8 | 59.2 | 54.6 | 56.9 | 54.8 |
| 70-79 | 110.5 | 111.6 | 114.6 | 114.4 | 119.8 | 121.9 | 121.0 | 122.3 | 128.3 | 132.3 |
| 80+ | 175.1 | 211.0 | 198.1 | 198.5 | 211.5 | 227.0 | 232.0 | 227.1 | 243.3 | 262.1 |
| **Male** (per 100,000 person-years) | | | | | | | | | | |
| 0-39 | 5.3 | 5.6 | 5.6 | 6.0 | 6.3 | 6.6 | 6.8 | 6.9 | 7.0 | 7.2 |
| 40-49 | 17.6 | 15.5 | 16.1 | 15.4 | 15.9 | 19.0 | 17.4 | 16.5 | 17.7 | 17.5 |
| 50-59 | 31.1 | 31.8 | 30.5 | 30.5 | 31.4 | 33.3 | 33.5 | 33.9 | 36.9 | 35.6 |
| 60-69 | 60.4 | 59.3 | 62.0 | 57.8 | 62.8 | 64.6 | 69.8 | 60.7 | 65.8 | 65.6 |
| 70-79 | 110.8 | 108.1 | 110.2 | 114.3 | 119.5 | 126.3 | 127.7 | 131.9 | 137.7 | 147.4 |
| 80+ | 181.7 | 219.0 | 215.4 | 221.3 | 242.3 | 247.2 | 258.9 | 253.1 | 276.6 | 279.6 |
| **Female** (per 100,000 person-years) | | | | | | | | | | |
| 0-39 | 3.9 | 4.1 | 4.2 | 4.2 | 3.9 | 4.4 | 4.3 | 4.4 | 4.2 | 4.1 |
| 40-49 | 11.6 | 12.9 | 11.2 | 11.7 | 10.7 | 11.5 | 10.6 | 9.8 | 11.4 | 11.1 |
| 50-59 | 28.8 | 26.3 | 25.6 | 23.0 | 21.3 | 22.9 | 22.0 | 19.4 | 20.9 | 20.1 |
| 60-69 | 59.5 | 57.9 | 55.3 | 53.8 | 52.9 | 51.6 | 49.4 | 48.8 | 48.5 | 44.6 |
| 70-79 | 110.3 | 113.8 | 117.6 | 114.5 | 120.0 | 118.8 | 116.1 | 115.3 | 121.3 | 120.9 |
| 80+ | 172.4 | 207.7 | 191.1 | 189.2 | 199.1 | 218.8 | 220.9 | 216.1 | 229.0 | 254.4 |

Tables 3-17. Annual incidence and incidence rates for hypertensive heart disease in Korea (2006-2015).

| Years | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | P for trend |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **HHD (I11, I13)** | | | | | | | | | | | |
| Incidence persons | 8,350 | 8,544 | 7,996 | 7,142 | 6,800 | 7,115 | 6,979 | 6,347 | 6,161 | 6,317 | <.0001 |
| Mean age, year | 72.1±12.5 | 73.3±12.5 | 73.7±12.5 | 73.6±12.8 | 74.0±12.7 | 73.7±13.3 | 73.6±13.6 | 73.2±13.9 | 73.0±13.9 | 74.1±14.0 | |
| Total Incidence rate (per 100,000 persons-year) | | | | | | | | | | | |
| Crude rate | 17.0 | 17.2 | 16.0 | 14.2 | 13.4 | 14.0 | 13.6 | 12.3 | 11.9 | 12.1 | |
| Age-standardized rate | 16.0 | 15.5 | 13.7 | 11.6 | 10.5 | 10.5 | 9.8 | 8.5 | 7.8 | 7.7 | |
| **Male** | | | | | | | | | | | |
| Incidence persons | 2,759 | 2,726 | 2,552 | 2,239 | 2,243 | 2,360 | 2,213 | 2,136 | 1,995 | 2,203 | |
| Male, % | 33.0 | 31.9 | 31.9 | 31.3 | 33.0 | 33.2 | 31.7 | 33.7 | 32.4 | 34.9 | |
| Mean age, year | 66.9±13.5 | 68.0±13.8 | 68.3±14.2 | 67.8±14.2 | 68.6±14.1 | 67.9±14.7 | 67.5±15.1 | 67.5±15.2 | 67.7±15.4 | 68.6±15.2 | |
| Male Incidence rate (per 100,000 person-years) | | | | | | | | | | | |
| Crude rate | 11.2 | 10.9 | 10.2 | 8.9 | 8.8 | 9.2 | 8.6 | 8.3 | 7.7 | 8.5 | |
| Age-standardized rate | 13.1 | 12.5 | 11.1 | 9.2 | 8.9 | 8.9 | 7.9 | 7.2 | 6.5 | 6.8 | |
| **Female** | | | | | | | | | | | |
| Incidence persons | 5,591 | 5,818 | 5,444 | 4,903 | 4,557 | 4,755 | 4,766 | 4,211 | 4,166 | 4,114 | |
| Female, % | 67.0 | 68.1 | 68.1 | 68.7 | 67.0 | 66.8 | 68.3 | 66.3 | 67.6 | 65.1 | |
| Mean age, year | 74.7±11.0 | 75.7±11.0 | 76.3±10.8 | 76.2±11.1 | 76.7±10.9 | 76.6±11.6 | 76.5±11.8 | 76.1±12.2 | 77.0±12.1 | 77.0±12.4 | |
| Female Incidence rate (per 100,000 person-years) | | | | | | | | | | | |
| Crude rate | 22.8 | 23.5 | 21.9 | 19.6 | 18.1 | 18.7 | 18.7 | 16.4 | 16.1 | 15.8 | |
| Age-standardized rate | 17.4 | 17.0 | 14.9 | 12.7 | 11.2 | 11.3 | 10.7 | 9.1 | 8.5 | 8.1 | |

Tables 3-18. Crude incidence rates by age group for hypertensive heart disease in Korea (2006-2015).

| Years | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 |
|---|---|---|---|---|---|---|---|---|---|---|
| **Total** (per 100,000 person-years) | | | | | | | | | | |
| 0-39 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.5 | 0.5 | 0.6 | 0.6 | 0.6 |
| 40-49 | 4.7 | 4.5 | 4.0 | 3.7 | 3.2 | 3.7 | 3.4 | 3.4 | 2.9 | 3.1 |
| 50-59 | 15.6 | 13.0 | 11.4 | 10.0 | 8.3 | 9.3 | 9.3 | 8.4 | 7.4 | 7.2 |
| 60-69 | 38.9 | 34.9 | 28.7 | 25.4 | 22.2 | 24.0 | 22.0 | 19.7 | 17.8 | 16.9 |
| 70-79 | 143.7 | 134.1 | 114.5 | 94.1 | 87.6 | 77.8 | 70.8 | 61.2 | 53.6 | 56.7 |
| 80+ | 357.6 | 391.4 | 368.9 | 305.1 | 278.8 | 281.3 | 256.7 | 213.7 | 208.6 | 192.4 |
| **Male** (per 100,000 person-years) | | | | | | | | | | |
| 0-39 | 0.5 | 0.5 | 0.6 | 0.5 | 0.5 | 0.7 | 0.8 | 0.7 | 0.8 | 0.8 |
| 40-49 | 5.7 | 5.4 | 5.3 | 4.7 | 4.1 | 4.4 | 3.9 | 4.1 | 3.5 | 3.9 |
| 50-59 | 17.3 | 14.0 | 12.4 | 10.1 | 9.1 | 10.1 | 9.9 | 8.8 | 7.7 | 7.3 |
| 60-69 | 36.7 | 31.6 | 25.4 | 25.0 | 22.2 | 22.4 | 20.9 | 18.9 | 16.2 | 16.7 |
| 70-79 | 102.5 | 94.9 | 82.2 | 61.9 | 62.1 | 55.4 | 45.4 | 44.2 | 38.7 | 44.1 |
| 80+ | 241.1 | 273.5 | 258.3 | 203.2 | 206.8 | 208.4 | 174.8 | 151.0 | 137.8 | 143.2 |
| **Female** (per 100,000 person-years) | | | | | | | | | | |
| 0-39 | 0.3 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.3 | 0.3 | 0.3 | 0.4 |
| 40-49 | 3.8 | 3.6 | 2.7 | 2.7 | 2.4 | 2.9 | 3.0 | 2.7 | 2.2 | 2.2 |
| 50-59 | 13.8 | 12.0 | 10.4 | 9.8 | 7.5 | 8.5 | 8.7 | 8.0 | 7.2 | 7.1 |
| 60-69 | 40.8 | 37.8 | 31.6 | 25.7 | 22.2 | 25.4 | 23.0 | 20.3 | 19.2 | 17.1 |
| 70-79 | 169.4 | 159.2 | 135.9 | 115.9 | 105.3 | 93.6 | 89.1 | 73.7 | 64.6 | 66.2 |
| 80+ | 405.8 | 439.5 | 413.7 | 346.7 | 307.8 | 310.9 | 290.4 | 240.0 | 239.0 | 214.2 |

Tables 3-19. Annual incidence and incidence rates for pulmonary heart disease in Korea (2006-2015).

| Years | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | P for trend |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Pulmonary HD (I26-I28)** | | | | | | | | | | | |
| Incidence persons | 1,799 | 2,277 | 2,605 | 2,822 | 3,277 | 3,746 | 3,727 | 3,966 | 4,253 | 4,471 | <.0001 |
| Mean age, year | 62.8±18.3 | 63.6±18.9 | 63.8±19.0 | 65.3±18.4 | 66.2±17.7 | 65.7±18.6 | 66.6±18.2 | 67.5±17.4 | 68.0±17.1 | 68.3±17.5 | |
| Total Incidence rate (per 100,000 persons-year) | | | | | | | | | | | |
| Crude rate | 3.7 | 4.6 | 5.2 | 5.6 | 6.5 | 7.4 | 7.3 | 7.7 | 8.2 | 8.6 | |
| Age-standardized rate | 3.5 | 4.2 | 4.7 | 4.8 | 5.4 | 5.9 | 5.6 | 5.8 | 5.9 | 6.0 | |
| **Male** | | | | | | | | | | | |
| Incidence persons | 698 | 869 | 1,036 | 1,097 | 1,237 | 1,460 | 1,452 | 1,507 | 1,625 | 1,716 | |
| Male, % | 38.8 | 38.2 | 39.8 | 38.9 | 37.7 | 39.0 | 39.0 | 38.0 | 38.2 | 38.4 | |
| Mean age, year | 59.0±19.4 | 59.7±20.5 | 59.4±20.6 | 61.8±19.4 | 62.2±19.0 | 62.0±19.5 | 62.6±19.4 | 63.4±18.8 | 64.2±18.3 | 64.3±18.6 | |
| Male Incidence rate (per 100,000 person-years) | | | | | | | | | | | |
| Crude rate | 2.8 | 3.5 | 4.1 | 4.3 | 4.9 | 5.7 | 5.7 | 5.8 | 6.3 | 6.6 | |
| Age-standardized rate | 3.2 | 3.8 | 4.3 | 4.5 | 4.8 | 5.5 | 5.2 | 5.2 | 5.4 | 5.5 | |
| **Female** | | | | | | | | | | | |
| Incidence persons | 1,101 | 1,408 | 1,569 | 1,725 | 2,040 | 2,286 | 2,275 | 2,459 | 2,628 | 2,755 | |
| Female, % | 61.2 | 61.8 | 60.2 | 61.1 | 62.3 | 61.0 | 61.0 | 62.0 | 61.8 | 61.6 | |
| Mean age, year | 65.2±17.2 | 66.0±17.5 | 66.7±17.2 | 67.4±17.4 | 68.7±16.4 | 68.0±17.7 | 69.1±17.0 | 70.1±15.9 | 70.4±15.8 | 70.8±16.3 | |
| Female Incidence rate (per 100,000 person-years) | | | | | | | | | | | |
| Crude rate | 4.5 | 5.7 | 6.3 | 6.9 | 8.1 | 9.0 | 8.9 | 9.6 | 10.2 | 10.6 | |
| Age-standardized rate | 3.8 | 4.6 | 4.9 | 5.2 | 5.8 | 6.3 | 5.9 | 6.1 | 6.3 | 6.3 | |

Tables 3-20. Crude incidence rates by age group for pulmonary heart disease in Korea (2006-2015).

| Years | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 |
|---|---|---|---|---|---|---|---|---|---|---|
| **Total** (per 100,000 person-years) | | | | | | | | | | |
| 0-39 | 0.7 | 1.0 | 1.1 | 1.1 | 1.1 | 1.5 | 1.3 | 1.3 | 1.3 | 1.5 |
| 40-49 | 2.3 | 2.0 | 2.4 | 2.2 | 2.4 | 3.0 | 2.7 | 3.1 | 3.2 | 2.8 |
| 50-59 | 3.3 | 4.2 | 4.4 | 4.2 | 4.7 | 5.2 | 4.8 | 4.5 | 4.9 | 5.2 |
| 60-69 | 10.2 | 12.1 | 13.2 | 14.1 | 15.5 | 15.9 | 14.4 | 15.0 | 14.4 | 13.9 |
| 70-79 | 26.8 | 33.6 | 37.1 | 37.4 | 43.5 | 44.9 | 44.0 | 44.7 | 46.1 | 45.8 |
| 80+ | 37.9 | 48.2 | 51.6 | 62.3 | 70.4 | 79.6 | 77.8 | 82.8 | 87.3 | 92.0 |
| **Male** (per 100,000 person-years) | | | | | | | | | | |
| 0-39 | 0.7 | 1.0 | 1.2 | 1.1 | 1.2 | 1.5 | 1.4 | 1.4 | 1.4 | 1.6 |
| 40-49 | 2.3 | 1.9 | 2.1 | 2.2 | 2.2 | 3.1 | 2.7 | 2.9 | 2.7 | 2.4 |
| 50-59 | 3.0 | 3.8 | 4.4 | 4.0 | 4.4 | 5.1 | 4.7 | 4.5 | 4.9 | 5.3 |
| 60-69 | 8.5 | 9.8 | 11.9 | 11.5 | 13.5 | 13.1 | 12.2 | 13.6 | 12.7 | 12.5 |
| 70-79 | 22.1 | 27.4 | 30.7 | 30.7 | 35.8 | 38.1 | 38.1 | 34.7 | 39.3 | 38.3 |
| 80+ | 37.7 | 49.5 | 50.6 | 69.6 | 61.7 | 79.3 | 72.6 | 77.1 | 77.6 | 80.7 |
| **Female** (per 100,000 person-years) | | | | | | | | | | |
| 0-39 | 0.7 | 1.0 | 1.0 | 1.1 | 1.0 | 1.5 | 1.3 | 1.2 | 1.2 | 1.3 |
| 40-49 | 2.3 | 2.0 | 2.7 | 2.1 | 2.7 | 3.0 | 2.7 | 3.3 | 3.8 | 3.2 |
| 50-59 | 3.6 | 4.6 | 4.4 | 4.3 | 4.9 | 5.3 | 4.9 | 4.4 | 4.8 | 5.1 |
| 60-69 | 11.7 | 14.2 | 14.4 | 16.4 | 17.3 | 18.4 | 16.5 | 16.3 | 16.1 | 15.1 |
| 70-79 | 29.7 | 37.5 | 41.3 | 42.0 | 48.8 | 49.7 | 48.3 | 52.0 | 51.1 | 51.4 |
| 80+ | 37.9 | 47.7 | 52.1 | 59.3 | 73.9 | 79.7 | 80.0 | 85.2 | 91.5 | 97.0 |

Tables 3-21. Annual incidence and incidence rates for valvular heart disease in Korea (2006-2015).

| Years | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | P for trend |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Valvular HD (I34-I38)** | | | | | | | | | | | |
| Incidence persons | 3,122 | 3,187 | 3,509 | 3,587 | 3,597 | 3,749 | 3,901 | 3,918 | 4,048 | 4,437 | <.0001 |
| Mean age, year | 60.4±17.7 | 61.2±18.4 | 62.0±17.4 | 63.0±17.3 | 63.5±17.4 | 65.0±17.0 | 65.3±17.3 | 65.6±17.6 | 67.4±16.4 | 67.2±16.8 | |
| Total Incidence rate (per 100,000 persons-year) | | | | | | | | | | | |
| Crude rate | 6.3 | 6.4 | 7.0 | 7.1 | 7.1 | 7.4 | 7.6 | 7.6 | 7.8 | 8.5 | |
| Age-standardized rate | 6.1 | 6.0 | 6.3 | 6.2 | 6.0 | 6.0 | 5.9 | 5.7 | 5.6 | 6.0 | |
| **Male** | | | | | | | | | | | |
| Incidence persons | 1,347 | 1,369 | 1,603 | 1,591 | 1,644 | 1,672 | 1,778 | 1,822 | 1,850 | 2,074 | |
| Male, % | 43.1 | 43.0 | 45.7 | 44.4 | 45.7 | 44.6 | 45.6 | 46.5 | 45.7 | 46.7 | |
| Mean age, year | 56.6±18.1 | 58.0±17.8 | 58.3±17.4 | 59.2±17.9 | 60.8±17.2 | 61.0±17.2 | 61.2±17.7 | 62.0±17.7 | 63.6±16.5 | 63.4±16.8 | |
| Male Incidence rate (per 100,000 person-years) | | | | | | | | | | | |
| Crude rate | 5.4 | 5.5 | 6.4 | 6.3 | 6.5 | 6.5 | 6.9 | 7.1 | 7.1 | 8.0 | |
| Age-standardized rate | 5.9 | 5.8 | 6.5 | 6.2 | 6.2 | 6.1 | 6.2 | 6.1 | 5.9 | 6.4 | |
| **Female** | | | | | | | | | | | |
| Incidence persons | 1,775 | 1,818 | 1,906 | 1,996 | 1,953 | 2,077 | 2,123 | 2,096 | 2,198 | 2,363 | |
| Female, % | 56.9 | 57.0 | 54.3 | 55.6 | 54.3 | 55.4 | 54.4 | 53.5 | 54.3 | 53.3 | |
| Mean age, year | 63.4±16.7 | 63.7±18.5 | 65.1±16.8 | 66.0±16.5 | 65.8±17.3 | 68.2±16.2 | 68.7±16.2 | 68.7±16.8 | 70.5±15.6 | 70.5±16.1 | |
| Female Incidence rate (per 100,000 person-years) | | | | | | | | | | | |
| Crude rate | 7.2 | 7.4 | 7.7 | 8.0 | 7.7 | 8.2 | 8.3 | 8.2 | 8.5 | 9.1 | |
| Age-standardized rate | 6.2 | 6.1 | 6.1 | 6.1 | 5.8 | 5.7 | 5.6 | 5.3 | 5.2 | 5.4 | |

Tables 3-22. Crude incidence rates by age group for valvular heart disease in Korea (2006-2015).

| Years | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 |
|---|---|---|---|---|---|---|---|---|---|---|
| **Total** (per 100,000 person-years) | | | | | | | | | | |
| 0-39 | 1.4 | 1.4 | 1.4 | 1.2 | 1.2 | 1.1 | 1.2 | 1.2 | 0.9 | 1.1 |
| 40-49 | 4.2 | 4.0 | 4.1 | 4.2 | 3.6 | 3.5 | 3.6 | 3.0 | 3.3 | 3.5 |
| 50-59 | 9.8 | 8.4 | 9.6 | 8.7 | 8.2 | 7.4 | 7.3 | 7.1 | 6.6 | 7.2 |
| 60-69 | 19.6 | 18.9 | 20.0 | 20.2 | 19.5 | 19.1 | 18.2 | 17.2 | 17.3 | 18.2 |
| 70-79 | 36.2 | 35.7 | 37.4 | 37.2 | 37.5 | 39.8 | 39.6 | 39.8 | 40.1 | 40.4 |
| 80+ | 48.9 | 56.7 | 60.5 | 63.4 | 61.2 | 68.3 | 69.9 | 66.5 | 72.5 | 76.4 |
| **Male** (per 100,000 person-years) | | | | | | | | | | |
| 0-39 | 1.4 | 1.4 | 1.6 | 1.4 | 1.3 | 1.3 | 1.4 | 1.4 | 1.0 | 1.2 |
| 40-49 | 4.6 | 4.2 | 4.5 | 4.7 | 3.9 | 4.1 | 4.5 | 3.7 | 3.9 | 4.4 |
| 50-59 | 9.7 | 8.7 | 9.9 | 9.1 | 9.5 | 8.2 | 8.4 | 8.3 | 7.8 | 8.9 |
| 60-69 | 18.3 | 18.2 | 21.2 | 19.7 | 19.2 | 20.3 | 18.4 | 18.0 | 19.3 | 19.4 |
| 70-79 | 32.3 | 33.0 | 36.4 | 35.0 | 36.9 | 36.1 | 38.0 | 39.9 | 39.5 | 40.9 |
| 80+ | 41.6 | 49.1 | 51.8 | 58.2 | 66.9 | 62.7 | 66.6 | 66.6 | 66.0 | 72.3 |
| **Female** (per 100,000 person-years) | | | | | | | | | | |
| 0-39 | 1.3 | 1.5 | 1.2 | 1.1 | 1.2 | 0.9 | 1.0 | 1.1 | 0.7 | 0.9 |
| 40-49 | 3.9 | 3.7 | 3.6 | 3.6 | 3.3 | 2.8 | 2.6 | 2.4 | 2.7 | 2.7 |
| 50-59 | 9.8 | 8.1 | 9.3 | 8.3 | 6.9 | 6.7 | 6.3 | 5.9 | 5.5 | 5.6 |
| 60-69 | 20.8 | 19.5 | 18.9 | 20.5 | 19.7 | 18.1 | 18.0 | 16.4 | 15.4 | 17.0 |
| 70-79 | 38.7 | 37.5 | 38.0 | 38.8 | 37.9 | 42.4 | 40.7 | 39.8 | 40.6 | 39.9 |
| 80+ | 51.9 | 59.8 | 64.0 | 65.6 | 58.9 | 70.6 | 71.3 | 66.5 | 75.2 | 78.2 |

Residential areas were subdivided into 14 groups (Seoul + Incheon, Gyonggi, Daejeon + Sejong + Chungnam, Busan, Gyeongbuk, Gyeongnam, Jeonnam, Daegu, Jeongbuk, Gangwon, Chungbuk, Gwangju, Ulsan, and Jeju) according to Regional Cardiocerebrovascular Center (RCCVC) project data.

The residential areas with relatively higher age-standardized incidence rates of HD per 100,000 persons were Jeonnam (206.8), Busan (203.4), Chungbuk (198.9), and Gwangju (196.6), respectively. Daegu had the lowest age-standardized incidence rate (144.8 per 100,000 persons, Tables 3-23). The age-standardized incidence rates for HD and HD subtypes were relatively high in Jeonnam, Busan, Chungbuk, and Gwangju for both males and females (Tables 3-24 and 3-25).

Tables 3-23. Age-standardized incidence rates for heart disease (HD) by residence areas in Korea, 2015.

| Residence areas | Jeonnam | Busan | Chungbuk | Gwangju | Gangwon | Gyongnam | Gyongbuk | Jeju | Jeonbuk | Ulsan | Daejeon/Sejong/Chungnam | Seoul/Incheon | Gyonggi | Daegu |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| HD Total | 206.8 | 203.4 | 198.9 | 196.6 | 190.3 | 177.8 | 176.0 | 172.0 | 171.3 | 167.1 | 163.5 | 160.8 | 160.0 | 144.8 |
| Ischemic HD | 137.6 | 142.5 | 128.4 | 136.2 | 121.7 | 115.5 | 108.9 | 107.7 | 109.2 | 111.3 | 106.2 | 106.0 | 104.1 | 86.1 |
| Arrhythmia | 35.6 | 31.3 | 37.0 | 35.0 | 33.9 | 32.5 | 36.3 | 32.1 | 30.7 | 30.3 | 33.9 | 28.7 | 29.6 | 29.0 |
| Heart Failure | 21.6 | 23.4 | 27.9 | 14.9 | 30.4 | 24.3 | 24.5 | 23.2 | 20.8 | 20.6 | 20.7 | 18.8 | 20.2 | 20.7 |
| HD-others | 27.0 | 22.2 | 19.8 | 28.4 | 21.0 | 24.5 | 24.3 | 23.5 | 22.0 | 19.2 | 17.8 | 21.1 | 20.3 | 19.8 |
| Hypertensive HD | 12.6 | 15.8 | 15.7 | 8.5 | 11.4 | 8.5 | 7.8 | 9.3 | 9.5 | 9.7 | 6.9 | 4.4 | 5.1 | 5.4 |
| Pulmonary HD | 6.7 | 6.2 | 7.0 | 5.8 | 8.3 | 6.4 | 6.6 | 5.4 | 5.7 | 6.3 | 5.2 | 5.9 | 5.2 | 6.3 |
| Valvular HD | 8.1 | 5.8 | 5.7 | 5.6 | 6.1 | 5.8 | 5.9 | 5.6 | 6.2 | 6.0 | 4.8 | 5.8 | 6.1 | 6.6 |

Tables 3-24. Age-standardized incidence rates for heart disease (HD) by residence areas in Korean males, 2015.

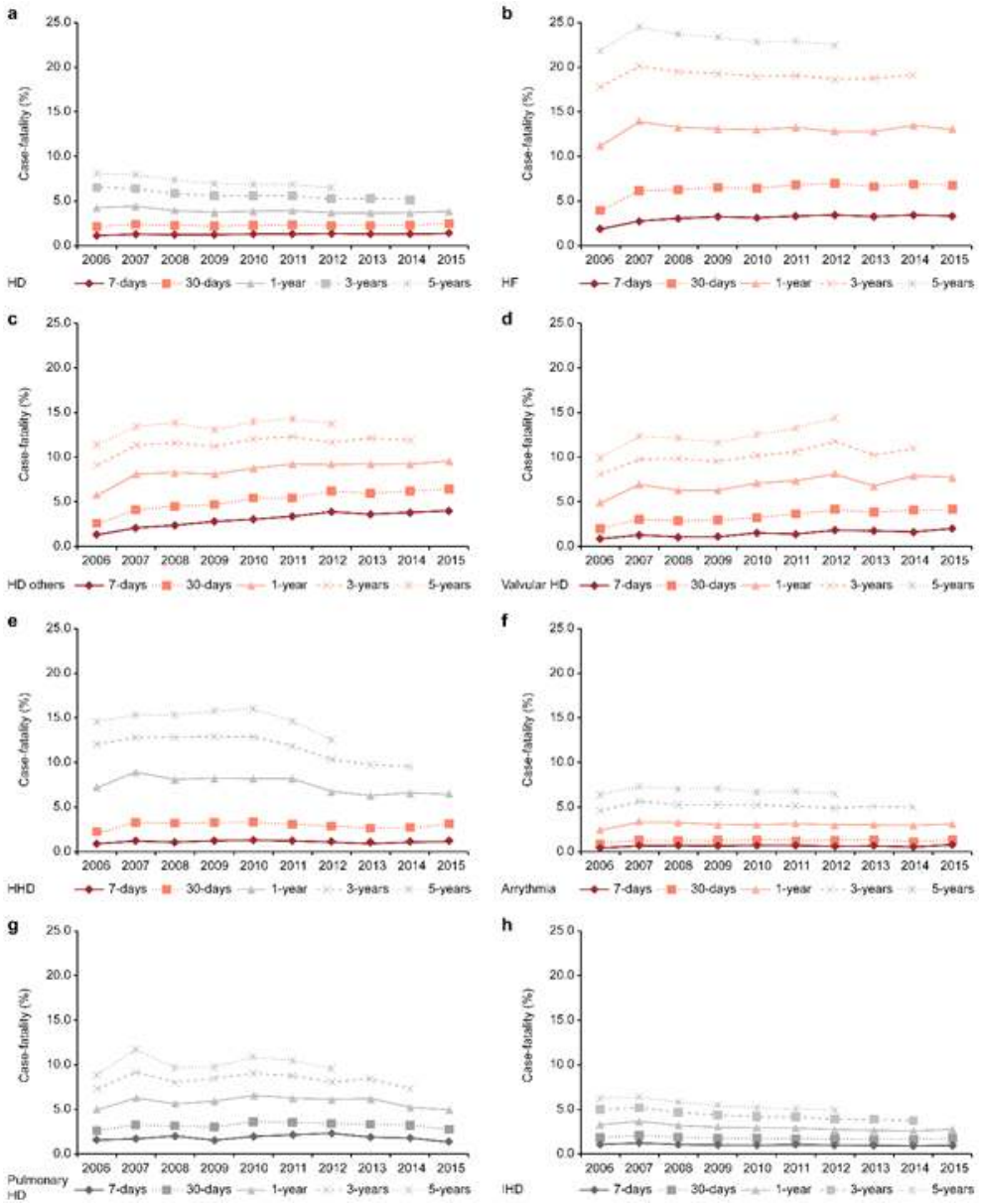
| Residence areas | Busan | Jeonnam | Gwangju | Gangwon | Chungbuk | Jeju | Gyongbuk | Gyongnam | Jeonbuk | Ulsan | Seoul/ Incheon | Daejeon/ Sejong/ Ghungnam | Gyonggi | Daegu |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| HD Total | 248.1 | 248.0 | 238.5 | 234.3 | 234.2 | 228.0 | 222.7 | 219.2 | 219.0 | 215.1 | 205.7 | 205.7 | 203.3 | 190.2 |
| Ischemic HD | 186.1 | 179.3 | 176.0 | 160.0 | 165.5 | 155.0 | 151.1 | 155.0 | 154.5 | 154.2 | 148.1 | 143.4 | 143.5 | 127.5 |
| Arrhythmia | 34.3 | 38.3 | 36.0 | 39.0 | 41.1 | 39.3 | 42.0 | 36.5 | 34.1 | 38.7 | 32.9 | 40.4 | 33.6 | 34.1 |
| Heart Failure | 23.2 | 19.4 | 13.5 | 29.7 | 26.0 | 26.5 | 24.8 | 22.5 | 19.4 | 21.3 | 18.9 | 21.2 | 20.5 | 20.0 |
| HD-others | 25.7 | 31.1 | 36.1 | 26.1 | 20.3 | 31.0 | 28.7 | 29.7 | 24.4 | 22.0 | 25.2 | 20.0 | 24.5 | 23.0 |
| Hypertensive HD | 14.6 | 11.0 | 6.6 | 10.7 | 12.9 | 8.6 | 6.7 | 6.7 | 9.3 | 9.2 | 4.0 | 6.6 | 4.6 | 4.9 |
| Pulmonary HD | 5.5 | 5.8 | 5.4 | 7.5 | 7.0 | 3.9 | 6.4 | 6.9 | 5.2 | 5.2 | 5.2 | 4.6 | 4.7 | 6.0 |
| Valvular HD | 6.8 | 9.1 | 5.8 | 6.5 | 5.4 | 5.5 | 6.7 | 5.5 | 6.7 | 6.4 | 6.4 | 5.4 | 6.4 | 7.7 |

Tables 3-25. Age-standardized incidence rates for heart disease (HD) by residence areas in Korean females, 2015.

| Residence areas | Jeonnam | Chungbuk | Busan | Gwangju | Gangwon | Gyongnam | Gyongbuk | Jeonbuk | Daejeon/Sejong/Chungnam | Ulsan | Jeju | Seoul/Incheon | Gyonggi | Daegu |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| HD Total | 164.4 | 163.6 | 161.2 | 157.6 | 148.2 | 136.7 | 130.2 | 124.2 | 121.7 | 121.2 | 119.1 | 118.6 | 118.0 | 103.1 |
| Ischemic HD | 95.9 | 92.8 | 102.4 | 99.6 | 86.1 | 78.1 | 68.7 | 66.1 | 69.9 | 70.3 | 63.2 | 67.5 | 66.7 | 49.1 |
| Arrhythmia | 32.7 | 33.6 | 28.6 | 34.1 | 29.1 | 28.5 | 31.4 | 27.3 | 28.0 | 22.8 | 25.2 | 24.7 | 25.9 | 24.7 |
| Heart Failure | 23.0 | 28.4 | 22.9 | 15.7 | 30.4 | 24.7 | 23.5 | 21.1 | 19.9 | 19.9 | 20.2 | 18.1 | 19.5 | 20.3 |
| HD-others | 23.2 | 19.0 | 18.7 | 21.8 | 16.4 | 19.7 | 19.8 | 19.6 | 15.6 | 17.0 | 17.6 | 17.4 | 16.4 | 16.9 |
| Hypertensive HD | 13.5 | 18.1 | 16.3 | 10.0 | 11.3 | 9.5 | 8.2 | 9.2 | 6.9 | 9.9 | 9.1 | 4.4 | 5.3 | 5.6 |
| Pulmonary HD | 7.5 | 6.8 | 6.7 | 6.0 | 8.9 | 6.1 | 6.7 | 6.1 | 5.6 | 7.1 | 6.2 | 6.4 | 5.5 | 6.2 |
| Valvular HD | 7.1 | 6.0 | 4.9 | 5.3 | 5.7 | 5.8 | 5.1 | 5.8 | 4.1 | 6.0 | 5.3 | 5.3 | 5.7 | 5.6 |

The 7-day case-fatality rate for HD increased from 1.2% in 2006 to 1.4% in 2015, and the cumulative 30-day case-fatality rate for HD increased from 2.2% in 2006 to 2.5% in 2015 (Figure 3-1; Tables 3-26 to 3-34). However, cumulative 1-year, 3-year and 5-year case-fatality rates decreased during this 10-year period, as did case-fatality rates for IHD and pulmonary HD. In contrast, case-fatality rates for HF, valvular HD, and miscellaneous (other) HD diagnoses were relatively higher than those of the other HD subtypes and these rates increased during the 10-year study period. In particular, for HF, the 7-day case-fatality rate was 3.3%, the cumulative 30-day case-fatality rate was 6.7%, and the 1-year cumulative case-fatality rate was 13.0% in 2015; the corresponding 3-year and 5-year case-fatality rates were 19.1% (in 2014), and 22.3% (in 2012), respectively. The cumulative five-year case-fatality rate confirmed that one-fourth of all HF cases died within five years due to heart disease. The cumulative 5-year case-fatality rates for valvular HD, HHD, and miscellaneous (other) HD diagnoses were approximately 15% and the rate for pulmonary HD was approximately 10% in 2015. It should be noted that case-fatality rates for overall HD, IHD, and pulmonary HD tendend to decrease between 2006 and 2017, but case-fatality rates increased for HF, valvular HD, and miscellaneous (other) HD diagnoses than for the other HD subtypes. Case-fatality rates by HD subtypes in females were higher than those in males. Differences in case-fatality rates by sex changed little in the last 10 years.

Figure 3-1. Trends in case-fatality rates for heart disease (HD) and HD subtypes in Korea (2006-2015).




(a) Overall trends in heart disease (ICD-10 code: I00-I09,I11,I13,I20-I51)

(b) Heart failure (ICD-10 code: I50)

(c) Heart disease (others) diagnoses (ICD-10 code: I00-I09,I30-I33,I40-I46,I51)

(d) Valvular HD (ICD-10 code: I34-I38)

(e) Hypertensive HD (ICD-10 code: I11,I13)

(f) Arrythmia (ICD-10 code: I47-I49)

(g) Pulmonary HD (ICD-10 code: I26-I28)

(h) Ischemic HD (ICD-10 code: I20-I25)

Tables 3-26. Trends in case-fatality rates by heart disease subtypes in Korea, 2006-2015.

| Years | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 |
|---|---|---|---|---|---|---|---|---|---|---|
| Heart Disease (I00-I09, I11, I13, I20~I51) | | | | | | | | | | |
| 7-day | 1.2 | 1.3 | 1.3 | 1.3 | 1.3 | 1.3 | 1.3 | 1.3 | 1.3 | 1.4 |
| 30-day | 2.2 | 2.4 | 2.3 | 2.2 | 2.3 | 2.3 | 2.3 | 2.2 | 2.3 | 2.5 |
| 1-year | 4.3 | 4.4 | 4.0 | 3.8 | 3.8 | 4.0 | 3.7 | 3.7 | 3.7 | 3.9 |
| 3-year | 6.5 | 6.4 | 5.9 | 5.6 | 5.6 | 5.6 | 5.2 | 5.3 | 5.1 | - |
| 5-year | 8.1 | 7.9 | 7.3 | 6.9 | 6.8 | 6.9 | 6.5 | - | - | - |
| Heart Failure (I50) | | | | | | | | | | |
| 7-day | 1.8 | 2.7 | 3.0 | 3.2 | 3.1 | 3.2 | 3.4 | 3.2 | 3.4 | 3.3 |
| 30-day | 3.9 | 6.1 | 6.2 | 6.5 | 6.4 | 6.8 | 6.9 | 6.6 | 6.8 | 6.7 |
| 1-year | 11.1 | 13.9 | 13.2 | 13.1 | 13.0 | 13.2 | 12.8 | 12.7 | 213.4 | 13.0 |
| 3-year | 17.7 | 20.1 | 19.4 | 19.2 | 18.9 | 19.0 | 18.5 | 18.7 | 19.1 | - |
| 5-year | 21.8 | 24.5 | 23.6 | 23.3 | 22.7 | 22.8 | 22.3 | - | - | - |
| Heart Disease-others (I00-I09, I30-I33, I39, I40-I46, I51) | | | | | | | | | | |
| 7-day | 1.2 | 2.0 | 2.3 | 2.7 | 3.0 | 3.3 | 3.8 | 3.6 | 3.7 | 4.0 |
| 30-day | 2.5 | 4.0 | 4.4 | 4.6 | 5.3 | 5.3 | 6.1 | 5.8 | 6.1 | 6.4 |
| 1-year | 5.7 | 8.1 | 8.2 | 8.0 | 8.7 | 9.2 | 9.1 | 9.1 | 9.2 | 9.5 |
| 3-year | 9.1 | 11.2 | 11.5 | 11.1 | 12.0 | 12.2 | 11.6 | 12.1 | 11.8 | - |
| 5-year | 11.3 | 13.4 | 13.8 | 13.0 | 14.0 | 14.2 | 13.6 | - | - | - |

Tables 3-27. Trends in case-fatality rates by heart disease subtypes in Korea, 2006-2015 (continued).

| Years | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 |
|---|---|---|---|---|---|---|---|---|---|---|
| Valvular Heart Disease (I34-I38) | | | | | | | | | | |
| 7-day | 0.8 | 1.2 | 1.0 | 1.0 | 1.5 | 1.4 | 1.7 | 1.7 | 1.6 | 2.0 |
| 30-day | 1.9 | 3.0 | 2.8 | 2.9 | 3.2 | 3.6 | 4.1 | 3.8 | 4.0 | 4.1 |
| 1-year | 4.9 | 6.9 | 6.2 | 6.2 | 7.0 | 7.4 | 8.1 | 6.7 | 7.8 | 7.7 |
| 3-year | 7.9 | 9.7 | 9.8 | 9.5 | 10.1 | 10.5 | 11.7 | 10.2 | 10.9 | - |
| 5-year | 9.8 | 12.3 | 12.1 | 11.6 | 12.5 | 13.2 | 14.3 | - | - | - |
| Hypertensive Heart Disease (I11, I13) | | | | | | | | | | |
| 7-day | 0.8 | 1.2 | 1.0 | 1.2 | 1.3 | 1.2 | 1.1 | 1.0 | 1.1 | 1.1 |
| 30-day | 2.2 | 3.3 | 3.2 | 3.2 | 3.3 | 3.0 | 2.8 | 2.6 | 2.6 | 3.1 |
| 1-year | 7.2 | 8.8 | 8.0 | 8.2 | 8.1 | 8.1 | 6.7 | 6.2 | 6.6 | 6.4 |
| 3-year | 12.0 | 12.8 | 12.8 | 12.9 | 12.8 | 11.7 | 10.3 | 9.7 | 9.5 | - |
| 5-year | 14.5 | 15.3 | 15.4 | 15.8 | 15.9 | 14.6 | 12.4 | - | - | - |
| Pulmonary Heart Disease (I26~I18) | | | | | | | | | | |
| 7-day | 1.6 | 1.7 | 2.0 | 1.5 | 2.0 | 2.1 | 2.6 | 1.9 | 1.8 | 1.4 |
| 30-day | 2.6 | 3.2 | 3.2 | 3.0 | 3.6 | 3.5 | 3.4 | 3.3 | 3.2 | 2.8 |
| 1-year | 5.0 | 6.3 | 5.6 | 5.9 | 6.6 | 6.2 | 6.1 | 6.2 | 5.2 | 4.9 |
| 3-year | 7.3 | 9.2 | 7.9 | 8.4 | 9.1 | 8.8 | 8.0 | 8.4 | 7.2 | - |
| 5-year | 8.8 | 11.7 | 9.7 | 9.7 | 10.9 | 10.5 | 9.5 | - | - | - |

Tables 3-28. Trends in case-fatality rates by heart disease subtypes in Korea, 2006-2015 (continued).

| Years | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 |
|---|---|---|---|---|---|---|---|---|---|---|
| Cardiac Arrhythmia (I47-I49) | | | | | | | | | | |
| 7-day | 0.4 | 0.6 | 0.7 | 0.6 | 0.7 | 0.6 | 0.6 | 0.7 | 0.6 | 0.7 |
| 30-day | 0.9 | 1.3 | 1.2 | 1.2 | 1.2 | 1.3 | 1.2 | 1.3 | 1.1 | 1.3 |
| 1-year | 2.5 | 3.3 | 3.3 | 3.1 | 3.0 | 3.1 | 3.0 | 3.0 | 2.9 | 3.1 |
| 3-year | 4.6 | 5.6 | 5.2 | 5.3 | 5.2 | 5.1 | 4.9 | 5.1 | 5.0 | - |
| 5-year | 6.4 | 7.3 | 7.0 | 7.1 | 6.7 | 6.7 | 6.5 | - | - | - |
| Ischemic Heart Disease (I20~I25) | | | | | | | | | | |
| 7-day | 1.0 | 1.2 | 1.1 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 0.9 | 1.0 |
| 30-day | 1.8 | 2.1 | 1.9 | 1.8 | 1.7 | 1.7 | 1.7 | 1.6 | 1.6 | 1.7 |
| 1-year | 3.3 | 3.7 | 3.3 | 3.0 | 2.9 | 2.9 | 2.7 | 2.7 | 2.6 | 2.8 |
| 3-year | 4.9 | 5.2 | 4.7 | 4.4 | 4.2 | 4.1 | 3.9 | 3.8 | 3.7 | - |
| 5-year | 6.2 | 6.4 | 5.9 | 5.4 | 5.1 | 5.1 | 4.9 | - | - | - |

Tables 3-29. Trends in case-fatality rates by heart disease subtypes in Korean males, 2006-2015.

| Years | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 |
|---|---|---|---|---|---|---|---|---|---|---|
| Heart Disease (I00-I09, I11, I13, I20~I51) | | | | | | | | | | |
| 7-day | 1.0 | 1.1 | 1.0 | 0.9 | 1.0 | 1.0 | 1.1 | 1.0 | 1.0 | 1.1 |
| 30-day | 1.8 | 2.0 | 1.9 | 1.7 | 1.8 | 1.8 | 1.8 | 1.8 | 1.8 | 1.9 |
| 1-year | 3.4 | 3.5 | 3.3 | 2.9 | 3.0 | 3.2 | 3.0 | 2.9 | 2.9 | 3.0 |
| 3-year | 5.3 | 5.2 | 4.8 | 4.3 | 4.4 | 4.4 | 4.2 | 4.2 | 4.0 | - |
| 5-year | 6.6 | 6.4 | 6.0 | 5.4 | 5.4 | 5.5 | 5.1 | - | - | - |
| Heart Failure (I50) | | | | | | | | | | |
| 7-day | 1.8 | 2.8 | 2.7 | 2.7 | 3.0 | 3.0 | 3.1 | 3.1 | 3.3 | 2.9 |
| 30-day | 3.5 | 6.2 | 6.0 | 6.1 | 5.7 | 6.2 | 6.3 | 6.1 | 6.4 | 6.1 |
| 1-year | 10.2 | 13.5 | 12.8 | 12.1 | 12.0 | 12.3 | 12.1 | 12.1 | 13.0 | 11.9 |
| 3-year | 16.9 | 19.1 | 19.0 | 18.1 | 17.4 | 17.7 | 17.4 | 17.7 | 18.3 | - |
| 5-year | 21.0 | 23.1 | 23.2 | 22.2 | 21.1 | 21.5 | 20.9 | - | - | - |
| Heart Disease-others (I00-I09, I30-I33, I39, I40-I46, I51) | | | | | | | | | | |
| 7-day | 1.3 | 2.0 | 2.8 | 2.5 | 3.2 | 3.5 | 3.7 | 3.8 | 4.2 | 4.0 |
| 30-day | 2.8 | 3.7 | 4.7 | 4.6 | 5.4 | 5.8 | 5.8 | 6.3 | 6.7 | 6.4 |
| 1-year | 5.5 | 7.6 | 8.7 | 7.9 | 8.8 | 9.4 | 9.0 | 9.4 | 9.6 | 9.2 |
| 3-year | 8.7 | 10.7 | 11.9 | 10.7 | 11.7 | 12.1 | 11.5 | 12.2 | 11.7 | - |
| 5-year | 10.8 | 12.8 | 13.9 | 12.5 | 13.5 | 14.0 | 13.2 | - | - | - |

Tables 3-30. Trends in case-fatality rates by heart disease subtypes in Korean males, 2006-2015 (continued).

| Years | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 |
|---|---|---|---|---|---|---|---|---|---|---|
| Valvular Heart Disease (I34-I38) | | | | | | | | | | |
| 7-day | 0.6 | 1.2 | 0.9 | 1.0 | 1.5 | 1.1 | 1.5 | 1.1 | 1.2 | 1.7 |
| 30-day | 1.8 | 2.8 | 2.2 | 2.9 | 3.1 | 3.0 | 3.8 | 3.0 | 3.0 | 3.8 |
| 1-year | 4.8 | 6.1 | 4.7 | 5.4 | 6.7 | 6.0 | 7.1 | 5.5 | 6.5 | 6.6 |
| 3-year | 6.2 | 8.6 | 6.8 | 8.5 | 9.3 | 9.2 | 9.8 | 7.9 | 8.7 | - |
| 5-year | 7.7 | 10.8 | 8.8 | 10.1 | 11.6 | 11.3 | 12.0 | - | - | - |
| Hypertensive Heart Disease (I11, I13) | | | | | | | | | | |
| 7-day | 0.7 | 1.0 | 1.0 | 0.9 | 1.3 | 0.8 | 1.1 | 1.1 | 1.2 | 1.0 |
| 30-day | 1.7 | 2.6 | 3.0 | 2.5 | 3.3 | 2.4 | 2.6 | 2.2 | 2.6 | 2.5 |
| 1-year | 5.7 | 7.9 | 7.6 | 6.4 | 7.5 | 6.4 | 6.0 | 5.5 | 6.2 | 5.5 |
| 3-year | 10.1 | 11.4 | 12.0 | 10.4 | 12.1 | 9.4 | 9.2 | 8.3 | 8.5 | - |
| 5-year | 11.7 | 13.4 | 14.0 | 12.6 | 14.7 | 11.9 | 10.7 | - | - | - |
| Pulmonary Heart Disease (I26~I18) | | | | | | | | | | |
| 7-day | 1.1 | 1.4 | 1.4 | 1.3 | 1.9 | 1.6 | 1.6 | 1.8 | 1.1 | 1.0 |
| 30-day | 1.7 | 3.0 | 2.7 | 2.8 | 2.8 | 2.9 | 2.4 | 2.9 | 2.7 | 2.6 |
| 1-year | 4.4 | 5.6 | 4.5 | 5.1 | 5.8 | 5.8 | 4.3 | 5.6 | 4.3 | 4.2 |
| 3-year | 6.7 | 8.4 | 6.4 | 6.9 | 8.1 | 7.7 | 5.7 | 7.0 | 6.2 | - |
| 5-year | 7.7 | 10.5 | 8.1 | 8.2 | 9.1 | 9.2 | 7.4 | - | - | - |

Tables 3-31. Trends in case-fatality rates by heart disease subtypes in Korean males, 2006-2015 (continued).

| Years | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 |
|---|---|---|---|---|---|---|---|---|---|---|
| Cardiac Arrhythmia (I47-I49) | | | | | | | | | | |
| 7-day | 0.4 | 0.6 | 0.6 | 0.5 | 0.5 | 0.5 | 0.6 | 0.6 | 0.5 | 0.7 |
| 30-day | 0.8 | 1.2 | 1.0 | 1.0 | 1.0 | 1.0 | 1.1 | 1.0 | 1.0 | 1.3 |
| 1-year | 2.0 | 2.6 | 2.7 | 2.4 | 2.6 | 2.4 | 2.6 | 2.3 | 2.3 | 2.6 |
| 3-year | 3.6 | 4.3 | 4.2 | 4.2 | 4.4 | 3.8 | 3.9 | 4.0 | 3.8 | - |
| 5-year | 4.9 | 5.6 | 5.5 | 5.7 | 5.7 | 5.0 | 4.9 | - | - | - |
| Ischemic Heart Disease (I20~I25) | | | | | | | | | | |
| 7-day | 0.9 | 1.0 | 0.9 | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 | 0.7 | 0.8 |
| 30-day | 1.5 | 1.7 | 1.6 | 1.4 | 1.4 | 1.4 | 1.3 | 1.3 | 1.3 | 1.4 |
| 1-year | 2.8 | 3.0 | 2.8 | 2.5 | 2.3 | 2.5 | 2.3 | 2.2 | 2.1 | 2.3 |
| 3-year | 4.4 | 4.4 | 4.1 | 3.6 | 3.4 | 3.5 | 3.3 | 3.2 | 3.1 | - |
| 5-year | 5.5 | 5.6 | 5.1 | 4.6 | 4.3 | 4.4 | 4.2 | - | - | - |

Tables 3-32. Trends in case-fatality rates by heart disease subtypes in Korean females, 2006-2015.

| Years | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 |
|---|---|---|---|---|---|---|---|---|---|---|
| Heart Disease (I00-I09, I11, I13, I20~I51) | | | | | | | | | | |
| 7-day | 1.3 | 1.5 | 1.5 | 1.6 | 1.6 | 1.7 | 1.6 | 1.7 | 1.6 | 1.8 |
| 30-day | 2.6 | 2.9 | 2.7 | 2.8 | 2.8 | 2.9 | 2.9 | 2.8 | 2.8 | 3.1 |
| 1-year | 5.1 | 5.4 | 4.7 | 4.8 | 4.8 | 4.9 | 4.5 | 4.6 | 4.6 | 5.0 |
| 3-year | 7.7 | 7.6 | 7.0 | 7.0 | 7.0 | 6.9 | 6.5 | 6.7 | 6.5 | - |
| 5-year | 9.6 | 9.5 | 8.8 | 8.6 | 8.5 | 8.6 | 8.1 | - | - | - |
| Heart Failure (I50) | | | | | | | | | | |
| 7-day | 1.8 | 2.7 | 3.2 | 3.5 | 3.1 | 3.3 | 3.6 | 3.3 | 3.5 | 3.5 |
| 30-day | 4.1 | 6.1 | 6.4 | 6.7 | 6.8 | 7.1 | 7.3 | 6.8 | 7.1 | 7.1 |
| 1-year | 11.6 | 14.1 | 13.5 | 13.6 | 13.5 | 13.7 | 13.2 | 13.1 | 13.7 | 13.7 |
| 3-year | 18.1 | 20.5 | 19.6 | 19.8 | 19.7 | 19.8 | 19.2 | 19.3 | 19.6 | - |
| 5-year | 22.2 | 25.2 | 23.9 | 23.9 | 23.6 | 23.6 | 23.2 | - | - | - |
| Heart Disease-Others (I00-I09, I30-I33, I39, I40-I46, I51) | | | | | | | | | | |
| 7-day | 1.1 | 2.0 | 1.9 | 2.9 | 2.8 | 3.2 | 3.9 | 3.3 | 3.2 | 3.9 |
| 30-day | 2.3 | 4.2 | 4.2 | 4.6 | 5.3 | 4.9 | 6.4 | 5.3 | 5.5 | 6.4 |
| 1-year | 5.9 | 8.5 | 7.7 | 8.2 | 8.6 | 8.9 | 9.3 | 8.8 | 8.8 | 9.8 |
| 3-year | 9.4 | 11.6 | 11.1 | 11.5 | 12.2 | 12.3 | 11.6 | 12.0 | 11.9 | - |
| 5-year | 11.8 | 13.9 | 13.7 | 13.4 | 14.4 | 14.4 | 14.0 | - | - | - |

Tables 3-33. Trends in case-fatality rates by heart disease subtypes in Korean females, 2006-2015 (continued).

| Years | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 |
|---|---|---|---|---|---|---|---|---|---|---|
| Valvular Heart Disease (I34-I38) | | | | | | | | | | |
| 7-day | 1.0 | 1.3 | 1.0 | 1.1 | 1.5 | 1.5 | 1.9 | 2.1 | 1.9 | 2.2 |
| 30-day | 2.0 | 3.1 | 3.4 | 2.9 | 3.2 | 4.0 | 4.4 | 4.5 | 4.8 | 4.4 |
| 1-year | 5.0 | 7.5 | 7.6 | 6.9 | 7.3 | 8.4 | 8.9 | 7.8 | 9.0 | 8.6 |
| 3-year | 9.2 | 10.5 | 12.3 | 10.3 | 10.8 | 11.6 | 13.2 | 12.1 | 12.7 | - |
| 5-year | 11.4 | 13.4 | 14.8 | 12.7 | 13.3 | 14.6 | 16.3 | - | - | - |
| Hypertensive Heart Disease (I11, I13) | | | | | | | | | | |
| 7-day | 0.9 | 1.3 | 1.0 | 1.4 | 1.2 | 1.3 | 1.1 | 1.0 | 1.0 | 1.2 |
| 30-day | 2.5 | 3.5 | 3.3 | 3.6 | 3.3 | 3.4 | 2.9 | 2.8 | 2.7 | 3.4 |
| 1-year | 8.0 | 9.3 | 8.2 | 9.0 | 8.4 | 9.0 | 7.0 | 6.6 | 6.8 | 6.9 |
| 3-year | 12.9 | 13.5 | 13.2 | 14.0 | 13.2 | 12.9 | 10.8 | 10.5 | 10.0 | - |
| 5-year | 15.8 | 16.2 | 16.0 | 17.2 | 16.6 | 15.9 | 13.2 | - | - | - |
| Pulmonary Heart Disease (I26~I18) | | | | | | | | | | |
| 7-day | 1.8 | 1.8 | 2.4 | 1.6 | 2.1 | 2.4 | 2.8 | 2.0 | 2.2 | 1.6 |
| 30-day | 3.2 | 3.3 | 3.5 | 3.1 | 4.1 | 3.9 | 4.1 | 3.5 | 3.5 | 2.9 |
| 1-year | 5.4 | 6.7 | 6.4 | 6.4 | 7.0 | 6.6 | 7.3 | 6.6 | 5.8 | 5.4 |
| 3-year | 7.6 | 9.7 | 9.0 | 9.4 | 9.7 | 9.4 | 9.5 | 9.3 | 7.9 | - |
| 5-year | 9.5 | 12.5 | 10.7 | 10.7 | 11.9 | 11.3 | 10.9 | - | - | - |

Tables 3-34. Trends in case-fatality rates by heart disease subtypes in Korean females, 2006-2015 (continued).

| Years | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 |
|---|---|---|---|---|---|---|---|---|---|---|
| Cardiac Arrhythmia (I47-I49) | | | | | | | | | | |
| 7-day | 0.5 | 0.7 | 0.9 | 0.8 | 0.8 | 0.7 | 0.6 | 0.8 | 0.6 | 0.8 |
| 30-day | 0.9 | 1.4 | 1.3 | 1.5 | 1.4 | 1.6 | 1.3 | 1.7 | 1.3 | 1.4 |
| 1-year | 2.9 | 4.1 | 3.8 | 3.7 | 3.4 | 3.9 | 3.3 | 3.7 | 3.5 | 3.6 |
| 3-year | 5.7 | 6.8 | 6.2 | 6.3 | 6.0 | 6.3 | 5.9 | 6.2 | 6.1 | - |
| 5-year | 7.8 | 8.9 | 8.3 | 8.4 | 7.7 | 8.4 | 8.1 | - | - | - |
| Ischemic Heart Disease (I20~I25) | | | | | | | | | | |
| 7-day | 1.2 | 1.5 | 1.3 | 1.3 | 1.4 | 1.4 | 1.3 | 1.3 | 1.3 | 1.3 |
| 30-day | 2.1 | 2.5 | 2.2 | 2.2 | 2.2 | 2.2 | 2.1 | 2.0 | 2.1 | 2.3 |
| 1-year | 3.9 | 4.5 | 3.8 | 3.8 | 3.7 | 3.6 | 3.4 | 3.4 | 3.4 | 3.6 |
| 3-year | 5.7 | 6.1 | 5.5 | 5.5 | 5.2 | 5.0 | 4.8 | 4.9 | 4.7 | - |
| 5-year | 7.1 | 7.4 | 6.8 | 6.7 | 6.4 | 6.1 | 5.9 | - | - | - |

The residence areas with the highest 30-day case-fatality rates for HD were Daegu, Jeonnam, Gyeongbuk, and Gangwon (Tables 3-35 and 3-36). Daegu had the highest case-fatality rates 30-day and 1-year rates, even though the age-standardized incidence rate of HD and HD subtypes was the lowest of any of the residential areas (Tables 3-23).

Jeonnam and Gangwon had relatively higher age-standardized incidence and case-fatality rates. Busan and Gwangju had higher age-standardized incidence rates but lower case-fatality rates (Tables 3-23 and 3-35).

Tables 3-35. Thirty-day heart disease (HD) case-fatality rates by residence areas in Korea, 2015.

| Residence areas | Daegu | Jeonnam | Gyongbuk | Gangwon | Gyongnam | Gyonggi | Jeju | Daejeon/ Sejong/ Ghungnam | Seoul/ Incheon | Chungbuk | Jeonbuk | Ulsan | Busan | Gwangju |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| HD Total | 3.2 | 3.0 | 2.8 | 2.8 | 2.7 | 2.5 | 2.5 | 2.4 | 2.3 | 2.3 | 2.3 | 2.2 | 2.0 | 1.9 |
| Heart Failure | 8.1 | 7.7 | 7.2 | 6.8 | 6.5 | 6.7 | 6.6 | 6.3 | 6.7 | 5.6 | 5.0 | 7.7 | 6.8 | 6.4 |
| HD-others | 5.6 | 7.2 | 4.4 | 7.3 | 6.8 | 7.6 | 6.5 | 4.5 | 6.4 | 7.9 | 6.2 | 7.1 | 4.9 | 6.2 |
| Valvular HD | 5.4 | 4.1 | 3.4 | 4.6 | 5.0 | 3.6 | 3.6 | 5.3 | 4.7 | 2.0 | 3.8 | 1.2 | 3.5 | 2.8 |
| Hypertensive HD | 4.6 | 2.5 | 5.1 | 3.7 | 2.8 | 3.0 | 3.2 | 5.6 | 2.7 | 1.6 | 2.2 | 2.4 | 2.1 | 2.4 |
| Pulmonary HD | 3.1 | 4.7 | 3.5 | 2.5 | 3.3 | 1.5 | 0.0 | 3.0 | 1.8 | 3.5 | 3.0 | 6.2 | 5.1 | 1.8 |
| Ischemic HD | 2.5 | 2.4 | 2.0 | 1.8 | 1.8 | 1.7 | 1.4 | 1.8 | 1.6 | 1.6 | 1.6 | 1.5 | 1.2 | 1.5 |
| Arrhythmia | 1.8 | 2.0 | 1.4 | 2.3 | 1.2 | 1.2 | 1.4 | 1.2 | 1.0 | 0.8 | 1.6 | 1.0 | 1.4 | 1.1 |

Tables 3-36. One-year heart disease (HD) case-fatality rates by residence areas in Korea, 2015.

| Residence areas | Daegu | Jeonnam | Gyongbuk | Gangwon | Gyongnam | Gyonggi | Jeju | Daejeon/ Sejong/ Chungnam | Seoul/ Incheon | Chungbuk | Jeonbuk | Ulsan | Busan | Gwangju |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| HD Total | 4.9 | 4.6 | 4.7 | 4.4 | 4.4 | 3.8 | 3.3 | 3.9 | 3.5 | 3.7 | 3.8 | 3.6 | 3.3 | 2.8 |
| Heart Failure | 15.2 | 13.6 | 13.2 | 12.6 | 13.5 | 13.3 | 11.6 | 12.6 | 13.0 | 11.8 | 11.6 | 12.9 | 12.8 | 12.5 |
| HD-others | 8.2 | 11.3 | 7.3 | 10.6 | 10.2 | 10.6 | 9.1 | 8.0 | 9.7 | 11.7 | 8.3 | 9.8 | 7.7 | 8.1 |
| Valvular HD | 7.7 | 9.6 | 6.6 | 7.5 | 8.3 | 7.7 | 7.3 | 7.1 | 7.9 | 8.0 | 9.0 | 4.9 | 6.4 | 4.7 |
| Hypertensive HD | 9.2 | 7.1 | 10.8 | 6.8 | 6.9 | 5.4 | 9.5 | 10.3 | 6.5 | 4.3 | 3.5 | 4.0 | 4.3 | 4.2 |
| Pulmonary HD | 4.0 | 7.9 | 7.9 | 5.1 | 5.5 | 3.0 | 1.9 | 6.0 | 3.4 | 4.7 | 6.0 | 9.9 | 7.0 | 4.4 |
| Ischemic HD | 3.8 | 3.6 | 3.3 | 2.8 | 3.0 | 2.8 | 1.7 | 2.9 | 2.5 | 2.7 | 2.7 | 2.5 | 2.3 | 2.4 |
| Arrhythmia | 4.0 | 4.4 | 3.4 | 4.5 | 3.1 | 3.0 | 2.0 | 3.0 | 2.3 | 3.2 | 3.5 | 2.4 | 3.0 | 2.7 |

# Chapter 4. Trends in Incidence and Case Fatality Rates for Ischemic Heart Disease in Korea (2006–2015).

## 4.1. Background

Cardiovascular disease is an important global health concern (Sidney et al. 2017). Western countries (which have relatively high levels of income) have decreased mortality due to IHD, while in a majority of other regions, there has either been no change or a gradual decrease in IHD mortality (Sidney et al. 2017; Ford et al. 2014; Ritchey et al. 2014; Bhatnagar et al. 2016; Zhang et al. 2016; Mendy et al. 2017). Coronary artery disease (CAD), especially MI, is a major cause of death in the Asia–Pacific region; however, there is a lack of data on the characteristics of patients with acute MI in Asia (Kim et al. 2019). In Korea, death rates for IHD continue to increase (Lee et al, 2015; Kim et al. 2013; Kim et al. 2019).

The increase in IHD mortality is affected by the increased incidence of IHD fatality rates. Incidence is an important metric for explaining potentially undesirable changes in disease trajectories. However, there is currently a substantial gap in our knowledge due to the lack of nationally representative data on the incidence of IHD (Ford et al. 2014).

The total incidence of IHD was approximately 80,000 persons in 2015, accounting for more than 60% of all HD persons (Seo et al. 2020). In this study, the age–standardized incidence rate of IHD decreased over the course of 10 years, whereas the incidence of AMI increased similarly (Kim et al. 2019). Therefore, it is necessary to identify IHD subtypes with differential incidences.

IHD is the most prevalent HD subtype (Mendy et al. 2017); this category of IHD, includes AP, MI, and asymptomatic heart ischemia (Tables 4-1). Patients with IHD typically die as a result of CAD (Gwon et al. 2020). IHD encompasses a wide range of coronary artery infarctions, including AP, MI, and other similar diagnoses. AP is composed of stable AP, unstable AP, and variant AP, while MI is comprised STEMI, NSTEMI, and other similar diagnoses. Some Korean studies have investigated trends in incidence and case-fatality to identify the reason for trends towards increasing IHD mortality; however, these studies have focused on AMI. As a result, there is little evidence regarding trends for the aforementioned IHD subtypes (Hong et al. 2009; Kim et al. 2013; Kim et al. 2019).

To establish an effective public health policy, it is important to investigate IHD subtypes by examining recent trends in incidence and fatality rates. This will decrease the burden of IHD by providing feedback on past disease control efforts and by modifying current health policies (Ford et al. 2014). Therefore, we aimed to investigate national trends in incidence and case-fatality rates for IHD and its subtypes, AP and its subtypes, and MI and its subtypes in Korea from 2006 to 2015.

Tables 4-1. Explanations of International Classification of Diseases-10 (ICD-10) codes regarding ischemic heart disease.

| ICD-10 codes | Code name |
|---|---|
| I20 | Angina pectoris |
| I21 | Acute myocardial infarction |
| I22 | subsequent ST elevation (STEMI) and non-ST elevation (NSTEMI) myocardial infarction |
| I23 | Certain current complications following ST elevation (STEMI) and non-ST elevation (NSTEMI) myocardial infarction (within the 28 day period) |
| I24 | Other acute ischemic heart diseases |
| I25 | Chronic ischemic heart disease |

## 4.2. Methods

We implemented following steps for calculating the yearly incidence of IHD and IHD subtypes. First, we collected NHIS claims data on inpatients with IHD as their primary diagnosis between 2003 and 2015 and IHD as a cause of death between 2006 and 2017 from Statistics Korea in order to calculate the yearly incidence of IHD.

Second, we used the IICD-10 codes I20-I25 to define IHD and classified IHD subtypes as AP (I20), MI (I21-I22), and miscellaneous (other) IHD diagnoses (I23-I25). Furthermore, we classified the AP subtypes as stable AP (I20.8-I20.9), unstable AP (I20.0), and variant AP (I20.1); MI subtypes were classified as STEMI (I21.0-I21.3, I22.0-I22.1, I22.8), NSTEMI (I21.4), and MI (other diagnoses) (I21.9, I22.9) (Tables 4-2) (Zhang et al. 2016).

We were able to include people who died of IHD, AP, MI, and IHD (other diagnoses) within these incidence measures. However, deaths from AP subtypes (stable AP, unstable AP, variant AP) and MI subtypes (STEMI, NSTEMI, other MI diagnoses) were not included within the incidence measures during each year, because the cause of death records from Statistics Korea included only three digits (i.e. did not include the fourth and fifth digits) of the ICD-10 codes.

Third, we calculated crude incidence rates stratified by sex and age group. The age groups were subdivided into those aged < 40 years, 40-49 years, 50-59 years, 60-69 years, 70-79 years, and 80 years or older.

Fourth, age-standardized incidence was determined from the standard population; specifically, this measure constructed based on resident registration central population in 2005 and based on yearly modifications in population age derived from yearly age-standardized death rates (Statistics Korea 2018).

Tables 4-2. Classification of International Classification of Diseases-10 (ICD-10) codes for ischemic heart disease (IHD) and its subtypes.

| IHD subtypes | ICD-10 codes |
|---|---|
| Angina Pectoris | I21 |
| Stable AP | I20.8~I20.9 |
| Unstable AP | I20.0 |
| Variant AP | I20.1 |
| Myocardial Infarction | I21~I22 |
| NSTEMI | I21.4 |
| STEMI | I21.0~I21.3, I22.0~I22.1, I22.8 |
| MI-others | I21.9, I22.9 |
| IHD-others | I23~I25 |

We implemented the following steps to calculate case-fatality rates for IHD and its subtypes. First, we collected data on patients' causes of death from Statistics Korea by linking the patients' personal identification numbers with the incidence of overall IHD, IHD subtypes, AP subtypes, and MI subtypes during each year. We only included individuals who died of heart disease in these estimates.

Second, using the NHIS claims database, we calculated case-fatality rates by considering the difference between the date of first admission for IHD and the date of death due to heart disease. We classified these data into 7-day, 30-day, 1-year, 3-year, and 5-year cumulative case-fatality rates. Using the same method, we calculated the case-fatality rate for each IHD subtype.

We used SAS software (version 9.4, SAS Institute, Cary, US) for all analyses and performed the Cochran-Armitage trend test to evaluate trends in incidence (Cui et al. 2017).

## 4.3. Results

The incidence rates for IHD and its subtypes were divided into those who were diagnosed at the hospital and those who died from the disease (Tables 4-3 and 4-4). Those diagnosed at the hospital were divided into survivors and those who died. The number of people who died of IHD and its subtypes outside of hospital showed a tendency to increase over time.

In 2015, the incidence of AP was approximately twice that of MI or of miscellaneous (other) IHD diagnoses, but there was little difference between MI and other IHD diagnoses in terms of incidence) (Tables 4-5 to 4-10). The percentage of males with MI increased from 63.3% in 2006 to 72.6% in 2015. Over the past 10 years, the incidence of IHD and its subtypes as well as the crude rates of MI and IHD increased, whereas the crude rates (per 100,000 persons) for IHD and AP and age-standardized rates (per 100,000 persons) for IHD and its subtypes decreased (p for trend < 0.0001) (Tables 4-5).

Tables 4−3. Annual incidence of ischemic heart disease and its subtypes according to incident types.

| Years | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 |
|---|---|---|---|---|---|---|---|---|---|---|
| **Ischemic Heart Disease (I20~I25)** | | | | | | | | | | |
| In-hospital | | | | | | | | | | |
| Alive | 77,829 | 79,640 | 78,079 | 78,652 | 80,553 | 81,399 | 83,460 | 80,430 | 83,182 | 79,498 |
| Death | 1,804 | 2,144 | 1,774 | 1,683 | 1,692 | 1,687 | 1,693 | 1,551 | 1,565 | 1,587 |
| Out-of-hospital | | | | | | | | | | |
| Death | 407 | 781 | 744 | 847 | 954 | 1,073 | 1,127 | 1,169 | 1,278 | 1,211 |
| **Angina Pectoris (I20)** | | | | | | | | | | |
| In-hospital | | | | | | | | | | |
| Alive | 54,832 | 57,611 | 56,094 | 56,544 | 58,254 | 58,689 | 59,664 | 56,977 | 59,100 | 55,635 |
| Death | 132 | 158 | 118 | 105 | 136 | 139 | 157 | 131 | 130 | 123 |
| Out-of-hospital | | | | | | | | | | |
| Death | 101 | 173 | 152 | 160 | 164 | 209 | 184 | 189 | 206 | 188 |

Tables 4−4. Annual incidence of ischemic heart disease and its subtypes according to incident types (continued).

| Years | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 |
|---|---|---|---|---|---|---|---|---|---|---|
| **Myocardial Infarction (I21~I22)** | | | | | | | | | | |
| In-hospital | | | | | | | | | | |
| Alive | 18,214 | 18,154 | 17,259 | 17,243 | 17,217 | 17,954 | 19,024 | 20,123 | 21,326 | 20,866 |
| Death | 1,111 | 1,445 | 1,301 | 1,208 | 1,161 | 1,167 | 1,074 | 1,101 | 1,190 | 1,212 |
| Out-of-hospital | | | | | | | | | | |
| Death | 490 | 998 | 1,052 | 1,262 | 1,352 | 1,466 | 1,609 | 1,615 | 1,806 | 1,825 |
| **Ischemic Heart Disease-others (I23~I25)** | | | | | | | | | | |
| In-hospital | | | | | | | | | | |
| Alive | 17,606 | 18,415 | 20,884 | 21,415 | 22,326 | 22,445 | 22,549 | 20,739 | 20,882 | 19,768 |
| Death | 145 | 249 | 213 | 205 | 260 | 238 | 292 | 223 | 215 | 211 |
| Out-of-hospital | | | | | | | | | | |
| Death | 232 | 566 | 542 | 589 | 769 | 848 | 960 | 832 | 820 | 864 |

Tables 4-5. Annual incidence and incidence rates for angina pectoris in Korea (2006-2015).

| Years | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | P for trend |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Angina Pectoris (I20)** | | | | | | | | | | | |
| Incidence persons | 55,065 | 57,942 | 56,364 | 56,809 | 58,554 | 59,037 | 60,005 | 57,297 | 59,436 | 55,971 | <.0001 |
| Mean age, years | 61.9±11.5 | 62.2±11.5 | 62.5±11.6 | 62.9±11.6 | 63.1±11.7 | 63.3±11.6 | 63.6±11.6 | 63.7±11.7 | 64.0±11.7 | 64.3±11.7 | |
| Total Incidence rate (per 100,000 persons-year) | | | | | | | | | | | |
| Crude rate | 111.8 | 116.6 | 112.7 | 113.0 | 115.8 | 116.0 | 117.3 | 111.4 | 114.8 | 107.6 | |
| Age-standardized rate | 107.2 | 107.8 | 100.8 | 97.4 | 96.6 | 93.6 | 91.5 | 84.4 | 84.4 | 76.4 | |
| **Male** | | | | | | | | | | | |
| Incidence persons | 29,983 | 31,439 | 30,884 | 32,036 | 33,431 | 33,889 | 34,791 | 33,648 | 35,104 | 33,775 | |
| Male, % | 54.5 | 54.3 | 54.8 | 56.4 | 57.1 | 57.4 | 58.0 | 58.7 | 59.1 | 60.3 | |
| Mean age, years | 59.8±11.4 | 60.2±11.5 | 60.3±11.6 | 60.7±11.5 | 60.9±11.5 | 61.3±11.5 | 61.6±11.5 | 61.6±11.5 | 61.9±11.4 | 62.3±11.4 | |
| Male Incidence rate (per 100,000 person-years) | | | | | | | | | | | |
| Crude rate | 121.2 | 126.0 | 123.0 | 126.9 | 131.7 | 132.7 | 135.7 | 130.5 | 135.4 | 129.6 | |
| Age-standardized rate | 127.7 | 128.1 | 120.7 | 120.0 | 120.4 | 117.4 | 116.0 | 108.1 | 108.4 | 100.3 | |
| **Female** | | | | | | | | | | | |
| Incidence persons | 25,082 | 26,503 | 25,480 | 24,773 | 25,123 | 25,148 | 25,214 | 23,649 | 24,332 | 22,196 | |
| Female, % | 45.5 | 45.7 | 45.2 | 43.6 | 42.9 | 42.6 | 42.0 | 41.3 | 40.9 | 39.7 | |
| Mean age, years | 64.6±11.0 | 64.7±11.1 | 65.2±11.0 | 65.7±11.0 | 65.9±11.2 | 66.1±11.2 | 66.2±11.3 | 66.7±11.3 | 67.0±11.4 | 67.4±11.4 | |
| Female Incidence rate (per 100,000 person-years) | | | | | | | | | | | |
| Crude rate | 102.4 | 107.2 | 102.3 | 98.9 | 99.7 | 99.1 | 98.8 | 92.1 | 94.2 | 85.5 | |
| Age-standardized rate | 88.6 | 89.6 | 82.5 | 76.7 | 74.8 | 71.9 | 69.2 | 62.4 | 61.9 | 54.1 | |

Tables 4-6. Crude incidence rates for angina pectoris by age group in Korea (2006-2015).

| Years | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 |
|---|---|---|---|---|---|---|---|---|---|---|
| **Total** (per 100,000 person-years) | | | | | | | | | | |
| 0-39 | 5.6 | 5.8 | 5.6 | 5.2 | 5.3 | 5.1 | 4.9 | 4.6 | 4.6 | 4.1 |
| 40-49 | 79.3 | 79.0 | 72.6 | 68.7 | 69.3 | 63.6 | 62.5 | 59.8 | 59.3 | 53.1 |
| 50-59 | 250.3 | 242.5 | 217.2 | 211.9 | 205.6 | 200.6 | 192.5 | 179.5 | 180.2 | 163.6 |
| 60-69 | 482.1 | 485.7 | 458.8 | 439.9 | 434.6 | 424.8 | 421.0 | 377.0 | 373.6 | 329.5 |
| 70-79 | 578.1 | 601.2 | 574.2 | 558.0 | 553.0 | 539.8 | 520.5 | 483.3 | 488.3 | 455.2 |
| 80+ | 394.6 | 413.5 | 397.8 | 411.5 | 430.0 | 426.7 | 431.6 | 406.2 | 410.6 | 387.3 |
| **Male** (per 100,000 person-years) | | | | | | | | | | |
| 0-39 | 8.2 | 8.6 | 8.5 | 7.8 | 8.2 | 7.8 | 7.5 | 7.1 | 6.8 | 6.3 |
| 40-49 | 104.5 | 103.5 | 97.7 | 96.0 | 96.9 | 89.2 | 88.2 | 86.1 | 87.3 | 78.1 |
| 50-59 | 309.5 | 293.9 | 269.7 | 268.9 | 264.5 | 260.2 | 245.5 | 237.2 | 239.9 | 223.6 |
| 60-69 | 545.2 | 552.5 | 527.9 | 526.9 | 524.0 | 522.6 | 528.9 | 478.6 | 474.3 | 430.7 |
| 70-79 | 636.4 | 669.3 | 620.0 | 617.8 | 627.1 | 598.5 | 592.9 | 545.3 | 557.2 | 531.6 |
| 80+ | 501.5 | 516.5 | 506.0 | 529.4 | 555.9 | 566.8 | 586.9 | 525.0 | 516.7 | 498.5 |
| **Female** (per 100,000 person-years) | | | | | | | | | | |
| 0-39 | 2.8 | 2.8 | 2.5 | 2.3 | 2.2 | 2.3 | 2.1 | 1.9 | 2.1 | 1.7 |
| 40-49 | 52.9 | 53.6 | 46.6 | 40.3 | 40.7 | 36.8 | 35.8 | 32.6 | 30.3 | 27.3 |
| 50-59 | 191.0 | 190.8 | 164.2 | 154.3 | 146.2 | 140.6 | 138.9 | 121.2 | 119.8 | 102.8 |
| 60-69 | 427.1 | 426.6 | 396.9 | 361.1 | 352.9 | 334.5 | 320.6 | 281.8 | 278.2 | 233.8 |
| 70-79 | 541.8 | 557.4 | 544.0 | 517.7 | 501.9 | 498.4 | 468.2 | 430.0 | 437.3 | 397.7 |
| 80+ | 350.5 | 371.4 | 353.9 | 363.7 | 379.2 | 370.0 | 367.7 | 356.4 | 365.0 | 338.2 |

Tables 4-7. Annual incidence and incidence rates for myocardial infarction in Korea (2006-2015).

| Years | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | P for trend |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Myocardial Infarction (I21~I22)** | | | | | | | | | | | |
| Incidence persons | 19,815 | 20,597 | 19,612 | 19,713 | 19,730 | 20,587 | 21,707 | 22,839 | 24,322 | 24,903 | <.0001 |
| Mean age, years | 64.9±13.2 | 65.4±13.3 | 65.8±13.2 | 65.8±13.3 | 65.8±13.4 | 66.1±13.4 | 66.2±13.4 | 65.9±13.6 | 66.2±13.6 | 66.5±13.6 | |
| Total Incidence rate (per 100,000 persons-year) | | | | | | | | | | | |
| Crude rate | 40.2 | 41.5 | 39.2 | 39.2 | 39.0 | 40.4 | 42.4 | 44.4 | 47.0 | 47.9 | |
| Age-standardized rate | 38.4 | 38.0 | 34.6 | 33.2 | 32.0 | 31.9 | 32.2 | 32.9 | 33.7 | 33.2 | |
| **Male** | | | | | | | | | | | |
| Incidence persons | 12,534 | 13,058 | 12,653 | 12,895 | 13,179 | 13,783 | 14,669 | 15,653 | 16,794 | 17,353 | |
| Male, % | 63.3 | 63.4 | 64.5 | 65.4 | 66.8 | 67.0 | 67.6 | 68.5 | 69.0 | 72.6 | |
| Mean age, years | 61.1±12.9 | 61.5±12.9 | 61.8±12.8 | 61.8±12.8 | 61.8±12.8 | 62.2±12.8 | 62.2±12.7 | 62.0±12.9 | 62.3±12.8 | 62.7±12.7 | |
| Male Incidence rate (per 100,000 person-years) | | | | | | | | | | | |
| Crude rate | 50.7 | 52.3 | 50.4 | 51.1 | 51.9 | 54.0 | 57.2 | 60.7 | 64.8 | 66.6 | |
| Age-standardized rate | 55.0 | 54.7 | 50.7 | 49.3 | 48.3 | 48.3 | 49.3 | 50.8 | 52.4 | 52.1 | |
| **Female** | | | | | | | | | | | |
| Incidence persons | 7,281 | 7,539 | 6,959 | 6,818 | 6,551 | 6,804 | 7,038 | 7,186 | 7,528 | 6,550 | |
| Female, % | 36.7 | 36.6 | 35.5 | 34.6 | 33.2 | 33.0 | 32.4 | 31.5 | 31.0 | 27.4 | |
| Mean age, years | 71.4±11.0 | 72.3±10.9 | 73.0±10.8 | 73.5±10.5 | 73.8±10.7 | 74.1±11.0 | 74.5±10.8 | 74.5±10.9 | 74.9±11.1 | 75.2±11.3 | |
| Female Incidence rate (per 100,000 person-years) | | | | | | | | | | | |
| Crude rate | 29.7 | 30.5 | 27.9 | 27.2 | 26.0 | 26.8 | 27.6 | 28.0 | 29.2 | 29.1 | |
| Age-standardized rate | 23.7 | 23.1 | 20.2 | 18.7 | 17.2 | 16.9 | 16.5 | 16.3 | 16.2 | 15.5 | |

Tables 4−8. Crude incidence rates for myocardial infarction by age group in Korea (2006−2015).

| Years | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 |
|---|---|---|---|---|---|---|---|---|---|---|
| **Total** (per 100,000 person-years) | | | | | | | | | | |
| 0-39 | 2.2 | 2.2 | 1.8 | 1.8 | 1.9 | 1.7 | 1.7 | 2.1 | 2.1 | 2.0 |
| 40-49 | 26.7 | 26.1 | 24.1 | 23.7 | 23.5 | 23.2 | 24.9 | 26.9 | 27.7 | 27.2 |
| 50-59 | 68.0 | 65.8 | 59.6 | 58.5 | 55.7 | 58.2 | 58.5 | 60.2 | 62.8 | 62.1 |
| 60-69 | 136.4 | 132.3 | 120.6 | 112.8 | 110.9 | 106.6 | 109.1 | 110.6 | 112.8 | 110.9 |
| 70-79 | 261.4 | 258.1 | 231.8 | 222.6 | 208.7 | 206.0 | 202.0 | 200.5 | 200.7 | 168.5 |
| 80+ | 371.3 | 400.5 | 377.3 | 359.9 | 338.2 | 355.1 | 355.1 | 343.1 | 358.6 | 349.9 |
| **Male** (per 100,000 person-years) | | | | | | | | | | |
| 0-39 | 3.8 | 3.8 | 3.2 | 3.2 | 3.4 | 3.1 | 3.1 | 3.9 | 3.8 | 3.6 |
| 40-49 | 46.0 | 45.9 | 42.9 | 43.0 | 42.8 | 41.5 | 45.3 | 49.2 | 50.4 | 49.5 |
| 50-59 | 111.5 | 109.8 | 100.0 | 101.0 | 97.0 | 101.6 | 102.7 | 106.5 | 111.1 | 110.4 |
| 60-69 | 190.1 | 187.9 | 179.1 | 169.9 | 167.8 | 164.5 | 171.7 | 172.8 | 180.5 | 179.5 |
| 70-79 | 327.2 | 319.0 | 294.9 | 274.8 | 274.2 | 271.0 | 262.6 | 263.6 | 268.4 | 277.5 |
| 80+ | 458.0 | 485.2 | 447.8 | 445.7 | 405.9 | 432.4 | 434.4 | 423.1 | 438.6 | 421.9 |
| **Female** (per 100,000 person-years) | | | | | | | | | | |
| 0-39 | 0.4 | 0.4 | 0.3 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.3 | 0.2 |
| 40-49 | 6.5 | 5.5 | 4.6 | 3.6 | 3.3 | 4.1 | 3.8 | 3.7 | 4.1 | 4.1 |
| 50-59 | 24.4 | 21.6 | 18.9 | 15.7 | 14.1 | 14.4 | 13.9 | 13.3 | 14.0 | 13.3 |
| 60-69 | 89.4 | 83.1 | 68.3 | 61.1 | 58.8 | 53.1 | 50.8 | 52.4 | 48.7 | 45.9 |
| 70-79 | 220.4 | 219.0 | 190.2 | 187.3 | 163.5 | 160.1 | 158.2 | 154.4 | 150.6 | 142.0 |
| 80+ | 335.5 | 365.8 | 348.7 | 325.0 | 310.9 | 323.8 | 322.6 | 309.5 | 324.1 | 318.0 |

Tables 4-9. Annual incidence and incidence rates for miscellaneous (other) ischemic heart disease (IHD) diagnoses in Korea (2006-2015).

| Years | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | P for trend |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Miscellaneous (other) IHD diagnoses** | | | | | | | | | | | |
| Incidence persons | 17,983 | 19,230 | 21,639 | 22,209 | 23,355 | 23,531 | 23,801 | 21,794 | 21,917 | 20,843 | <.0001 |
| Mean age, years | 64.5±12.2 | 65.2±12.3 | 65.0±12.2 | 65.2±12.1 | 65.6±12.3 | 65.8±12.2 | 66.0±12.3 | 66.4±12.3 | 66.4±12.3 | 66.8±12.4 | |
| Total Incidence rate (per 100,000 persons-year) | | | | | | | | | | | |
| Crude rate | 36.5 | 38.7 | 43.3 | 44.2 | 46.2 | 46.2 | 46.5 | 42.4 | 42.3 | 40.1 | |
| Age-standardized rate | 34.9 | 35.5 | 38.3 | 37.6 | 38.0 | 36.7 | 35.5 | 31.2 | 30.3 | 27.7 | |
| **Male** | | | | | | | | | | | |
| Incidence persons | 10,162 | 10,865 | 12,768 | 13,180 | 13,968 | 14,439 | 14,659 | 13,477 | 13,677 | 13,194 | |
| Male, % | 56.5 | 56.5 | 59.0 | 59.3 | 59.8 | 61.4 | 61.6 | 61.8 | 62.4 | 63.3 | |
| Mean age, years | 61.6±11.9 | 61.9±12.1 | 61.9±12.0 | 62.3±11.9 | 62.6±12.0 | 63.0±11.9 | 63.2±11.9 | 63.4±11.9 | 63.6±11.9 | 63.8±11.9 | |
| Male Incidence rate (per 100,000 person-years) | | | | | | | | | | | |
| Crude rate | 41.1 | 43.6 | 50.9 | 52.2 | 55.0 | 56.5 | 57.2 | 52.3 | 52.7 | 50.6 | |
| Age-standardized rate | 44.3 | 45.3 | 50.7 | 50.1 | 51.0 | 50.5 | 49.0 | 43.3 | 42.3 | 39.2 | |
| **Female** | | | | | | | | | | | |
| Incidence persons | 7,821 | 8,365 | 8,871 | 9,029 | 9,387 | 9,092 | 9,142 | 8,317 | 8,240 | 7,649 | |
| Female, % | 43.5 | 43.5 | 41.0 | 40.7 | 40.2 | 38.6 | 38.4 | 38.2 | 37.6 | 36.7 | |
| Mean age, years | 68.3±11.6 | 69.3±11.4 | 69.4±11.1 | 69.4±11.2 | 70.1±11.3 | 70.3±11.4 | 70.5±11.5 | 71.3±11.2 | 71.2±11.5 | 71.9±11.4 | |
| Female Incidence rate (per 100,000 person-years) | | | | | | | | | | | |
| Crude rate | 31.9 | 33.8 | 35.6 | 36.0 | 37.2 | 35.8 | 35.8 | 32.4 | 31.9 | 29.5 | |
| Age-standardized rate | 26.5 | 26.7 | 27.1 | 26.5 | 26.2 | 24.4 | 23.4 | 20.1 | 19.3 | 17.1 | |

Tables 4−10. Crude incidence rates by age group for miscellaneous (other) ischemic heart disease diagnoses in Korea (2006−2015).

| Years | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 |
|---|---|---|---|---|---|---|---|---|---|---|
| **Total** (per 100,000 person-years) | | | | | | | | | | |
| 0-39 | 1.4 | 1.5 | 1.6 | 1.5 | 1.6 | 1.4 | 1.4 | 1.2 | 1.4 | 1.2 |
| 40-49 | 20.1 | 20.2 | 22.7 | 22.0 | 22.0 | 20.5 | 20.9 | 17.9 | 17.3 | 16.0 |
| 50-59 | 68.4 | 65.4 | 72.5 | 71.9 | 68.3 | 68.0 | 64.7 | 58.7 | 55.9 | 50.6 |
| 60-69 | 150.0 | 147.5 | 159.9 | 159.0 | 161.2 | 156.1 | 149.8 | 127.0 | 125.6 | 112.8 |
| 70-79 | 222.8 | 239.1 | 254.9 | 244.5 | 250.6 | 243.0 | 235.2 | 206.6 | 197.5 | 183.3 |
| 80+ | 259.9 | 294.9 | 292.4 | 294.0 | 313.6 | 298.9 | 290.0 | 275.2 | 260.9 | 242.9 |
| **Male** (per 100,000 person-years) | | | | | | | | | | |
| 0-39 | 2.1 | 2.3 | 2.7 | 2.4 | 2.5 | 2.2 | 2.3 | 2.0 | 2.3 | 2.0 |
| 40-49 | 29.7 | 30.8 | 36.0 | 34.6 | 35.6 | 33.2 | 33.3 | 29.7 | 28.2 | 26.5 |
| 50-59 | 96.5 | 93.8 | 104.1 | 104.0 | 101.6 | 101.9 | 97.9 | 89.7 | 86.0 | 80.1 |
| 60-69 | 187.4 | 186.1 | 210.7 | 208.7 | 212.5 | 212.8 | 205.1 | 176.4 | 176.1 | 161.5 |
| 70-79 | 250.9 | 266.3 | 294.2 | 287.8 | 297.4 | 297.8 | 291.5 | 253.3 | 243.9 | 224.7 |
| 80+ | 296.2 | 329.8 | 352.2 | 362.8 | 383.8 | 385.7 | 363.7 | 336.1 | 324.6 | 309.5 |
| **Female** (per 100,000 person-years) | | | | | | | | | | |
| 0-39 | 0.7 | 0.5 | 0.4 | 0.5 | 0.6 | 0.5 | 0.5 | 0.3 | 0.5 | 0.4 |
| 40-49 | 10.0 | 9.2 | 8.9 | 9.0 | 7.8 | 7.2 | 8.0 | 5.6 | 5.9 | 5.0 |
| 50-59 | 40.2 | 36.8 | 40.6 | 39.4 | 34.7 | 33.8 | 31.3 | 27.3 | 25.5 | 20.7 |
| 60-69 | 117.5 | 113.3 | 114.3 | 113.9 | 114.3 | 103.7 | 98.2 | 80.7 | 77.9 | 66.9 |
| 70-79 | 205.2 | 221.7 | 228.9 | 215.2 | 218.2 | 204.4 | 194.5 | 172.5 | 163.1 | 152.1 |
| 80+ | 244.9 | 280.6 | 268.2 | 266.0 | 285.3 | 263.8 | 259.8 | 249.7 | 233.5 | 213.4 |

The mean age for IHD occurrence as well as the ratio of male to female patients with IHD or its subtypes increased during this period. In 2015, stable AP had the highest incidence, followed by unstable AP and variant AP (Tables 4-11 to 4-16). In the last 10 years, the incidence and crude rates of stable and variant AP increased (per 100,000 persons), whereas unstable AP decreased. The age-standardized incidence rates (per 100,000 persons) or stable and unstable AP decreased, whereas that of variant AP increased. The mean age of occurrence and the ratio of men to women with AP and its subtypes increased during this time. The mean age of occurrence of stable AP increased from 61.8 years in 2006 to 65.5 years in 2015 (Tables 4-11).

The incidence of MI was more than three times that of NSTEMI or STEMI, and there was a slight difference between NSTEMI and STEMI in 2015 (Tables 4-18 to 4-22). In the past 10 years, the population incidence, crude rates, and age-standardized rates of NSTEMI and STEMI increased, but those of miscellaneous (other) MI diagnoses decreased. The age-standardized rate of NSTEMI increased from 1.9 persons (per 100,000) in 2006 to 9.7 persons (per 100,000) in 2015 (Tables 4-19). The mean age as well as the ratio of men to women with MI subtypes increased during this time. The proportion men with STEMI increased from 67.5% in 2006 to 76.4% in 2015 (Tables 4-21).

Tables 4-11. Annual incidence and incidence rates for stable angina pectoris in Korea (2006-2015).

| Years | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | P for trend |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Stable Angina Pectoris (I20.8~I20.9)** | | | | | | | | | | | |
| Incidence persons | 28,860 | 32,463 | 34,135 | 35,024 | 35,074 | 35,563 | 35,835 | 33,170 | 35,765 | 33,616 | <.0001 |
| Mean age, years | 61.8±11.4 | 62.4±11.4 | 62.7±11.5 | 63.2±11.3 | 63.5±11.5 | 63.9±11.4 | 64.2±11.4 | 64.5±11.4 | 64.9±11.3 | 65.5±11.4 | |
| Total Incidence rate (per 100,000 persons-year) | | | | | | | | | | | |
| Crude rate | 58.6 | 65.4 | 68.3 | 69.6 | 69.3 | 69.9 | 70.0 | 64.5 | 69.1 | 64.6 | |
| Age-standardized rate | 56.2 | 60.4 | 61.0 | 60.0 | 57.8 | 56.3 | 54.4 | 48.6 | 50.3 | 45.3 | |
| **Male** | | | | | | | | | | | |
| Incidence persons | 15,329 | 17,407 | 18,504 | 19,545 | 19,638 | 19,965 | 20,286 | 19,046 | 20,656 | 19,748 | |
| Male, % | 53.1 | 53.6 | 54.2 | 55.8 | 56.0 | 56.1 | 56.6 | 57.4 | 57.8 | 58.7 | |
| Mean age, years | 59.8±11.5 | 60.4±11.4 | 60.7±11.5 | 61.2±11.3 | 61.5±11.4 | 62.0±11.2 | 62.3±11.3 | 62.6±11.3 | 63.0±11.1 | 63.5±11.2 | |
| Male Incidence rate (per 100,000 person-years) | | | | | | | | | | | |
| Crude rate | 62.0 | 69.8 | 73.7 | 77.4 | 77.4 | 78.2 | 79.1 | 73.9 | 79.6 | 75.8 | |
| Age-standardized rate | 65.3 | 71.0 | 72.5 | 73.4 | 70.9 | 69.3 | 67.8 | 61.3 | 63.6 | 58.5 | |
| **Female** | | | | | | | | | | | |
| Incidence persons | 13,531 | 15,056 | 15,631 | 15,479 | 15,436 | 15,598 | 15,549 | 14,124 | 15,109 | 13,868 | |
| Female, % | 46.9 | 46.4 | 45.8 | 44.2 | 44.0 | 43.9 | 43.4 | 42.6 | 42.2 | 41.3 | |
| Mean age, years | 64.0±10.9 | 64.6±11.1 | 65.2±11.1 | 65.8±10.9 | 66.1±10.1 | 66.4±11.1 | 66.6±11.0 | 67.1±11.1 | 67.5±11.0 | 68.4±11.1 | |
| Female Incidence rate (per 100,000 person-years) | | | | | | | | | | | |
| Crude rate | 55.2 | 60.9 | 62.8 | 61.8 | 61.2 | 61.5 | 60.9 | 55.0 | 58.5 | 53.4 | |
| Age-standardized rate | 48.0 | 50.9 | 50.6 | 47.9 | 45.9 | 44.5 | 42.4 | 37.1 | 38.1 | 33.2 | |

Tables 4-12. Crude incidence rates by age group for stable angina pectoris in Korea (2006-2015).

| Years | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 |
|---|---|---|---|---|---|---|---|---|---|---|
| **Total** (per 100,000 person-years) | | | | | | | | | | |
| 0-39 | 3.0 | 3.2 | 3.4 | 2.9 | 2.9 | 2.7 | 2.5 | 2.1 | 2.1 | 1.8 |
| 40-49 | 40.7 | 42.2 | 42.2 | 38.5 | 38.0 | 33.3 | 33.2 | 30.2 | 28.8 | 25.7 |
| 50-59 | 132.1 | 133.9 | 128.0 | 126.4 | 118.3 | 116.0 | 109.5 | 98.3 | 102.0 | 89.8 |
| 60-69 | 257.7 | 280.3 | 282.9 | 282.4 | 268.8 | 266.7 | 258.7 | 226.1 | 236.2 | 203.1 |
| 70-79 | 299.1 | 337.8 | 356.3 | 353.3 | 343.8 | 339.0 | 324.5 | 294.9 | 311.1 | 295.5 |
| 80+ | 192.7 | 227.7 | 239.1 | 253.8 | 263.3 | 263.9 | 274.9 | 250.2 | 265.9 | 265.9 |
| **Male** (per 100,000 person-years) | | | | | | | | | | |
| 0-39 | 4.3 | 4.6 | 5.0 | 4.4 | 4.4 | 4.0 | 3.8 | 3.2 | 3.0 | 2.8 |
| 40-49 | 51.9 | 54.2 | 54.8 | 52.8 | 52.0 | 45.6 | 46.5 | 42.3 | 42.3 | 37.8 |
| 50-59 | 157.6 | 158.4 | 156.2 | 157.7 | 149.9 | 147.0 | 135.3 | 125.5 | 132.6 | 119.5 |
| 60-69 | 281.7 | 321.1 | 329.7 | 339.1 | 319.1 | 325.5 | 321.7 | 286.6 | 297.2 | 265.1 |
| 70-79 | 329.3 | 374.1 | 382.1 | 393.6 | 388.9 | 373.3 | 364.5 | 330.0 | 354.3 | 341.1 |
| 80+ | 248.8 | 276.7 | 301.7 | 328.2 | 335.8 | 347.9 | 371.6 | 339.0 | 340.5 | 341.7 |
| **Female** (per 100,000 person-years) | | | | | | | | | | |
| 0-39 | 1.5 | 1.7 | 1.6 | 1.4 | 1.2 | 1.3 | 1.1 | 0.9 | 1.1 | 0.8 |
| 40-49 | 29.1 | 29.6 | 29.0 | 23.6 | 23.4 | 20.5 | 19.3 | 17.8 | 14.9 | 13.2 |
| 50-59 | 106.6 | 109.3 | 99.5 | 94.8 | 86.6 | 84.7 | 83.5 | 70.8 | 71.1 | 59.7 |
| 60-69 | 236.7 | 244.2 | 241.1 | 230.9 | 222.8 | 212.7 | 200.0 | 169.4 | 178.6 | 144.6 |
| 70-79 | 280.3 | 314.5 | 339.3 | 326.1 | 312.6 | 314.8 | 295.6 | 269.2 | 279.1 | 261.3 |
| 80+ | 169.5 | 207.7 | 213.7 | 223.6 | 234.0 | 229.9 | 235.2 | 212.9 | 233.8 | 232.4 |

Tables 4-13. Annual incidence and incidence rates for unstable angina pectoris in Korea (2006-2015).

| Years | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | P for trend |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Unstable Angina Pectoris (I20.0)** | | | | | | | | | | | |
| Incidence persons | 24,435 | 25,598 | 23,139 | 23,582 | 24,966 | 25,161 | 25,595 | 25,030 | 24,820 | 23,524 | <.0001 |
| Mean age, years | 63.0±10.9 | 63.4±11.1 | 63.8±11.1 | 64.1±11.1 | 64.2±11.2 | 64.6±11.2 | 65.0±11.1 | 65.2±11.1 | 65.3±11.2 | 65.4±11.2 | |
| Total Incidence rate (per 100,000 persons-year) | | | | | | | | | | | |
| Crude rate | 49.6 | 51.5 | 46.3 | 46.9 | 49.4 | 49.4 | 50.0 | 48.7 | 48.0 | 45.2 | |
| Age-standardized rate | 47.5 | 47.5 | 41.1 | 40.1 | 40.9 | 39.6 | 38.6 | 36.3 | 34.7 | 31.6 | |
| **Male** | | | | | | | | | | | |
| Incidence persons | 13,988 | 14,504 | 13,122 | 13,789 | 14,886 | 15,041 | 15,624 | 15,410 | 15,326 | 14,849 | |
| Male, % | 57.2 | 56.7 | 56.7 | 58.5 | 59.6 | 59.8 | 61.0 | 61.6 | 61.7 | 63.1 | |
| Mean age, years | 60.7±10.9 | 61.2±11.1 | 61.4±11.2 | 61.7±11.1 | 62.0±11.1 | 62.3±11.1 | 62.9±11.0 | 62.8±10.9 | 62.9±11.0 | 63.2±10.9 | |
| Male Incidence rate (per 100,000 person-years) | | | | | | | | | | | |
| Crude rate | 56.6 | 58.1 | 52.3 | 54.6 | 58.7 | 58.9 | 60.9 | 59.8 | 59.1 | 57.0 | |
| Age-standardized rate | 59.9 | 59.4 | 51.5 | 51.7 | 53.7 | 52.1 | 52.0 | 49.2 | 47.0 | 43.8 | |
| **Female** | | | | | | | | | | | |
| Incidence persons | 10,477 | 11,094 | 10,017 | 9,793 | 10,080 | 10,120 | 9,971 | 9,620 | 9,494 | 8,675 | |
| Female, % | 42.8 | 43.3 | 43.3 | 41.5 | 40.4 | 40.2 | 39.0 | 38.4 | 38.3 | 36.9 | |
| Mean age, years | 65.9±10.3 | 66.2±10.4 | 66.8±10.2 | 67.4±10.4 | 67.5±10.6 | 68.0±10.4 | 68.3±10.5 | 69.0±10.4 | 69.1±10.6 | 69.3±10.5 | |
| Female Incidence rate (per 100,000 person-years) | | | | | | | | | | | |
| Crude rate | 42.6 | 44.9 | 40.2 | 39.1 | 40.0 | 39.9 | 39.1 | 37.5 | 36.8 | 33.4 | |
| Age-standardized rate | 36.4 | 36.9 | 31.8 | 29.6 | 29.3 | 28.2 | 26.6 | 24.5 | 23.3 | 20.4 | |

Tables 4-14. Crude incidence rates by age group for unstable angina pectoris in Korea (2006-2015).

| Years | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 |
|---|---|---|---|---|---|---|---|---|---|---|
| **Total** (per 100,000 person-years)20.6 | | | | | | | | | | |
| 0-39 | 1.6 | 1.7 | 1.4 | 1.3 | 1.4 | 1.3 | 1.2 | 1.1 | 1.1 | 1.0 |
| 40-49 | 30.0 | 29.7 | 24.8 | 24.8 | 25.3 | 23.3 | 21.9 | 20.6 | 21.0 | 18.6 |
| 50-59 | 105.3 | 102.6 | 85.7 | 83.6 | 82.2 | 78.6 | 74.3 | 71.6 | 68.8 | 64.4 |
| 60-69 | 223.3 | 219.1 | 192.8 | 182.4 | 188.9 | 183.4 | 182.4 | 167.0 | 155.5 | 138.3 |
| 70-79 | 286.1 | 296.8 | 260.2 | 258.0 | 259.9 | 257.5 | 252.3 | 240.0 | 230.7 | 214.4 |
| 80+ | 180.5 | 196.5 | 182.7 | 194.7 | 204.9 | 205.7 | 206.9 | 202.6 | 192.5 | 174.1 |
| **Male** (per 100,000 person-years) | | | | | | | | | | |
| 0-39 | 2.6 | 2.6 | 2.3 | 2.0 | 2.3 | 2.1 | 1.9 | 1.8 | 1.7 | 1.7 |
| 40-49 | 42.8 | 42.3 | 37.4 | 37.3 | 38.4 | 35.4 | 33.5 | 32.9 | 33.3 | 30.2 |
| 50-59 | 143.3 | 135.5 | 114.9 | 115.5 | 113.9 | 111.9 | 106.8 | 106.0 | 101.4 | 96.4 |
| 60-69 | 270.5 | 260.1 | 228.5 | 230.2 | 244.5 | 238.2 | 244.3 | 224.3 | 211.1 | 190.9 |
| 70-79 | 320.5 | 341.8 | 286.7 | 289.0 | 300.1 | 290.7 | 294.1 | 280.9 | 269.5 | 257.2 |
| 80+ | 239.6 | 262.1 | 246.9 | 259.4 | 279.2 | 286.7 | 302.8 | 264.8 | 246.5 | 232.5 |
| **Female** (per 100,000 person-years) | | | | | | | | | | |
| 0-39 | 0.7 | 0.6 | 0.5 | 0.4 | 0.5 | 0.4 | 0.5 | 0.3 | 0.4 | 0.3 |
| 40-49 | 16.7 | 16.6 | 11.8 | 11.9 | 11.7 | 10.8 | 9.8 | 7.9 | 8.3 | 6.7 |
| 50-59 | 67.2 | 69.5 | 56.2 | 51.4 | 50.1 | 45.1 | 41.4 | 36.7 | 35.7 | 32.0 |
| 60-69 | 182.1 | 182.8 | 160.8 | 139.1 | 138.1 | 132.7 | 124.8 | 113.3 | 102.9 | 88.6 |
| 70-79 | 264.7 | 267.9 | 242.7 | 237.1 | 232.1 | 234.1 | 222.2 | 210.2 | 202.0 | 182.2 |
| 80+ | 156.1 | 169.6 | 156.6 | 168.4 | 174.5 | 173.0 | 167.5 | 176.5 | 169.3 | 148.3 |

Tables 4-15. Annual incidence and incidence rates for variant angina pectoris in Korea (2006-2015).

| Years | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | P for trend |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Variant Angina Pectoris (I20.1)** | | | | | | | | | | | |
| Incidence persons | 4,584 | 4,965 | 5,211 | 5,832 | 6,428 | 6,880 | 7,545 | 7,628 | 7,780 | 7,417 | <.0001 |
| Mean age, years | 55.6±11.4 | 55.6±11.4 | 56.5±11.6 | 56.7±11.3 | 56.9±11.4 | 56.8±11.4 | 57.3±11.1 | 57.3±11.2 | 57.5±11.3 | 57.6±11.0 | |
| Total Incidence rate (per 100,000 persons-year) | | | | | | | | | | | |
| Crude rate | 9.3 | 10.0 | 10.4 | 11.6 | 12.7 | 13.5 | 14.7 | 14.8 | 15.0 | 14.3 | |
| Age-standardized rate | 9.0 | 9.4 | 9.5 | 10.3 | 10.9 | 11.3 | 12.0 | 11.9 | 11.8 | 10.9 | |
| **Male** | | | | | | | | | | | |
| Incidence persons | 2,607 | 2,801 | 2,941 | 3,263 | 3,559 | 3,979 | 4,335 | 4,520 | 4,599 | 4,438 | |
| Male, % | 56.9 | 56.4 | 56.4 | 55.9 | 55.4 | 57.8 | 57.5 | 59.3 | 59.1 | 59.8 | |
| Mean age, years | 54.1±11.5 | 54.0±11.4 | 54.9±11.7 | 54.9±11.4 | 55.1±11.4 | 55.2±11.4 | 56.1±11.3 | 55.9±11.3 | 56.2±11.4 | 56.4±11.0 | |
| Male Incidence rate (per 100,000 person-years) | | | | | | | | | | | |
| Crude rate | 10.5 | 11.2 | 11.7 | 12.9 | 14.0 | 15.6 | 16.9 | 17.5 | 17.7 | 17.0 | |
| Age-standardized rate | 10.6 | 11.0 | 11.2 | 11.9 | 12.6 | 13.7 | 14.4 | 14.7 | 14.5 | 13.6 | |
| **Female** | | | | | | | | | | | |
| Incidence persons | 1,977 | 2,164 | 2,270 | 2,569 | 2,869 | 2,901 | 3,210 | 3,108 | 3,181 | 2,979 | |
| Female, % | 43.1 | 43.6 | 43.6 | 44.1 | 44.6 | 42.2 | 42.5 | 40.7 | 40.9 | 40.2 | |
| Mean age, years | 57.9±10.9 | 57.8±11.1 | 58.6±11.1 | 58.9±10.8 | 59.0±10.9 | 59.1±10.9 | 59.0±10.8 | 59.2±10.6 | 59.4±10.9 | 59.4±10.7 | |
| Female Incidence rate (per 100,000 person-years) | | | | | | | | | | | |
| Crude rate | 8.1 | 8.8 | 9.1 | 10.3 | 11.4 | 11.4 | 12.6 | 12.1 | 12.3 | 11.5 | |
| Age-standardized rate | 7.4 | 7.8 | 7.9 | 8.6 | 9.3 | 9.0 | 9.7 | 9.2 | 9.1 | 8.4 | |

Tables 4-16. Crude incidence rates by age group for variant angina pectoris in Korea (2006-2015).

| Years | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 |
|---|---|---|---|---|---|---|---|---|---|---|
| **Total** (per 100,000 person-years) | | | | | | | | | | |
| 0-39 | 1.1 | 1.2 | 1.2 | 1.3 | 1.5 | 1.6 | 1.6 | 1.7 | 1.7 | 1.5 |
| 40-49 | 12.9 | 13.6 | 12.7 | 13.1 | 14.1 | 14.6 | 14.5 | 14.6 | 15.3 | 14.3 |
| 50-59 | 26.0 | 27.0 | 26.4 | 29.8 | 31.1 | 32.9 | 34.8 | 33.7 | 32.8 | 31.3 |
| 60-69 | 31.5 | 33.0 | 35.0 | 37.5 | 40.1 | 41.2 | 46.4 | 46.1 | 44.1 | 40.8 |
| 70-79 | 23.2 | 23.5 | 27.5 | 29.4 | 31.6 | 31.1 | 33.3 | 31.5 | 31.9 | 28.6 |
| 80+ | 7.8 | 8.2 | 10.2 | 9.5 | 12.0 | 12.2 | 14.5 | 12.2 | 14.8 | 12.0 |
| **Male** (per 100,000 person-years) | | | | | | | | | | |
| 0-39 | 1.7 | 1.8 | 1.8 | 1.9 | 2.2 | 2.3 | 2.3 | 2.7 | 2.5 | 2.2 |
| 40-49 | 15.8 | 16.8 | 15.3 | 16.5 | 17.7 | 19.1 | 18.3 | 19.3 | 20.3 | 18.5 |
| 50-59 | 29.5 | 30.1 | 30.3 | 33.9 | 34.7 | 37.6 | 39.0 | 38.9 | 38.6 | 38.0 |
| 60-69 | 35.1 | 35.8 | 38.8 | 39.9 | 42.0 | 46.8 | 54.3 | 54.7 | 50.5 | 48.2 |
| 70-79 | 26.9 | 27.4 | 30.8 | 32.9 | 33.2 | 33.6 | 39.2 | 36.1 | 37.7 | 33.1 |
| 80+ | 11.6 | 10.0 | 14.9 | 10.6 | 16.6 | 18.0 | 18.5 | 19.0 | 20.3 | 16.2 |
| **Female** (per 100,000 person-years) | | | | | | | | | | |
| 0-39 | 0.6 | 0.7 | 0.6 | 0.7 | 0.7 | 0.7 | 0.8 | 0.7 | 0.8 | 0.7 |
| 40-49 | 9.8 | 10.1 | 10.0 | 9.6 | 10.3 | 9.8 | 10.6 | 9.7 | 10.1 | 9.9 |
| 50-59 | 22.6 | 23.8 | 22.4 | 25.7 | 27.5 | 28.1 | 30.5 | 28.5 | 26.9 | 24.5 |
| 60-69 | 28.3 | 30.5 | 31.7 | 35.3 | 38.3 | 36.0 | 39.2 | 38.0 | 38.0 | 33.9 |
| 70-79 | 20.9 | 21.0 | 25.4 | 27.1 | 30.4 | 29.3 | 29.1 | 28.1 | 27.5 | 25.2 |
| 80+ | 6.2 | 7.4 | 8.3 | 9.1 | 10.1 | 9.8 | 12.8 | 9.3 | 12.5 | 10.1 |

Tables 4-17. Annual incidence and incidence rates for miscellaneous (other) myocardial infarction diagnoses in Korea (2006-2015).

| Years | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | P for trend |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Miscellaneous (other) Myocardial Infarction diagnoses (I21.9, I22.9)** | | | | | | | | | | | |
| Incidence persons | 13,716 | 13,881 | 12,826 | 11,863 | 11,270 | 10,756 | 10,866 | 10,402 | 10,015 | 10,215 | <.0001 |
| Mean age, years | 64.8±13.2 | 65.4±13.2 | 65.8±13.3 | 65.9±13.3 | 65.7±13.4 | 66.3±13.5 | 66.4±13.4 | 66.0±13.6 | 66.4±13.6 | 66.4±13.7 | |
| Total Incidence rate (per 100,000 persons-year) | | | | | | | | | | | |
| Crude rate | 27.9 | 27.9 | 25.7 | 23.6 | 22.3 | 21.1 | 21.2 | 20.2 | 19.3 | 19.6 | |
| Age-standardized rate | 26.6 | 25.6 | 22.6 | 20.0 | 18.3 | 16.7 | 16.1 | 15.0 | 13.8 | 13.6 | |
| **Male** | | | | | | | | | | | |
| Incidence persons | 8,677 | 8,758 | 8,265 | 7,766 | 7,546 | 7,119 | 7,304 | 7,072 | 6,915 | 7,092 | |
| Male, % | 63.3 | 63.1 | 64.4 | 65.5 | 67.0 | 66.2 | 67.2 | 68.0 | 69.0 | 69.4 | |
| Mean age, years | 61.1±12.9 | 61.5±12.8 | 61.8±12.9 | 61.9±12.8 | 61.8±12.7 | 62.3±12.9 | 62.3±12.7 | 61.9±12.8 | 62.4±12.7 | 62.5±12.8 | |
| Male Incidence rate (per 100,000 person-years) | | | | | | | | | | | |
| Crude rate | 35.1 | 35.1 | 32.9 | 30.8 | 29.7 | 27.9 | 28.5 | 27.4 | 26.7 | 27.2 | |
| Age-standardized rate | 38.1 | 36.7 | 33.2 | 29.7 | 27.7 | 25.0 | 24.6 | 22.9 | 21.6 | 21.3 | |
| **Female** | | | | | | | | | | | |
| Incidence persons | 5,039 | 5,123 | 4,561 | 4,097 | 3,724 | 3,637 | 3,562 | 3,330 | 3,100 | 3,123 | |
| Female, % | 36.7 | 36.9 | 35.6 | 34.5 | 33.0 | 33.8 | 32.8 | 32.0 | 31.0 | 30.6 | |
| Mean age, years | 71.0±11.1 | 72.0±11.0 | 73.0±10.8 | 73.4±10.5 | 73.7±10.8 | 74.2±11.0 | 74.7±10.7 | 74.6±11.0 | 75.1±11.1 | 75.4±11.3 | |
| Female Incidence rate (per 100,000 person-years) | | | | | | | | | | | |
| Crude rate | 20.6 | 20.7 | 18.3 | 16.4 | 14.8 | 14.3 | 14.0 | 13.0 | 12.0 | 12.0 | |
| Age-standardized rate | 16.5 | 15.8 | 13.2 | 11.2 | 9.8 | 9.1 | 8.3 | 7.5 | 6.6 | 6.4 | |

Tables 4−18. Crude incidence rates by age group for miscellaneous (other) myocardial infarction diagnoses in Korea (2006−2015).

| Years | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 |
|---|---|---|---|---|---|---|---|---|---|---|
| **Total** (per 100,000 person-years) | | | | | | | | | | |
| 0-39 | 1.5 | 1.4 | 1.2 | 1.1 | 1.1 | 1.0 | 0.8 | 0.9 | 0.8 | 0.9 |
| 40-49 | 18.4 | 17.1 | 15.3 | 13.7 | 13.7 | 11.6 | 12.1 | 12.2 | 10.9 | 11.1 |
| 50-59 | 47.7 | 45.4 | 39.2 | 35.6 | 31.6 | 29.8 | 29.2 | 28.0 | 25.8 | 25.8 |
| 60-69 | 95.2 | 89.5 | 78.3 | 68.7 | 63.8 | 55.7 | 54.3 | 49.9 | 46.2 | 44.6 |
| 70-79 | 180.4 | 174.7 | 152.0 | 133.6 | 118.4 | 107.4 | 101.2 | 90.3 | 83.0 | 81.8 |
| 80+ | 251.6 | 263.4 | 250.7 | 217.0 | 191.7 | 192.5 | 182.6 | 158.5 | 151.7 | 143.9 |
| **Male** (per 100,000 person-years) | | | | | | | | | | |
| 0-39 | 2.6 | 2.5 | 2.2 | 1.9 | 2.0 | 1.7 | 1.5 | 1.7 | 1.5 | 1.6 |
| 40-49 | 31.3 | 29.8 | 27.4 | 24.9 | 25.0 | 20.8 | 21.9 | 22.1 | 20.0 | 20.4 |
| 50-59 | 77.3 | 75.4 | 65.4 | 61.1 | 54.6 | 51.8 | 51.4 | 49.4 | 45.7 | 45.8 |
| 60-69 | 133.0 | 125.9 | 115.8 | 103.4 | 97.0 | 84.8 | 85.7 | 77.7 | 74.7 | 73.4 |
| 70-79 | 226.1 | 215.8 | 192.4 | 166.2 | 155.8 | 140.4 | 130.3 | 116.5 | 113.1 | 111.2 |
| 80+ | 320.3 | 319.8 | 306.3 | 271.2 | 232.7 | 236.5 | 223.6 | 191.2 | 180.5 | 166.3 |
| **Female** (per 100,000 person-years) | | | | | | | | | | |
| 0-39 | 0.3 | 0.3 | 0.2 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 |
| 40-49 | 4.8 | 4.0 | 2.7 | 2.1 | 2.0 | 2.0 | 1.9 | 1.8 | 1.5 | 1.5 |
| 50-59 | 18.0 | 15.2 | 12.6 | 9.8 | 8.4 | 7.8 | 6.8 | 6.3 | 5.8 | 5.6 |
| 60-69 | 62.2 | 57.4 | 44.6 | 37.2 | 33.5 | 28.9 | 25.2 | 23.8 | 19.2 | 17.4 |
| 70-79 | 151.9 | 148.3 | 125.4 | 111.6 | 92.6 | 84.2 | 80.2 | 71.1 | 60.7 | 59.7 |
| 80+ | 223.1 | 240.4 | 228.2 | 195.0 | 175.1 | 174.6 | 165.8 | 144.8 | 139.3 | 134.1 |

Tables 4-19. Annual incidence and incidence rates for non-ST elevation myocardial infarction in Korea (2006-2015).

| Years | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | P for trend |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Non-ST elevation Myocardial Infacrtion (I21.4)** | | | | | | | | | | | |
| Incidence persons | 975 | 1,472 | 1,805 | 2,264 | 2,687 | 3,437 | 4,237 | 5,477 | 6,824 | 7,246 | <.0001 |
| Mean age, years | 65.5±12.9 | 65.7±12.9 | 65.8±12.6 | 66.7±12.9 | 66.9±12.9 | 66.4±12.7 | 65.9±12.7 | 66.3±12.8 | 66.4±12.9 | 66.5±12.9 | |
| Total Incidence rate (per 100,000 persons-year) | | | | | | | | | | | |
| Crude rate | 2.0 | 3.0 | 3.6 | 4.5 | 5.3 | 6.8 | 8.3 | 10.6 | 13.2 | 13.9 | |
| Age-standardized rate | 1.9 | 2.7 | 3.2 | 3.8 | 4.3 | 5.3 | 6.3 | 7.9 | 9.4 | 9.7 | |
| **Male** | | | | | | | | | | | |
| Incidence persons | 605 | 901 | 1,111 | 1,375 | 1,767 | 2,217 | 2,804 | 3,653 | 4,592 | 4,938 | |
| Male, % | 62.1 | 61.2 | 61.6 | 60.7 | 65.8 | 64.5 | 66.2 | 66.7 | 67.3 | 68.1 | |
| Mean age, years | 61.6±12.6 | 61.9±12.6 | 62.3±12.3 | 62.7±12.7 | 62.3±12.5 | 62.8±12.4 | 62.3±12.3 | 62.7±12.5 | 62.9±12.4 | 63.2±12.4 | |
| Male Incidence rate (per 100,0012.60 person-years) | | | | | | | | | | | |
| Crude rate | 2.4 | 3.6 | 4.4 | 5.4 | 7.0 | 8.7 | 10.9 | 14.2 | 17.7 | 18.9 | |
| Age-standardized rate | 2.7 | 3.8 | 4.5 | 5.3 | 6.4 | 7.8 | 9.4 | 11.8 | 14.3 | 14.8 | |
| **Female** | | | | | | | | | | | |
| Incidence persons | 370 | 571 | 694 | 889 | 920 | 1,220 | 1,433 | 1,824 | 2,232 | 2,308 | |
| Female, % | 37.9 | 38.8 | 38.4 | 39.3 | 34.2 | 35.5 | 33.8 | 33.3 | 32.7 | 31.9 | |
| Mean age, years | 71.9±10.4 | 71.8±11.0 | 71.5±10.8 | 73.0±10.4 | 72.9±10.4 | 72.9±10.6 | 72.9±10.5 | 73.4±10.2 | 73.5±10.8 | 73.6±11.0 | |
| Female Incidence rate (per 100,000 person-years) | | | | | | | | | | | |
| Crude rate | 1.5 | 2.3 | 2.8 | 3.5 | 3.7 | 4.8 | 5.6 | 7.1 | 8.6 | 8.9 | |
| Age-standardized rate | 1.2 | 1.8 | 2.1 | 2.5 | 2.4 | 3.1 | 3.5 | 4.3 | 4.9 | 4.9 | |

Tables 4-20. Crude incidence rates by age group for non-ST elevation myocardial infarction in Korea (2006-2015).

| Years | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 |
|---|---|---|---|---|---|---|---|---|---|---|
| **Total** (per 100,000 person-years) | | | | | | | | | | |
| 0-39 | 0.1 | 0.1 | 0.1 | 0.1 | 0.2 | 0.2 | 0.3 | 0.4 | 0.5 | 0.5 |
| 40-49 | 1.4 | 1.9 | 2.3 | 2.3 | 2.9 | 3.4 | 4.5 | 5.5 | 7.1 | 7.2 |
| 50-59 | 3.1 | 4.4 | 5.0 | 6.5 | 8.1 | 9.7 | 11.8 | 13.7 | 16.8 | 17.6 |
| 60-69 | 7.0 | 10.2 | 12.1 | 12.8 | 15.0 | 18.3 | 22.4 | 29.1 | 34.1 | 34.8 |
| 70-79 | 13.0 | 18.6 | 22.7 | 28.5 | 29.6 | 37.3 | 42.0 | 53.0 | 60.9 | 61.9 |
| 80+ | 19.5 | 28.2 | 30.5 | 41.0 | 43.5 | 54.8 | 59.3 | 74.2 | 92.3 | 91.8 |
| **Male** (per 100,000 person-years) | | | | | | | | | | |
| 0-39 | 0.1 | 0.2 | 0.2 | 0.3 | 0.4 | 0.4 | 0.5 | 0.8 | 0.9 | 0.9 |
| 40-49 | 2.3 | 3.3 | 3.8 | 4.1 | 5.4 | 6.1 | 8.0 | 10.0 | 12.6 | 12.8 |
| 50-59 | 5.3 | 6.9 | 7.9 | 10.7 | 13.7 | 16.2 | 20.1 | 23.6 | 28.8 | 30.6 |
| 60-69 | 9.7 | 14.3 | 16.5 | 18.0 | 22.0 | 26.6 | 34.3 | 43.1 | 52.9 | 53.0 |
| 70-79 | 15.7 | 22.3 | 29.4 | 33.1 | 38.3 | 47.7 | 51.5 | 67.5 | 77.9 | 84.5 |
| 80+ | 22.2 | 32.3 | 34.8 | 48.3 | 53.2 | 67.9 | 75.5 | 98.1 | 120.1 | 115.6 |
| **Female** (per 100,000 person-years) | | | | | | | | | | |
| 0-39 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 | 0.1 |
| 40-49 | 0.4 | 0.5 | 0.6 | 0.5 | 0.4 | 0.6 | 0.8 | 0.9 | 1.4 | 1.5 |
| 50-59 | 0.8 | 1.8 | 2.1 | 2.3 | 2.3 | 3.1 | 3.5 | 3.6 | 4.7 | 4.5 |
| 60-69 | 4.6 | 6.5 | 8.3 | 8.1 | 8.6 | 10.6 | 11.3 | 15.9 | 16.4 | 17.6 |
| 70-79 | 11.3 | 16.1 | 18.3 | 25.5 | 23.6 | 30.0 | 35.1 | 42.4 | 48.2 | 45.0 |
| 80+ | 18.4 | 26.5 | 28.8 | 38.1 | 39.6 | 49.5 | 52.6 | 64.1 | 80.4 | 81.3 |

Tables 4-21. Annual incidence and incidence rates for ST elevation myocardial infarction in Korea (2006-2015).

| Years | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | P for trend |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **ST elevation Myocardial Infarction (I21.0~I21.3, I22.0~I21.1, I22.8)** | | | | | | | | | | | |
| Incidence persons | 4,644 | 4,862 | 4,824 | 5,417 | 5,425 | 6,165 | 6,331 | 6,838 | 7,224 | 7,218 | <.0001 |
| Mean age, years | 63.6±12.9 | 63.3±13.1 | 63.5±13.0 | 63.4±13.1 | 63.6±13.1 | 63.6±13.1 | 63.5±13.1 | 63.3±13.4 | 63.5±13.3 | 64.1±13.1 | |
| Total Incidence rate (per 100,000 persons-year) | | | | | | | | | | | |
| Crude rate | 9.4 | 9.8 | 9.6 | 10.8 | 10.7 | 12.1 | 12.4 | 13.3 | 14.0 | 13.9 | |
| Age-standardized rate | 9.0 | 9.0 | 8.6 | 9.2 | 8.9 | 9.7 | 9.6 | 10.1 | 10.3 | 9.9 | |
| **Male** | | | | | | | | | | | |
| Incidence persons | 3,137 | 3,371 | 3,332 | 3,849 | 3,897 | 4,504 | 4,646 | 5,119 | 5,422 | 5,517 | |
| Male, % | 67.5 | 69.3 | 69.1 | 71.1 | 71.8 | 73.1 | 73.4 | 74.9 | 75.1 | 76.4 | |
| Mean age, years | 59.7±12.6 | 59.7±12.6 | 59.8±12.4 | 59.8±12.4 | 60.2±12.4 | 60.2±12.2 | 60.2±12.3 | 60.1±12.6 | 60.2±12.3 | 61.1±12.2 | |
| Male Incidence rate (per 100,000 person-years) | | | | | | | | | | | |
| Crude rate | 12.7 | 13.5 | 13.3 | 15.2 | 15.4 | 17.6 | 18.1 | 19.9 | 20.9 | 21.2 | |
| Age-standardized rate | 13.5 | 13.9 | 13.1 | 14.5 | 14.1 | 15.6 | 15.5 | 16.6 | 16.9 | 16.6 | |
| **Female** | | | | | | | | | | | |
| Incidence persons | 1,507 | 1,491 | 1,492 | 1,568 | 1,528 | 1,661 | 1,685 | 1,719 | 1,802 | 1,701 | |
| Female, % | 32.5 | 30.7 | 30.9 | 28.9 | 28.2 | 26.9 | 26.6 | 25.1 | 24.9 | 23.6 | |
| Mean age, years | 70.7±10.3 | 71.6±10.1 | 71.7±10.6 | 72.2±10.3 | 72.4±10.2 | 72.8±10.8 | 72.6±10.8 | 72.9±10.9 | 73.4±11.1 | 73.9±10.9 | |
| Female Incidence rate (per 100,000 person-years) | | | | | | | | | | | |
| Crude rate | 6.1 | 6.0 | 6.0 | 6.3 | 6.1 | 6.5 | 6.6 | 6.7 | 7.0 | 6.6 | |
| Age-standardized rate | 5.0 | 4.6 | 4.4 | 4.4 | 4.1 | 4.2 | 4.1 | 4.0 | 4.0 | 3.6 | |

Tables 4-22. Crude incidence rates by age group for ST elevation myocardial infarction in Korea (2006-2015).

| Years | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 |
|---|---|---|---|---|---|---|---|---|---|---|
| **Total** (per 100,000 person-years) | | | | | | | | | | |
| 0-39 | 0.6 | 0.6 | 0.5 | 0.6 | 0.7 | 0.6 | 0.6 | 0.8 | 0.8 | 0.6 |
| 40-49 | 7.2 | 7.6 | 7.4 | 8.5 | 7.6 | 8.9 | 9.5 | 10.2 | 10.6 | 9.8 |
| 50-59 | 17.2 | 17.5 | 16.9 | 18.3 | 17.5 | 20.4 | 19.8 | 20.8 | 22.1 | 21.0 |
| 60-69 | 33.6 | 32.4 | 30.8 | 32.3 | 32.5 | 33.8 | 33.9 | 34.8 | 35.2 | 34.5 |
| 70-79 | 56.8 | 55.6 | 52.5 | 55.6 | 52.4 | 55.6 | 53.0 | 54.0 | 52.5 | 53.5 |
| 80+ | 65.4 | 68.7 | 64.0 | 68.0 | 65.9 | 73.0 | 69.9 | 71.3 | 74.2 | 70.6 |
| **Male** (per 100,000 person-years) | | | | | | | | | | |
| 0-39 | 1.1 | 1.1 | 1.0 | 1.2 | 1.2 | 1.2 | 1.2 | 1.6 | 1.5 | 1.2 |
| 40-49 | 12.9 | 14.1 | 13.5 | 15.8 | 14.1 | 16.1 | 17.5 | 19.0 | 19.7 | 18.4 |
| 50-59 | 29.2 | 30.5 | 29.1 | 32.5 | 31.6 | 37.0 | 35.1 | 37.8 | 40.3 | 38.7 |
| 60-69 | 47.5 | 47.8 | 47.1 | 50.0 | 50.4 | 55.0 | 54.0 | 56.8 | 57.5 | 58.1 |
| 70-79 | 74.9 | 71.9 | 66.8 | 71.2 | 69.3 | 75.1 | 73.0 | 74.1 | 73.4 | 78.4 |
| 80+ | 81.7 | 87.7 | 74.4 | 87.6 | 86.8 | 91.4 | 91.1 | 96.6 | 93.7 | 94.0 |
| **Female** (per 100,000 person-years) | | | | | | | | | | |
| 0-39 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.0 | 0.0 | 0.1 | 0.1 | 0.0 |
| 40-49 | 1.2 | 0.8 | 1.1 | 0.9 | 0.9 | 1.3 | 1.2 | 1.1 | 1.1 | 1.0 |
| 50-59 | 5.2 | 4.4 | 4.5 | 4.0 | 3.4 | 3.8 | 4.2 | 3.6 | 3.8 | 3.2 |
| 60-69 | 21.6 | 18.8 | 16.2 | 16.2 | 16.1 | 14.3 | 15.1 | 14.2 | 14.1 | 12.2 |
| 70-79 | 45.6 | 45.1 | 43.0 | 45.0 | 40.8 | 41.9 | 38.6 | 39.3 | 36.9 | 34.7 |
| 80+ | 58.7 | 60.9 | 59.8 | 60.0 | 57.5 | 65.6 | 61.2 | 60.7 | 65.8 | 60.2 |

The residential areas were subdivided into 14 groups (Seoul + Incheon, Gyonggi, Daejeon + Sejong + Chungnam, Busan, Gyeongbuk, Gyeongnam, Jeonnam, Daegu, Jeongbuk, Gangwon, Chungbuk, Gwangju, Ulsan, and Jeju) according to Regional Cardiocerebrovascular Center (RCCVC) project data.

The residence areas with relatively higher age-standardized incidence rates for IHD (per 100,000 persons) were Busan (142.5), Jeonnam (137.6) Gwangju (136.2), and Chungbuk (128.4). Daegu had the lowest age-standardized incidence rate (86.1 per 100,000 persons) (Tables 4-23). Age-standardized incidence rates were relatively high in Busan, Jeonnam, Gwangju, and Chungbuk for both male and female IHD subtypes (Tables 4-24 and 4-25).

Tables 4-23. Age-standardized incidence rates for ischemic heart disease (IHD) and IHD subtypes by residence areas in Korea, 2015.

| Residence areas | Busan | Jeonnam | Gwangju | Chungbuk | Gangwon | Gyongnam | Ulsan | Jeonbuk | Gyongbuk | Jeju | Daejeon/Sejong/Chungnam | Seoul/Incheon | Gyonggi | Daegu |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| IHD | 142.5 | 137.6 | 136.2 | 128.4 | 121.7 | 115.5 | 111.3 | 109.2 | 108.9 | 107.7 | 106.2 | 106.0 | 104.1 | 86.1 |
| AP | 103.3 | 102.9 | 104.4 | 95.2 | 88.9 | 78.9 | 63.1 | 75.9 | 76.5 | 70.4 | 73.0 | 70.7 | 68.9 | 50.8 |
| Stable AP | 49.1 | 71.9 | 50.0 | 58.5 | 38.5 | 49.6 | 29.3 | 40.6 | 52.4 | 50.3 | 46.4 | 43.1 | 40.3 | 36.0 |
| Unstable AP | 49.7 | 38.4 | 59.3 | 39.7 | 50.6 | 28.1 | 36.2 | 37.8 | 26.9 | 18.3 | 26.5 | 27.8 | 28.3 | 15.8 |
| Variant AP | 21.0 | 16.1 | 15.7 | 12.2 | 11.0 | 13.8 | 10.6 | 7.4 | 10.5 | 10.7 | 12.8 | 8.9 | 8.8 | 5.3 |
| MI | 37.8 | 38.0 | 37.8 | 33.4 | 32.3 | 37.2 | 29.7 | 32.3 | 36.5 | 36.0 | 30.0 | 30.4 | 31.1 | 40.0 |
| MI-others | 18.3 | 20.4 | 7.7 | 14.0 | 13.8 | 28.0 | 17.5 | 9.5 | 11.2 | 11.6 | 12.3 | 12.3 | 10.9 | 9.7 |
| NSTEMI | 11.3 | 2.9 | 3.2 | 10.9 | 10.7 | 4.6 | 5.3 | 11.7 | 13.0 | 12.4 | 8.1 | 9.4 | 10.5 | 18.1 |
| STEMI | 8.0 | 15.3 | 27.7 | 9.3 | 7.6 | 4.2 | 6.3 | 11.7 | 12.2 | 11.9 | 9.8 | 8.7 | 9.4 | 13.1 |
| IHD-others | 32.8 | 25.2 | 21.7 | 28.4 | 25.7 | 23.5 | 47.4 | 17.4 | 26.5 | 25.6 | 29.4 | 29.9 | 28.3 | 19.3 |

NSEMI: non-ST elevation MI; STEMI: ST elevation MI

Tables 4-24. Age-standardized incidence rates for ischemic heart disease (IHD) and IHD subtypes by residence areas in Korean males, 2015.

| Residence areas | Busan | Jeonnam | Gwangju | Chungbuk | Gangwon | Gyongnam | Jeju | Jeonbuk | Ulsan | Gyongbuk | Seoul/Incheon | Gyonggi | Daejeon/Sejong/Chungnam | Daegu |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| IHD | 186.1 | 179.3 | 176.0 | 165.5 | 160.0 | 155.0 | 155.0 | 154.5 | 154.2 | 151.1 | 148.1 | 143.5 | 143.4 | 127.5 |
| AP | 130.0 | 128.1 | 127.5 | 118.6 | 111.7 | 101.3 | 97.7 | 103.1 | 86.3 | 102.7 | 95.7 | 91.2 | 94.8 | 73.3 |
| Stable AP | 60.5 | 89.0 | 60.2 | 73.3 | 47.3 | 60.1 | 70.8 | 51.7 | 38.4 | 68.4 | 57.7 | 52.7 | 59.7 | 51.5 |
| Unstable AP | 68.7 | 51.3 | 77.4 | 50.0 | 67.2 | 39.7 | 26.2 | 54.2 | 51.4 | 39.4 | 38.9 | 38.6 | 37.1 | 23.1 |
| Variant AP | 21.4 | 17.5 | 17.3 | 14.7 | 12.0 | 18.0 | 14.1 | 9.9 | 13.9 | 14.2 | 11.9 | 11.4 | 15.7 | 8.3 |
| MI | 59.8 | 59.0 | 59.8 | 50.4 | 50.0 | 56.9 | 57.7 | 51.8 | 46.6 | 57.8 | 48.5 | 48.7 | 46.3 | 64.5 |
| MI-others | 28.7 | 31.7 | 11.0 | 21.2 | 21.6 | 43.8 | 18.7 | 15.1 | 27.3 | 18.0 | 19.4 | 17.3 | 18.8 | 15.1 |
| NSTEMI | 17.6 | 4.4 | 4.6 | 15.5 | 15.7 | 6.4 | 18.7 | 18.2 | 8.1 | 20.1 | 14.5 | 15.9 | 12.2 | 29.0 |
| STEMI | 13.9 | 24.3 | 45.8 | 15.1 | 13.1 | 6.8 | 20.7 | 19.1 | 11.0 | 20.1 | 15.0 | 15.8 | 16.0 | 22.3 |
| IHD-others | 43.2 | 34.6 | 30.8 | 38.9 | 35.0 | 33.5 | 39.5 | 23.2 | 67.9 | 39.1 | 42.4 | 41.1 | 41.5 | 28.2 |

NSEMI: non-ST elevation MI; STEMI: ST elevation MI

Tables 4-25. Age-standardized incidence rates for ischemic heart disease (IHD) and IHD subtypes by residence areas in Korean females, 2015.

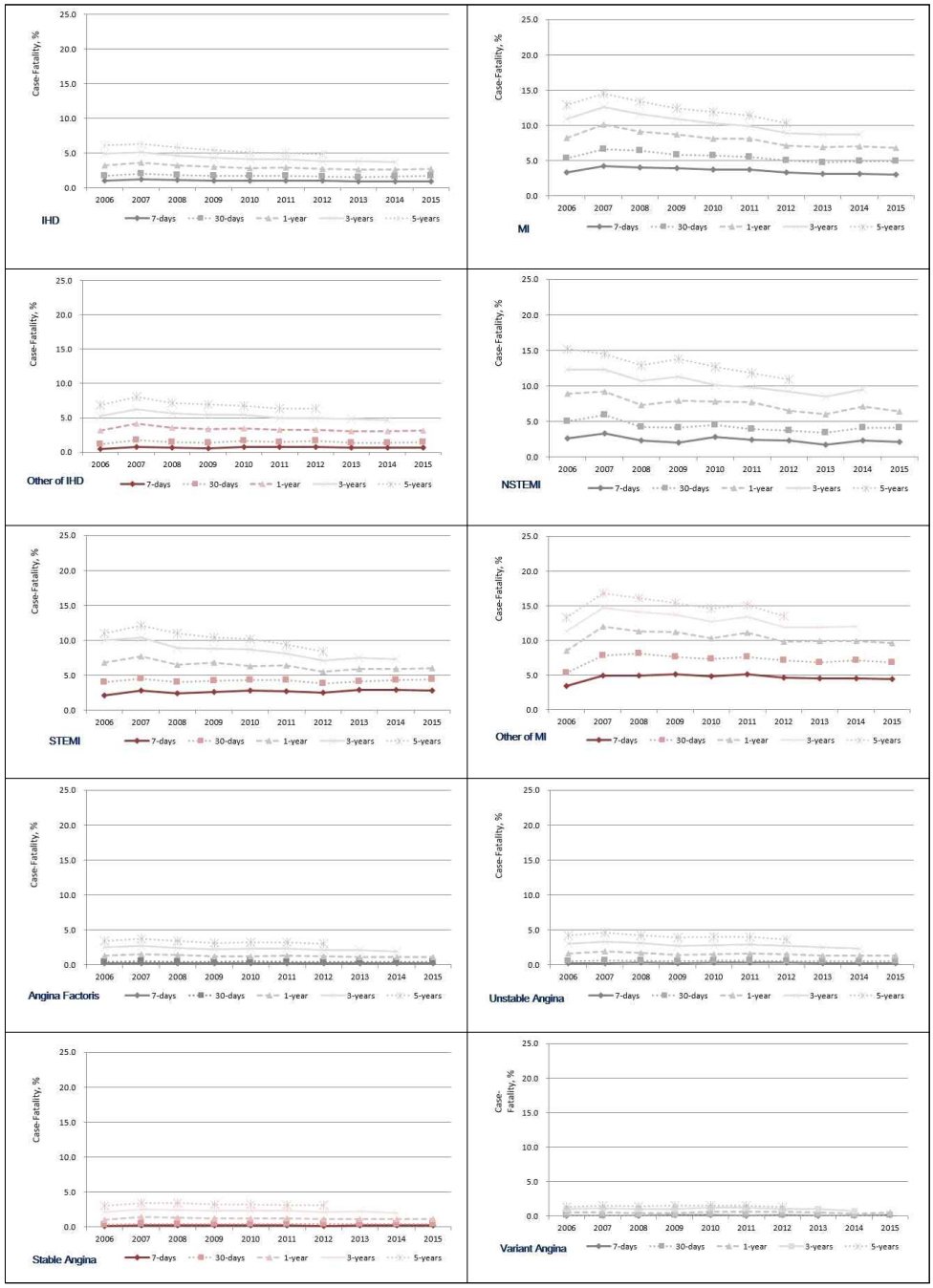
| Residence areas | Busan | Jeonnam | Gwangju | Chungbuk | Gangwon | Gyongnam | Daejeon/Sejong/Chungnam | Gyongbuk | Seoul/Incheon | Gyonggi | Ulsan | Jeonbuk | Jeju | Daegu |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| IHD | 102.4 | 95.9 | 93.3 | 92.8 | 86.1 | 78.1 | 69.9 | 68.7 | 67.5 | 66.7 | 66.3 | 66.1 | 59.1 | 49.1 |
| AP | 78.9 | 77.7 | 82.4 | 73.3 | 68.0 | 57.9 | 52.1 | 51.3 | 48.0 | 47.9 | 41.4 | 49.7 | 45.4 | 30.9 |
| Stable AP | 38.4 | 55.2 | 40.7 | 44.7 | 30.2 | 40.0 | 33.7 | 37.4 | 30.0 | 29.0 | 20.8 | 30.0 | 31.4 | 22.6 |
| Unstable AP | 32.8 | 25.6 | 42.3 | 30.2 | 35.6 | 17.3 | 16.4 | 15.2 | 17.7 | 18.6 | 21.8 | 22.2 | 11.5 | 9.2 |
| Variant AP | 20.4 | 14.7 | 14.2 | 9.7 | 10.0 | 9.6 | 9.9 | 6.9 | 6.0 | 6.3 | 7.4 | 4.9 | 7.4 | 2.5 |
| MI | 17.9 | 17.5 | 18.2 | 16.9 | 15.7 | 18.6 | 13.8 | 16.7 | 14.0 | 14.3 | 13.4 | 14.1 | 14.9 | 18.4 |
| MI-others | 8.9 | 9.1 | 4.6 | 1.1 | 6.7 | 13.1 | 5.9 | 4.9 | 5.7 | 4.8 | 7.8 | 4.1 | 4.6 | 4.9 |
| NSTEMI | 5.7 | 1.4 | 1.9 | 6.3 | 5.9 | 2.8 | 4.0 | 6.6 | 4.8 | 5.5 | 2.3 | 5.7 | 6.0 | 8.5 |
| STEMI | 2.6 | 6.9 | 11.5 | 3.7 | 2.2 | 1.7 | 3.7 | 4.6 | 2.9 | 3.1 | 1.8 | 4.6 | 3.4 | 4.8 |
| IHD-others | 23.3 | 15.9 | 13.2 | 18.6 | 17.0 | 14.7 | 17.9 | 14.8 | 18.7 | 16.5 | 28.3 | 12.2 | 11.9 | 11.2 |

During the last 10 years, the 7-day case-fatality rates for IHD have not changed meaningfully, but 1-year, 3-year, and 5-year cumulative case-fatality rates due to heart disease have decreased (Figure 4-1; Tables 4-26 to 4-28). The 5-year cumulative case-fatality rates for IHD were not high during this time (i.e., approximately 5%), but there was a substantial difference in terms of the rates for IHD subtypes. Overall, in 2015, the case-fatality rates of MI were highest, followed by those for miscellaneous (other) IHD diagnoses and AP (Figures 4-1).

The case-fatality rates for miscellaneous (other) MI diagnoses were highest, followed by those for NSTEMI and STEMI (Tables 4-26 and 4-27). The 7-day case-fatality rate for miscellaneous MI diagnoses increased from 3.4% in 2006 to 5.2% in 2011, but has been decreasing since (Tables 4-26). We found that the 5-year case-fatality rate for miscellaneous MI diagnoses was approximately 15% (Tables 4-26), and was higher in females (approximately 23%) (Tables 4-32).

In terms of MI, 7-day and 30-day case-fatality rates either showed little to no change or decreased slightly, while the 1-year, 3-year, and 5-year cumulative case-fatality rates tended to decrease. However, 7-day, 30-day, and 1-year case-fatality rates for miscellaneous (other) MI diagnoses, NSTEMI, and STEMI (excluding the 1-year case-fatality rate for NSTEMI) tended to increase; in females, the 3-year and 5-year cumulative case-fatality rates decreased (Tables 4-32 to 4-34).

Figure 4-1. Trends in case-fatality rates for ischemic heart disease (IHD) and IHD subtypes in Korea (2006-2015).




(a) Overall rate of ischemic heart disease (ICD-10 code: I20-I25)

(b) Myocardial infarction (ICD-10 code: I21-I22)

(c) Other (miscellaneous) myocardial infarction-related diagnoses (ICD-10 code: I21.9, I22.9)

(d) Non-ST-elevation myocardial infarction (ICD-10 code: I21.4)

(e) ST-elevation myocardial infarction (ICD-10 code: I21.0~I21.3, I22.0~I22.1, I22.8)

(f) Others (miscellaneous) ischemic heart disease diagnoses (ICD-10 code: I23~I25)

(g) Angina pectoris (ICD-10 code: I20)

(h) Unstable angina pectoris (ICD-10 code: I20.0)

(i) Stable angina pectoris (ICD-10 code: I20.8~I20.9)

(j) Variant angina pectoris (ICD-10 code: I20.1)

Tables 4-26. Trends in case-fatality rates by subtypes of ischemic heart disease in Korea, 2006-2015.

| Years | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 |
|---|---|---|---|---|---|---|---|---|---|---|
| MI (I21~I22) | | | | | | | | | | |
| 7-day | 3.3 | 4.2 | 4.0 | 3.9 | 3.7 | 3.7 | 3.3 | 3.2 | 3.1 | 3.0 |
| 30-day | 5.3 | 6.6 | 6.4 | 5.9 | 5.7 | 5.5 | 5.0 | 4.7 | 4.9 | 4.9 |
| 1-year | 8.2 | 10.1 | 9.1 | 8.7 | 8.1 | 8.1 | 7.1 | 6.9 | 7.0 | 6.8 |
| 3-year | 10.9 | 12.6 | 11.6 | 10.9 | 10.3 | 9.9 | 8.9 | 8.7 | 8.7 | - |
| 5-year | 12.9 | 14.5 | 13.4 | 12.5 | 11.9 | 11.4 | 10.3 | - | - | - |
| Myocardial Infarction-others (I21.9, I22.9) | | | | | | | | | | |
| 7-day | 3.4 | 4.9 | 5.0 | 5.1 | 4.8 | 5.2 | 4.6 | 4.6 | 4.6 | 4.4 |
| 30-day | 5.3 | 7.8 | 8.1 | 7.6 | 7.3 | 7.6 | 7.1 | 6.8 | 7.1 | 6.9 |
| 1-year | 8.5 | 12.0 | 11.3 | 11.2 | 10.4 | 11.1 | 9.8 | 9.9 | 9.9 | 9.6 |
| 3-year | 11.3 | 14.7 | 14.1 | 13.7 | 12.7 | 13.4 | 11.9 | 11.9 | 12.0 | - |
| 5-year | 13.3 | 16.8 | 16.1 | 15.4 | 14.6 | 15.1 | 13.5 | - | - | - |
| Non-ST Elevation Myocardial Infarction (I21.4) | | | | | | | | | | |
| 7-day | 2.1 | 2.8 | 2.4 | 2.7 | 2.8 | 2.7 | 2.5 | 2.9 | 2.9 | 2.8 |
| 30-day | 4.0 | 4.5 | 4.0 | 4.2 | 4.3 | 4.4 | 3.8 | 4.1 | 4.4 | 4.1 |
| 1-year | 6.9 | 7.5 | 6.5 | 6.8 | 6.3 | 6.4 | 5.5 | 5.9 | 5.9 | 6.0 |
| 3-year | 10.0 | 10.4 | 8.9 | 8.8 | 8.7 | 8.1 | 7.1 | 7.5 | 7.3 | - |
| 5-year | 11.1 | 12.2 | 11.0 | 10.4 | 10.2 | 9.5 | 8.4 | - | - | - |

Tables 4-27. Trends in case-fatality rates by subtypes for ischemic heart disease in Korea, 2006-2015 (continued).

| Years | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 |
|---|---|---|---|---|---|---|---|---|---|---|
| ST Elevation Myocardial Infarction (I21.0~I21.3, I22.0~I22.1, I22.8) | | | | | | | | | | |
| 7-day | 2.1 | 2.8 | 2.4 | 2.7 | 2.8 | 2.7 | 2.5 | 2.9 | 2.9 | 2.8 |
| 30-day | 4.0 | 4.5 | 4.0 | 4.2 | 4.3 | 4.4 | 3.8 | 4.1 | 4.4 | 4.1 |
| 1-year | 6.9 | 7.5 | 6.5 | 6.8 | 6.3 | 6.4 | 5.5 | 5.9 | 5.9 | 6.0 |
| 3-year | 10.0 | 10.4 | 8.9 | 8.8 | 8.7 | 8.1 | 7.1 | 7.5 | 7.3 | - |
| 5-year | 11.1 | 12.2 | 11.0 | 10.4 | 10.2 | 9.5 | 8.4 | - | - | - |
| Ischemic Heart Disease-others (I23~I25) | | | | | | | | | | |
| 7-day | 0.4 | 0.7 | 0.7 | 0.6 | 0.7 | 0.7 | 0.8 | 0.7 | 0.6 | 0.7 |
| 30-day | 1.2 | 1.8 | 1.5 | 1.3 | 1.7 | 1.5 | 1.7 | 1.3 | 1.4 | 1.5 |
| 1-year | 3.1 | 4.2 | 3.6 | 3.4 | 3.5 | 3.3 | 3.3 | 3.0 | 3.0 | 3.2 |
| 3-year | 5.3 | 6.3 | 5.6 | 5.4 | 5.4 | 5.0 | 4.9 | 4.9 | 4.7 | - |
| 5-year | 6.8 | 8.1 | 7.2 | 6.9 | 6.8 | 6.3 | 6.4 | - | - | - |
| Angina Pectoris (I20) | | | | | | | | | | |
| 7-day | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 |
| 30-day | 0.4 | 0.5 | 0.5 | 0.4 | 0.5 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 |
| 1-year | 1.3 | 1.6 | 1.4 | 1.2 | 1.3 | 1.3 | 1.2 | 1.1 | 1.1 | 1.1 |
| 3-year | 2.5 | 2.7 | 2.5 | 2.3 | 2.3 | 2.3 | 2.1 | 2.1 | 1.9 | - |
| 5-year | 3.5 | 3.7 | 3.4 | 3.2 | 3.2 | 3.2 | 3.0 | - | - | - |

Tables 4-28. Trends in case-fatality rates by subtypes of ischemic heart disease in Korea, 2006-2015 (continued).

| Years | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 |
|---|---|---|---|---|---|---|---|---|---|---|
| Unstable Angina Pectoris (I20.0) | | | | | | | | | | |
| 7-day | 0.3 | 0.3 | 0.3 | 0.2 | 0.3 | 0.3 | 0.3 | 0.3 | 0.2 | 0.2 |
| 30-day | 0.5 | 0.6 | 0.6 | 0.5 | 0.6 | 0.6 | 0.6 | 0.6 | 0.5 | 0.5 |
| 1-year | 1.6 | 1.9 | 1.7 | 1.4 | 1.6 | 1.6 | 1.5 | 1.4 | 1.4 | 1.3 |
| 3-year | 3.1 | 3.4 | 3.1 | 2.7 | 2.9 | 2.9 | 2.7 | 2.5 | 2.3 | - |
| 5-year | 4.2 | 4.6 | 4.2 | 3.9 | 4.0 | 4.0 | 3.6 | - | - | - |
| Stable Angina Pectoris (I20.8~I20.9) | | | | | | | | | | |
| 7-day | 0.1 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 |
| 30-day | 0.3 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 |
| 1-year | 1.1 | 1.4 | 1.4 | 1.3 | 1.2 | 1.3 | 1.2 | 1.2 | 1.1 | 1.25 |
| 3-year | 2.1 | 2.5 | 2.4 | 2.3 | 2.3 | 2.3 | 2.1 | 2.2 | 2.1 | - |
| 5-year | 3.0 | 3.4 | 3.4 | 3.2 | 3.2 | 3.1 | 3.1 | - | - | - |
| Variant Angina Pectoris (I20.1) | | | | | | | | | | |
| 7-day | 0.0 | 0.0 | 0.0 | 0.1 | 0.2 | 0.0 | 0.1 | 0.1 | 0.0 | 0.1 |
| 30-day | 0.2 | 0.1 | 0.1 | 0.1 | 0.2 | 0.1 | 0.2 | 0.2 | 0.1 | 0.2 |
| 1-year | 0.6 | 0.5 | 0.4 | 0.4 | 0.6 | 0.6 | 0.6 | 0.5 | 0.3 | 0.5 |
| 3-year | 1.0 | 1.1 | 1.0 | 1.0 | 1.3 | 1.2 | 1.0 | 1.0 | 0.7 | - |
| 5-year | 1.3 | 1.6 | 1.4 | 1.5 | 1.5 | 1.5 | 1.4 | - | - | - |

Tables 4-29. Trends in case-fatality rates by subtypes for ischemic heart disease in Korean males, 2006-2015.

| Years | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 |
|---|---|---|---|---|---|---|---|---|---|---|
| Myocardial Infarction (I21~I22) | | | | | | | | | | |
| 7-day | 2.5 | 3.0 | 3.0 | 2.9 | 2.5 | 2.6 | 2.3 | 2.3 | 2.1 | 2.2 |
| 30-day | 4.0 | 4.8 | 4.9 | 4.3 | 4.0 | 4.0 | 3.6 | 3.5 | 3.5 | 3.6 |
| 1-year | 6.4 | 7.3 | 6.9 | 6.4 | 5.8 | 6.0 | 5.2 | 5.1 | 4.9 | 5.1 |
| 3-year | 8.7 | 9.5 | 8.8 | 8.1 | 7.4 | 7.4 | 6.8 | 6.5 | 6.2 | - |
| 5-year | 10.4 | 11.1 | 10.2 | 9.4 | 8.6 | 8.6 | 7.9 | - | - | - |
| Myocardial Infarction-others (I21.9, I22.9) | | | | | | | | | | |
| 7-day | 2.4 | 3.6 | 3.8 | 3.9 | 3.2 | 3.6 | 3.1 | 3.4 | 2.9 | 3.1 |
| 30-day | 4.0 | 5.8 | 6.3 | 5.7 | 5.1 | 5.5 | 5.1 | 5.2 | 4.8 | 4.8 |
| 1-year | 6.3 | 8.9 | 8.8 | 8.2 | 7.4 | 8.1 | 7.1 | 7.5 | 6.8 | 6.8 |
| 3-year | 8.7 | 11.2 | 10.9 | 10.0 | 9.1 | 9.9 | 8.8 | 8.9 | 8.2 | - |
| 5-year | 10.5 | 13.1 | 12.4 | 11.5 | 10.6 | 11.2 | 10.0 | - | - | - |
| Non-ST Elevation Myocardial Infarction (I21.4) | | | | | | | | | | |
| 7-day | 2.3 | 2.4 | 1.6 | 1.6 | 2.4 | 1.6 | 1.7 | 1.0 | 1.6 | 1.7 |
| 30-day | 4.0 | 4.0 | 3.1 | 3.2 | 3.5 | 2.8 | 2.7 | 2.2 | 3.2 | 3.2 |
| 1-year | 7.4 | 6.4 | 5.4 | 6.3 | 6.1 | 5.6 | 5.2 | 4.2 | 5.4 | 5.2 |
| 3-year | 9.8 | 8.9 | 8.0 | 9.2 | 8.4 | 7.2 | 7.6 | 6.4 | 7.4 | - |
| 5-year | 12.7 | 10.3 | 10.1 | 11.2 | 9.5 | 8.8 | 9.0 | - | - | - |

Tables 4-30. Trends in case-fatality rates by subtypes for ischemic heart disease in Korean males, 2006-2015 (continued).

| Years | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 |
|---|---|---|---|---|---|---|---|---|---|---|
| ST Elevation Myocardial Infarction (I21.0~I21.3, I22.0~I22.1, I22.8) | | | | | | | | | | |
| 7-day | 1.7 | 2.0 | 1.7 | 1.8 | 1.8 | 2.0 | 1.8 | 2.1 | 1.9 | 2.0 |
| 30-day | 3.3 | 3.5 | 2.8 | 3.0 | 3.0 | 3.3 | 2.8 | 3.0 | 3.0 | 3.4 |
| 1-year | 5.8 | 5.8 | 4.5 | 5.0 | 4.3 | 5.0 | 4.0 | 4.3 | 4.1 | 4.7 |
| 3-year | 8.7 | 8.2 | 6.3 | 6.6 | 5.9 | 6.2 | 5.1 | 5.5 | 5.1 | - |
| 5-year | 9.1 | 9.6 | 7.8 | 7.8 | 7.0 | 7.4 | 6.1 | - | - | - |
| Ischemic Heart Disease-others (I23~I25) | | | | | | | | | | |
| 7-day | 0.4 | 0.6 | 0.5 | 0.4 | 0.6 | 0.6 | 0.7 | 0.5 | 0.5 | 0.6 |
| 30-day | 0.9 | 1.4 | 1.2 | 1.1 | 1.3 | 1.2 | 1.4 | 1.1 | 1.1 | 1.2 |
| 1-year | 2.4 | 3.6 | 2.9 | 2.6 | 2.8 | 2.7 | 2.7 | 2.4 | 2.5 | 2.7 |
| 3-year | 4.3 | 5.4 | 4.8 | 4.3 | 4.4 | 4.1 | 4.1 | 4.0 | 3.8 | - |
| 5-year | 5.7 | 6.9 | 6.2 | 5.6 | 5.5 | 5.5 | 5.3 | - | - | - |
| Angina Pectoris (I20) | | | | | | | | | | |
| 7-day | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 |
| 30-day | 0.4 | 0.5 | 0.5 | 0.4 | 0.5 | 0.4 | 0.4 | 0.4 | 0.4 | 0.5 |
| 1-year | 1.2 | 1.6 | 1.4 | 1.2 | 1.2 | 1.4 | 1.3 | 1.1 | 1.2 | 1.2 |
| 3-year | 2.4 | 2.7 | 2.5 | 2.2 | 2.3 | 2.4 | 2.2 | 2.0 | 2.1 | - |
| 5-year | 3.3 | 3.8 | 3.4 | 3.1 | 3.2 | 3.2 | 3.2 | - | - | - |

Tables 4-31. Trends in case-fatality rates by subtypes for ischemic heart disease in Korean males, 2006-2015 (continued).

| Years | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 |
|---|---|---|---|---|---|---|---|---|---|---|
| Unstable Angina Pectoris (I20.0) | | | | | | | | | | |
| 7-day | 0.3 | 0.2 | 0.3 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 |
| 30-day | 0.4 | 0.6 | 0.6 | 0.4 | 0.5 | 0.5 | 0.5 | 0.5 | 0.4 | 0.4 |
| 1-year | 1.5 | 1.9 | 1.7 | 1.2 | 1.3 | 1.4 | 1.3 | 1.1 | 1.2 | 1.2 |
| 3-year | 2.9 | 3.2 | 3.0 | 2.3 | 2.4 | 2.6 | 2.3 | 2.0 | 2.0 | - |
| 5-year | 4.0 | 4.5 | 4.2 | 3.4 | 3.5 | 3.5 | 3.3 | - | - | - |
| Stable Angina Pectoris (I20.8~I20.9) | | | | | | | | | | |
| 7-day | 0.1 | 0.2 | 0.2 | 0.2 | 0.1 | 0.2 | 0.1 | 0.2 | 0.2 | 0.2 |
| 30-day | 0.3 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.5 |
| 1-year | 1.0 | 1.3 | 1.4 | 1.2 | 1.0 | 1.2 | 1.1 | 1.1 | 1.1 | 1.1 |
| 3-year | 2.0 | 2.4 | 2.3 | 2.1 | 2.1 | 2.1 | 2.0 | 2.0 | 2.0 | - |
| 5-year | 2.8 | 3.3 | 3.2 | 2.9 | 2.8 | 2.8 | 2.9 | - | - | - |
| Variant Angina Pectoris (I20.1) | | | | | | | | | | |
| 7-day | 0.0 | 0.0 | 0.0 | 0.2 | 0.2 | 0.0 | 0.1 | 0.1 | 0.0 | 0.2 |
| 30-day | 0.2 | 0.1 | 0.2 | 0.2 | 0.3 | 0.1 | 0.1 | 0.2 | 0.1 | 0.2 |
| 1-year | 0.7 | 0.4 | 0.5 | 0.6 | 0.8 | 0.7 | 0.7 | 0.6 | 0.4 | 0.8 |
| 3-year | 1.2 | 1.2 | 1.3 | 1.3 | 1.5 | 1.5 | 1.2 | 1.2 | 1.0 | - |
| 5-year | 1.5 | 1.7 | 1.7 | 2.0 | 1.8 | 1.8 | 1.6 | - | - | - |

Tables 4-32. Trends in case-fatality rates by subtypes for ischemic heart disease in Korean females, 2006-2015.

| Years | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 |
|---|---|---|---|---|---|---|---|---|---|---|
| Myocardial Infarction (I21~I22) | | | | | | | | | | |
| 7-day | 4.8 | 6.3 | 5.8 | 5.9 | 6.2 | 6.0 | 5.4 | 5.2 | 5.6 | 5.6 |
| 30-day | 7.5 | 9.8 | 9.2 | 8.8 | 9.1 | 8.6 | 7.9 | 7.6 | 8.2 | 8.9 |
| 1-year | 11.5 | 15.1 | 13.1 | 13.1 | 12.8 | 12.4 | 11.0 | 11.0 | 11.6 | 12.4 |
| 3-year | 14.9 | 18.2 | 16.8 | 16.3 | 16.3 | 15.1 | 13.5 | 13.6 | 14.3 | - |
| 5-year | 17.3 | 20.6 | 19.4 | 18.4 | 18.6 | 17.2 | 15.6 | - | - | - |
| Myocardial Infarction-others (I21.9, I22.9) | | | | | | | | | | |
| 7-day | 5.1 | 7.3 | 7.1 | 7.6 | 8.1 | 8.2 | 7.7 | 7.1 | 8.2 | 7.3 |
| 30-day | 7.8 | 11.5 | 11.5 | 11.5 | 11.9 | 11.9 | 11.3 | 10.5 | 12.3 | 11.5 |
| 1-year | 12.4 | 17.5 | 16.0 | 17.0 | 16.5 | 17.0 | 15.4 | 15.1 | 16.9 | 16.2 |
| 3-year | 15.9 | 21.0 | 20.0 | 20.7 | 20.4 | 20.3 | 18.3 | 18.4 | 20.4 | - |
| 5-year | 18.3 | 23.5 | 22.9 | 22.9 | 22.9 | 22.9 | 20.9 | - | - | - |
| Non-ST Elevation Myocardial Infarction (I21.4) | | | | | | | | | | |
| 7-day | 3.2 | 4.7 | 3.5 | 2.8 | 3.6 | 4.1 | 3.5 | 3.2 | 3.9 | 3.0 |
| 30-day | 6.8 | 8.9 | 6.1 | 5.5 | 6.6 | 6.1 | 5.7 | 5.8 | 6.0 | 6.2 |
| 1-year | 11.4 | 13.7 | 10.4 | 10.6 | 11.4 | 11.6 | 9.1 | 9.6 | 10.7 | 9.2 |
| 3-year | 16.5 | 17.9 | 15.1 | 14.8 | 13.5 | 14.6 | 12.4 | 13.0 | 13.9 | - |
| 5-year | 19.5 | 21.4 | 17.6 | 17.9 | 19.1 | 17.5 | 14.8 | - | - | - |

Tables 4-33. Trends in case-fatality rates by subtypes for ischemic heart disease in Korean females, 2006-2015 (continued).

| Years | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 |
|---|---|---|---|---|---|---|---|---|---|---|
| ST Elevation Myocardial Infarction (I21.0~I21.3, I22.0~I22.1, I22.8) | | | | | | | | | | |
| 7-day | 3.0 | 4.7 | 4.1 | 4.7 | 5.4 | 4.6 | 4.5 | 5.5 | 6.0 | 5.2 |
| 30-day | 5.7 | 7.0 | 6.8 | 7.2 | 7.7 | 7.3 | 6.5 | 7.4 | 8.5 | 7.5 |
| 1-year | 9.2 | 12.2 | 11.1 | 11.5 | 11.6 | 10.4 | 9.7 | 10.8 | 11.4 | 10.3 |
| 3-year | 12.7 | 15.6 | 14.9 | 14.3 | 16.0 | 13.5 | 12.6 | 13.7 | 13.9 | - |
| 5-year | 15.2 | 18.2 | 18.3 | 16.9 | 18.5 | 15.2 | 14.7 | - | - | - |
| Ischemic Heart Disease-others (I23~I25) | | | | | | | | | | |
| 7-day | 0.5 | 1.0 | 0.9 | 0.8 | 0.9 | 1.0 | 1.0 | 1.0 | 0.8 | 0.8 |
| 30-day | 1.5 | 2.3 | 1.9 | 1.7 | 2.1 | 1.9 | 2.2 | 1.7 | 1.9 | 1.9 |
| 1-year | 4.2 | 5.1 | 4.6 | 4.5 | 4.6 | 4.2 | 4.3 | 4.1 | 4.0 | 4.1 |
| 3-year | 6.7 | 7.5 | 6.9 | 7.1 | 7.0 | 6.4 | 6.3 | 6.2 | 6.1 | - |
| 5-year | 8.5 | 9.8 | 8.7 | 9.0 | 8.7 | 7.7 | 8.2 | - | - | - |
| Angina Pectoris (I20) | | | | | | | | | | |
| 7-day | 0.2 | 0.3 | 0.2 | 0.2 | 0.3 | 0.3 | 0.3 | 0.3 | 0.2 | 0.2 |
| 30-day | 0.5 | 0.6 | 0.5 | 0.5 | 0.6 | 0.5 | 0.5 | 0.5 | 0.4 | 0.4 |
| 1-year | 1.4 | 1.7 | 1.4 | 1.4 | 1.5 | 1.5 | 1.3 | 1.3 | 1.2 | 1.2 |
| 3-year | 2.7 | 2.9 | 2.5 | 2.6 | 2.7 | 2.6 | 2.4 | 2.5 | 2.2 | - |
| 5-year | 3.7 | 3.9 | 3.6 | 3.5 | 3.6 | 3.7 | 3.3 | - | - | - |

Tables 4-34. Trends in case-fatality rates by subtypes for ischemic heart disease in Korean females, 2006-2015 (continued).

| Years | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 |
|---|---|---|---|---|---|---|---|---|---|---|
| Unstable Angina Pectoris (I20.0) | | | | | | | | | | |
| 7-day | 0.3 | 0.3 | 0.3 | 0.3 | 0.4 | 0.4 | 0.4 | 0.4 | 0.3 | 0.2 |
| 30-day | 0.6 | 0.7 | 0.6 | 0.7 | 0.8 | 0.8 | 0.7 | 0.7 | 0.6 | 0.6 |
| 1-year | 1.8 | 2.0 | 1.8 | 1.8 | 2.0 | 2.0 | 1.8 | 1.8 | 1.7 | 1.5 |
| 3-year | 3.3 | 3.6 | 3.2 | 3.2 | 3.5 | 3.3 | 3.2 | 3.3 | 2.9 | - |
| 5-year | 4.6 | 4.9 | 4.4 | 4.6 | 4.8 | 4.8 | 4.2 | - | - | - |
| Stable Angina Pectoris (I20.8~I20.9) | | | | | | | | | | |
| 7-day | 0.2 | 0.2 | 0.2 | 0.2 | 0.3 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 |
| 30-day | 0.4 | 0.5 | 0.4 | 0.5 | 0.5 | 0.4 | 0.5 | 0.4 | 0.4 | 0.4 |
| 1-year | 1.2 | 1.6 | 1.4 | 1.4 | 1.5 | 1.4 | 1.2 | 1.3 | 1.2 | 1.3 |
| 3-year | 2.3 | 2.7 | 2.6 | 2.7 | 2.7 | 2.6 | 2.3 | 2.5 | 2.2 | - |
| 5-year | 3.3 | 3.7 | 3.8 | 3.6 | 3.7 | 3.6 | 3.4 | - | - | - |
| Variant Angina Pectoris (I20.1) | | | | | | | | | | |
| 7-day | 0.1 | 0.0 | 0.0 | 0.0 | 0.1 | 0.0 | 0.1 | 0.1 | 0.0 | 0.0 |
| 30-day | 0.0 | 0.0 | 0.0 | 0.0 | 0.2 | 0.1 | 0.2 | 0.2 | 0.0 | 0.1 |
| 1-year | 0.4 | 0.7 | 0.3 | 0.2 | 0.4 | 0.4 | 0.5 | 0.4 | 0.2 | 0.1 |
| 3-year | 0.8 | 1.0 | 0.7 | 0.7 | 1.0 | 0.8 | 0.7 | 0.8 | 0.3 | - |
| 5-year | 1.0 | 1.3 | 1.1 | 0.9 | 1.2 | 1.2 | 1.1 | - | - | - |

The residence areas with the highest 30-day case-fatality rates for IHD were Daegu, Jeonnam, Gyeongbuk, and Gangwon (Tables 4-35 and 4-36). Daegu had the highest 30-day and 1-year case-fatality rates, even though the age-standardized incidence rates for IHD and its subtypes were the lowest (Tables 4-23).

Jeonnam and Gangwon had relatively higher age-standardized incidence rates and case-fatality rates for IHD and its subtypes. Busan and Gwangju had higher age-standardized incidence rates but lower case-fatality rates (Tables 4-23, 4-35, 4-36).

Tables 4-35. Thirty-day ischemic heart disease (IHD) case-fatality rates by residence areas in Korea, 2015.

| Residence areas | Daegu | Jeonnam | Gyongbuk | Gangwon | Daejeon/ Sejong/ Chungnam | Gyongnam | Gyonggi | Seoul/ Incheon | Chungbuk | Jeonbuk | Gwangju | Ulsan | Jeju | Busan |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| IHD | 2.5 | 2.4 | 2.0 | 1.8 | 1.8 | 1.8 | 1.7 | 1.6 | 1.6 | 1.6 | 1.5 | 1.5 | 1.4 | 1.2 |
| MI | 5.2 | 6.9 | 5.1 | 5.7 | 5.4 | 4.4 | 4.9 | 4.9 | 4.1 | 3.5 | 4.5 | 4.1 | 2.8 | 4.5 |
| MI-others | 12.5 | 9.9 | 10.5 | 7.4 | 7.5 | 4.5 | 6.8 | 6.5 | 6.0 | 4.0 | 8.8 | 4.1 | 4.8 | 6.1 |
| STEMI | 4.1 | 4.7 | 3.1 | 7.1 | 4.9 | 4.3 | 4.7 | 4.2 | 3.5 | 4.9 | 3.9 | 6.7 | 2.0 | 4.3 |
| NSTEMI | 3.6 | 3.6 | 4.3 | 4.2 | 3.9 | 6.3 | 4.2 | 4.6 | 4.0 | 2.4 | 1.6 | 2.6 | 3.6 | 4.4 |
| IHD-others | 1.9 | 2.2 | 2.2 | 2.2 | 1.7 | 1.0 | 1.4 | 1.2 | 1.5 | 2.2 | 3.8 | 0.6 | 0.4 | 0.9 |
| AP | 0.7 | 0.6 | 0.5 | 0.3 | 0.4 | 0.6 | 0.4 | 0.4 | 0.3 | 0.5 | 0.3 | 0.4 | 0.7 | 0.3 |
| Stable AP | 0.9 | 0.5 | 0.6 | 0.4 | 0.3 | 0.5 | 0.4 | 0.4 | 0.2 | 0.4 | 0.3 | 0.7 | 0.2 | 0.4 |
| Unstable AP | 0.2 | 1.0 | 0.2 | 0.4 | 0.5 | 0.8 | 0.5 | 0.4 | 0.5 | 0.7 | 0.4 | 0.4 | 0.6 | 0.4 |
| Variant AP | 0.0 | 0.0 | 0.5 | 0.0 | 0.2 | 0.2 | 0.1 | 0.1 | 0.0 | 0.0 | 0.4 | 1.3 | 0.0 | 0.2 |

NSEMI: non-ST elevation MI; STEMI: ST elevation MI

Tables 4-36. One-year ischemic heart disease (IHD) case-fatality rates by residence areas in Korea, 2015.

| Residence areas | Daegu | Jeonnam | Gyongbuk | Gyongnam | Daejeon/Sejong/Chungnam | Gangwon | Gyonggi | Chungbuk | Jeonbuk | Seoul/Incheon | Ulsan | Gwangju | Busan | Jeju |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| IHD | 3.8 | 3.6 | 3.3 | 3.0 | 2.9 | 2.8 | 2.8 | 2.7 | 2.7 | 2.5 | 2.5 | 2.4 | 2.3 | 1.7 |
| MI | 7.0 | 9.2 | 7.4 | 6.6 | 7.6 | 8.2 | 6.9 | 7.0 | 5.6 | 6.4 | 6.0 | 6.4 | 6.3 | 3.1 |
| MI-others | 15.6 | 13.3 | 12.8 | 7.1 | 10.9 | 11.5 | 9.4 | 11.7 | 7.0 | 9.0 | 6.9 | 10.1 | 8.1 | 4.8 |
| STEMI | 6.3 | 6.9 | 5.5 | 6.7 | 6.2 | 8.6 | 6.7 | 4.4 | 6.6 | 5.3 | 9.0 | 5.4 | 5.2 | 3.0 |
| NSTEMI | 5.6 | 6.4 | 6.8 | 8.4 | 7.4 | 5.9 | 6.4 | 6.1 | 4.7 | 6.4 | 3.9 | 11.5 | 7.9 | 3.6 |
| IHD-others | 3.9 | 4.8 | 3.7 | 2.9 | 3.0 | 3.6 | 3.2 | 3.2 | 6.1 | 2.8 | 1.8 | 5.5 | 2.5 | 1.3 |
| AP | 1.7 | 1.5 | 1.2 | 1.4 | 1.1 | 1.0 | 1.1 | 0.8 | 0.8 | 1.0 | 1.3 | 1.0 | 1.3 | 1.0 |
| Stable AP | 1.9 | 1.1 | 1.4 | 1.3 | 1.2 | 0.9 | 1.2 | 0.7 | 0.8 | 1.0 | 2.0 | 1.0 | 1.6 | 0.4 |
| Unstable AP | 0.9 | 2.1 | 1.1 | 1.7 | 1.3 | 1.3 | 1.2 | 0.8 | 0.9 | 1.3 | 1.2 | 1.1 | 1.5 | 1.2 |
| Variant AP | 2.3 | 0.2 | 1.0 | 0.2 | 0.3 | 0.8 | 0.7 | 1.5 | 0.5 | 0.4 | 1.3 | 0.4 | 0.3 | 0.0 |

# Chapter 5. Trends in Incidence and Case Fatality Rates for Cardiac Arrhythmia and Cardiac Arrhythmia Subtypes in Korea (2006–2015).

## 5.1. Background

Cardiac arrhythmias occur when the heart rate increases or decreased abnormally, or becomes irregular; arrhythmias and produced by fluctuations in impulse generation sites, conduction disorders, and impaired myocardial response (Gupta et al. 2015). Atrial fibrillation (AF) is the most common sustained cardiac arrhythmia and can be permanent or symptomatic with tachycardia and is associated with a substantial rate of cardiovascular morbidity and economic burden (Joung, 2011; Li el al. 2015). Cardiac arrhythmia is the second most frequent HD subtype after IHD and rates have been increasing continuously over the last 10 years (Seo et al. 2020). AF occurs in approximately 2% of the population worldwide, and this number is increasing rapidly as the population ages (Camm et al. 2012; Lee et al. 2014; Li et al. 2015). AF is a leading cause of arrhythmia hospitalization in the US, accounting for a third of arrhythmia hospitalizations (Rahman et al. 2014) and 6–24% of stroke cases (On 2011). AF and flutter are important risk factors for stroke and HF in clinical practice (Kim et al. 2014). AF increases the incidence of ischemic stroke and other thrombotic events, and compromises cardiovascular prognoses in terms of heart failure, dementia, and hospitalization (Park et al. 2018).

AF is the most common form of sustained arrhythmia in elderly patients (Feinberg et al. 1995; Psaty et al. 1997; Jeong 2005; Zhou et al. 2008; Park et al. 2018). AF occurs after 60 years of age, and the average age of patients with AF is approximately 75–85 years

(Camm et al. 2012; Wann et al. 2013). This is because the prevalence of AF increases with age and because the prevalence of risk factors such as diabetes, hypertension, obesity, CAD, and valvular HD is high (Kim et al. 2014). In general, AF is strongly associated with HF because these two diseases share common risk factors. Significant progress has been made in terms of understanding pathophysiology and treatment for AF, but prevalence and mortality rates for AF are still increasing (Joung, 2011). The 5-year cumulative case-fatality rate for HF is approximately 25% in Korea (Seo et al. 2020).

An increase in the proportion of the elderly population in Korea could lead to a sharp increase in the incidence of cardiac arrhythmia. In an aging society such as Korea, the increase in the prevalence of AF and in mortality due to AF has emerged as an important health and sociological problem (Jung et al. 2016). Despite considerable information on IHD incidence and mortality trends, little is known about trends for cardiac arrhythmia and its subtypes. The detection rate for AF is low in clinical practice, there is limited information on the incidence of cardiac arrhythmia in Korea. To the best of our knowledge, there is no data on AF incidence and case-fatality trends. Thus, we examined the national trends in incidence and case-fatality rates for cardiac arrhythmia and its subtypes in Korea between 2006 and 2015.

## 5.2. Methods

We implement the following steps to calculate the yearly incidence of cardiac arrhythmia and its subtypes. First, we collected NHIS claims data on inpatients who had cardiac arrhythmia as their primary diagnosis between 2003 and 2015 and cardiac arrhythmia as a cause of death between 2006 and 2017 from Statistics Korea to evaluate the yearly incidence of cardiac arrhythmia.

Second, we used the ICD-10 codes I47-I49 to define cardiac arrhythmia and classified the arrhythmia subtypes as tachycardia (I47), AF and flutter (I48), and miscellaneous (other) arrhythmia diagnoses (I49) (Tables 5-1).

Third, we calculated crude incidence rates by sex and age group. The age groups were subdivided into those aged < 40 years, 40-49 years, 50-59 years, 60-69 years, 70-79 years, and 80 years or older.

Fourth, the age-standardized incidence was determined from the standard population as constructed by rhe resident registration central population in 2005 based on yearly modifications in population age according to age-standardized death rates (Statistics Korea 2018).

Tables 5-1. International Classification of Diseases-10 (ICD-10) codes for cardiac arrhythmia

| ICD-10 codes | Code name |
|---|---|
| I47 | Paroxysmal tachycardia |
| I48 | Atrial Fibrillation and Flutter |
| I49 | Other cardiac arrhythmia |

We implemented the following steps to calculate the case-fatality rates for cardiac arrhythmia and its subtypes. First, we collected data on the patients' causes of death from Statistics Korea by linking the patients' personal identification numbers with the incidence of cardiac arrhythmia and its subtypes during each year. We only included individuals who died of heart disease.

Second, using the NHIS claims database, we calculated case-fatality rates by considering the difference between the date of first admission for cardiac arrhythmia and the date of death due

to heart disease. We classified these data into 7-day, 30-day, 1-year, 3-year, and 5-year cumulative case-fatality rates. Using the same method, we calculated the case-fatality rate for each arrhythmia subtype.

We used SAS software (version 9.4, SAS Institute, Cary, US) for all analyses. We performed the Cochran-Armitage trend test to evaluate trends (Cui et al. 2017).

## 5.3. Results

The incidence of cardiac arrhythmia and its subtypes were divided into patients who were diagnosed at the hospital and patients who died from the disease (Tables 5-2). Those diagnosed at the hospital were divided into survivors and those who died. The number of people who died of cardiac arrhythmia and its subtypes outside of hospitals showed a tendency to increase over time.

Tables 5−2. Annual incidence of cardiac arrhythmia and its subtypes according to incident types.

| Years | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 |
|---|---|---|---|---|---|---|---|---|---|---|
| **Atrial Fibrillation & Flutter (I48)** | | | | | | | | | | |
| In-hospital | | | | | | | | | | |
| Alive | 6,223 | 7,006 | 7,360 | 8,053 | 8,717 | 10,097 | 11,209 | 11,827 | 12,699 | 13,507 |
| Death | 24 | 33 | 49 | 58 | 56 | 92 | 81 | 79 | 96 | 93 |
| Out-of-hospital | | | | | | | | | | |
| Death | 31 | 76 | 118 | 144 | 156 | 177 | 211 | 211 | 240 | 223 |
| **Tachycardia (I47)** | | | | | | | | | | |
| In-hospital | | | | | | | | | | |
| Alive | 3,375 | 3,591 | 3,750 | 4,219 | 4,459 | 4,531 | 4,857 | 5,028 | 5,227 | 5,166 |
| Death | 5 | 4 | 9 | 7 | 9 | 15 | 15 | 16 | 19 | 15 |
| Out-of-hospital | | | | | | | | | | |
| Death | - | 3 | 8 | 7 | 18 | 12 | 14 | 14 | 19 | 23 |
| **Cardiac Arrhythmia-others (I49)** | | | | | | | | | | |
| In-hospital | | | | | | | | | | |
| Alive | 2,915 | 3,250 | 3,492 | 3,799 | 3,874 | 4,214 | 4,343 | 4,346 | 4,551 | 4,467 |
| Death | 7 | 16 | 11 | 17 | 16 | 22 | 21 | 28 | 22 | 41 |
| Out-of-hospital | | | | | | | | | | |
| Death | 25 | 48 | 73 | 89 | 116 | 123 | 128 | 166 | 164 | 190 |

We found that the incidence and crude rates of cardiac arrhythmia in the total population (p for trend < 0.0001), males (p for trend < 0.0001), and females (p for trend < 0.0001) increased over the last 10 years (Tables 3–11). The incidence of arrhythmia has approximately doubled in the last 10 years; the age–standardized incidence rates of arrhythmia increased in both men and women. The mean age of occurrence increased from 59.7 years in 2006 to 63.9 years in 2015, (i.e., 4.2 years over the course of 10 years).

The mean age of occurrence in males and females increased from 56.2 and 63.1 years in 2006 to 61.2 and 66.7 years in 2015, respectively (Table 3–11). The mean age of occurrence of arrhythmia in females was approximately seven years higher than that in males in 2006. This difference in mean age has decreased 6.9 years in 2006 to 5.5 years in 2015 (Tables 3–11).

In 2015, the number of occurrences of AF and flutter were the highest of any cardiac arrhythmia diagnoses, followed by tachycardia and miscellaneous (other) arrhythmia diagnoses (Tables 5–3, 5–5, 5–7). In the last 10 years, the incidence and crude rates of AF and flutter have approximately doubled, and the incidence rates of both tachycardia and miscellaneous (other) arrhythmia diagnoses have increased. The age–standardized incidence rates of all subtypes of cardiac arrhythmia increased. The mean age of occurrence and ratio of male patients with both AF and flutter and miscellaneous (other) arrhythmia diagnoses, whereas the ratio of female patients with tachycardia increased. The mean age for the occurrence of tachycardia was the lowest among the arrhythmia subtypes.

Tables 5-3. Annual incidence and incidence rates for atrial fibrillation and flutter in Korea (2006-2015).

| Years | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | P for trend |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Atrial Fibrillation & Flutter (I48)** | | | | | | | | | | | |
| Incidence persons | 6,278 | 7,115 | 7,527 | 8,255 | 8,929 | 10,366 | 11,501 | 12,117 | 13,035 | 13,823 | <.0001 |
| Mean age, years | 65.1±14.3 | 66.1±14.1 | 66.5±14.2 | 66.6±14.1 | 66.3±14.2 | 67.2±14.0 | 67.3±14.0 | 67.6±13.9 | 68.2±13.7 | 68.6±13.4 | |
| Total Incidence rate (per 100,000 persons-year) | | | | | | | | | | | |
| Crude rate | 12.8 | 14.3 | 15.1 | 16.4 | 17.7 | 20.4 | 22.5 | 23.6 | 25.2 | 26.6 | |
| Age-standardized rate | 12.2 | 13.1 | 13.3 | 13.9 | 14.5 | 16.1 | 17.1 | 17.2 | 17.8 | 18.1 | |
| **Male** | | | | | | | | | | | |
| Incidence persons | 3,264 | 3,660 | 3,791 | 4,366 | 4,833 | 5,519 | 6,259 | 6,576 | 6,927 | 7,563 | |
| Male, % | 52.0 | 51.4 | 50.4 | 52.9 | 54.1 | 53.2 | 54.4 | 54.3 | 53.1 | 54.7 | |
| Mean age, years | 61.2±14.6 | 62.1±14.5 | 62.5±14.8 | 62.7±14.4 | 62.5±14.3 | 63.3±14.0 | 63.3±13.9 | 63.8±13.7 | 64.1±13.8 | 64.9±13.4 | |
| Male Incidence rate (per 100,000 person-years) | | | | | | | | | | | |
| Crude rate | 13.2 | 14.7 | 15.1 | 17.3 | 19.0 | 21.6 | 24.4 | 25.5 | 26.7 | 29.0 | |
| Age-standardized rate | 14.6 | 15.6 | 15.6 | 17.1 | 18.1 | 19.8 | 21.4 | 21.6 | 21.9 | 22.9 | |
| **Female** | | | | | | | | | | | |
| Incidence persons | 3,014 | 3,455 | 3,736 | 3,889 | 4,096 | 4,847 | 5,242 | 5,541 | 6,108 | 6,260 | |
| Female, % | 48.0 | 48.6 | 49.6 | 47.1 | 45.9 | 46.8 | 45.6 | 45.7 | 46.9 | 45.3 | |
| Mean age, years | 69.4±12.6 | 70.3±14.5 | 70.6±12.3 | 70.9±12.5 | 70.8±12.7 | 71.5±12.6 | 72.0±12.6 | 72.1±12.6 | 72.8±11.9 | 73.0±12.0 | |
| Female Incidence rate (per 100,000 person-years) | | | | | | | | | | | |
| Crude rate | 12.3 | 14.0 | 15.0 | 15.5 | 16.3 | 19.1 | 20.5 | 21.6 | 23.7 | 24.1 | |
| Age-standardized rate | 10.0 | 10.9 | 11.2 | 11.1 | 11.3 | 12.6 | 13.0 | 13.2 | 13.8 | 13.6 | |

Tables 5-4. Crude incidence rates by age group for atrial fibrillation and flutter in Korea (2006-2015).

| Years | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 |
|---|---|---|---|---|---|---|---|---|---|---|
| **Total** (per 100,000 person-years) | | | | | | | | | | |
| 0-39 | 1.1 | 1.1 | 1.2 | 1.3 | 1.4 | 1.5 | 1.7 | 1.5 | 1.4 | 1.4 |
| 40-49 | 7.3 | 7.1 | 7.1 | 7.7 | 8.5 | 8.6 | 9.3 | 9.2 | 10.2 | 9.9 |
| 50-59 | 18.4 | 19.9 | 18.8 | 19.5 | 21.7 | 23.6 | 25.2 | 26.6 | 25.5 | 26.2 |
| 60-69 | 42.4 | 44.1 | 44.1 | 48.7 | 50.3 | 54.6 | 58.6 | 59.4 | 59.8 | 62.5 |
| 70-79 | 85.6 | 96.2 | 99.0 | 98.7 | 99.5 | 112.8 | 118.8 | 118.7 | 128.4 | 128.7 |
| 80+ | 134.5 | 154.8 | 162.3 | 169.7 | 169.1 | 202.9 | 208.2 | 213.4 | 223.7 | 229.9 |
| **Male** (per 100,000 person-years) | | | | | | | | | | |
| 0-39 | 1.7 | 1.7 | 1.9 | 2.0 | 2.1 | 2.3 | 2.5 | 2.3 | 2.3 | 2.1 |
| 40-49 | 10.7 | 10.5 | 10.3 | 11.5 | 13.1 | 12.6 | 14.5 | 14.2 | 15.5 | 15.2 |
| 50-59 | 23.1 | 26.2 | 24.3 | 26.5 | 30.2 | 32.0 | 36.4 | 37.1 | 36.2 | 38.1 |
| 60-69 | 49.2 | 49.9 | 49.2 | 58.2 | 59.4 | 67.2 | 73.8 | 76.1 | 73.9 | 79.3 |
| 70-79 | 92.9 | 103.7 | 99.6 | 104.9 | 109.9 | 126.2 | 130.1 | 129.2 | 136.9 | 143.7 |
| 80+ | 146.9 | 170.4 | 189.9 | 199.7 | 197.6 | 219.2 | 222.9 | 235.3 | 236.2 | 255.3 |
| **Female** (per 100,000 person-years) | | | | | | | | | | |
| 0-39 | 0.5 | 0.5 | 0.5 | 0.6 | 0.7 | 0.6 | 0.8 | 0.7 | 0.5 | 0.6 |
| 40-49 | 3.8 | 3.6 | 3.7 | 3.8 | 3.6 | 4.4 | 3.9 | 4.0 | 4.6 | 4.3 |
| 50-59 | 13.7 | 13.7 | 13.3 | 12.4 | 13.2 | 15.2 | 13.9 | 15.9 | 14.6 | 14.1 |
| 60-69 | 36.5 | 39.0 | 39.5 | 40.1 | 41.9 | 43.1 | 44.4 | 43.8 | 46.4 | 46.5 |
| 70-79 | 81.0 | 91.4 | 98.6 | 94.4 | 92.2 | 103.3 | 110.7 | 111.1 | 122.0 | 117.3 |
| 80+ | 129.3 | 148.5 | 151.1 | 157.5 | 157.5 | 196.4 | 202.2 | 204.3 | 218.4 | 218.7 |

Tables 5-5. Annual incidence and incidence rates for tachycardia in Korea (2006-2015).

| Years | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | P for trend |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Tachycardia (I47)** | | | | | | | | | | | |
| Incidence persons | 3,380 | 3,598 | 3,767 | 4,233 | 4,486 | 4,558 | 4,866 | 5,058 | 5,265 | 5,204 | <.0001 |
| Mean age, years | 48.8±20.0 | 48.9±19.9 | 49.6±20.2 | 49.6±19.5 | 49.9±19.6 | 50.3±19.4 | 51.0±19.6 | 50.6±19.7 | 51.2±19.8 | 52.0±20.0 | |
| Total Incidence rate (per 100,000 persons-year) | | | | | | | | | | | |
| Crude rate | 6.9 | 7.2 | 7.5 | 8.4 | 8.9 | 9.0 | 9.5 | 9.8 | 10.2 | 10.0 | |
| Age-standardized rate | 6.7 | 7.0 | 7.1 | 7.9 | 8.1 | 8.1 | 8.5 | 8.7 | 8.9 | 8.6 | |
| **Male** | | | | | | | | | | | |
| Incidence persons | 1,682 | 1,729 | 1,732 | 1,979 | 2,175 | 2,179 | 2,269 | 2,362 | 2,434 | 2,415 | |
| Male, % | 49.8 | 48.1 | 46.0 | 46.8 | 48.5 | 47.8 | 46.4 | 46.7 | 46.2 | 46.4 | |
| Mean age, years | 45.8±20.0 | 46.2±19.6 | 46.7±20.6 | 47.6±19.5 | 48.0±19.6 | 48.1±19.4 | 48.9±20.0 | 48.6±20.1 | 49.1±20.5 | 50.7±20.0 | |
| Male Incidence rate (per 100,000 person-years) | | | | | | | | | | | |
| Crude rate | 6.8 | 6.9 | 6.9 | 7.8 | 8.6 | 8.5 | 8.8 | 9.2 | 9.4 | 9.3 | |
| Age-standardized rate | 7.0 | 7.0 | 6.9 | 7.7 | 8.2 | 8.1 | 8.3 | 8.5 | 8.6 | 8.3 | |
| **Female** | | | | | | | | | | | |
| Incidence persons | 1,698 | 1,869 | 2,035 | 2,254 | 2,311 | 2,379 | 2,617 | 2,696 | 2,831 | 2,789 | |
| Female, % | 50.2 | 51.9 | 54.0 | 53.2 | 51.5 | 52.2 | 53.6 | 53.3 | 53.8 | 53.6 | |
| Mean age, years | 51.8±19.7 | 51.3±19.9 | 52.0±19.6 | 51.4±19.4 | 51.7±19.4 | 52.3±19.1 | 52.7±19.2 | 52.3±19.2 | 52.9±19.1 | 53.1±20.0 | |
| Female Incidence rate (per 100,000 person-years) | | | | | | | | | | | |
| Crude rate | 6.9 | 7.6 | 8.2 | 9.0 | 9.2 | 9.4 | 10.3 | 10.5 | 11.0 | 10.7 | |
| Age-standardized rate | 6.5 | 7.0 | 7.4 | 8.1 | 8.1 | 8.2 | 8.8 | 9.0 | 9.2 | 9.0 | |

Tables 5-6. Crude incidence rates by age group for tachycardia in Korea (2006-2015).

| Years | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 |
|---|---|---|---|---|---|---|---|---|---|---|
| **Total** (per 100,000 person-years) | | | | | | | | | | |
| 0-39 | 3.6 | 3.9 | 4.0 | 4.4 | 4.8 | 4.7 | 5.0 | 5.4 | 5.4 | 5.2 |
| 40-49 | 7.1 | 7.6 | 7.5 | 8.8 | 8.2 | 8.8 | 8.9 | 9.1 | 9.4 | 8.8 |
| 50-59 | 11.2 | 11.0 | 11.1 | 12.6 | 13.8 | 13.0 | 13.3 | 13.4 | 14.2 | 13.4 |
| 60-69 | 16.0 | 15.9 | 15.9 | 16.7 | 17.5 | 18.4 | 17.7 | 17.6 | 17.5 | 18.3 |
| 70-79 | 19.8 | 19.0 | 21.2 | 21.7 | 22.4 | 19.4 | 24.0 | 23.2 | 23.4 | 22.2 |
| 80+ | 17.9 | 20.0 | 22.3 | 21.7 | 21.5 | 24.1 | 25.1 | 23.0 | 25.0 | 26.5 |
| **Male** (per 100,000 person-years) | | | | | | | | | | |
| 0-39 | 4.0 | 4.1 | 4.1 | 4.5 | 4.9 | 5.1 | 5.1 | 5.5 | 5.5 | 4.9 |
| 40-49 | 7.0 | 7.6 | 6.9 | 8.1 | 8.2 | 7.9 | 7.8 | 8.7 | 8.0 | 8.5 |
| 50-59 | 10.8 | 10.5 | 9.9 | 12.0 | 13.0 | 11.9 | 12.1 | 12.0 | 12.6 | 12.0 |
| 60-69 | 16.1 | 14.7 | 14.8 | 14.9 | 17.6 | 18.5 | 17.5 | 17.0 | 16.9 | 18.1 |
| 70-79 | 21.3 | 19.8 | 19.7 | 21.0 | 23.5 | 20.2 | 23.2 | 21.6 | 23.9 | 22.3 |
| 80+ | 14.5 | 20.4 | 26.8 | 28.3 | 22.5 | 26.0 | 31.8 | 30.7 | 29.0 | 31.9 |
| **Female** (per 100,000 person-years) | | | | | | | | | | |
| 0-39 | 3.1 | 3.7 | 3.8 | 4.3 | 4.6 | 4.4 | 5.0 | 5.4 | 5.3 | 5.5 |
| 40-49 | 7.1 | 7.6 | 8.2 | 9.4 | 8.1 | 9.7 | 10.0 | 9.5 | 10.8 | 9.2 |
| 50-59 | 11.6 | 11.5 | 12.4 | 13.3 | 14.5 | 14.2 | 14.5 | 14.9 | 15.8 | 14.7 |
| 60-69 | 15.9 | 16.9 | 17.0 | 18.4 | 17.4 | 18.3 | 17.9 | 18.2 | 18.1 | 18.5 |
| 70-79 | 18.9 | 18.5 | 22.3 | 22.2 | 21.6 | 18.8 | 24.6 | 24.3 | 23.1 | 22.1 |
| 80+ | 19.4 | 19.9 | 20.5 | 19.0 | 21.0 | 23.4 | 22.4 | 19.8 | 23.3 | 24.2 |

Tables 5-7. Annual incidence and incidence rates for other cardiac arrhythmia diagnoses in Korea (2006-2015).

| Years | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | P for trend |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Other Cardiac Arrhythmia diagnoses (I49)** | | | | | | | | | | | |
| Incidence persons | 2,947 | 3,314 | 3,576 | 3,905 | 4,006 | 4,359 | 4,492 | 4,540 | 4,737 | 4,698 | <.0001 |
| Mean age, years | 60.6±17.6 | 61.7±17.6 | 62.0±17.5 | 62.4±17.6 | 62.3±17.2 | 61.8±18.1 | 62.8±17.7 | 63.3±18.0 | 63.7±18.0 | 64.2±18.1 | |
| Total Incidence rate (per 100,000 persons-year) | | | | | | | | | | | |
| Crude rate | 6.0 | 6.7 | 7.2 | 7.8 | 7.9 | 8.6 | 8.8 | 8.8 | 9.2 | 9.0 | |
| Age-standardized rate | 5.8 | 6.2 | 6.4 | 6.8 | 6.7 | 7.1 | 7.0 | 6.8 | 6.9 | 6.6 | |
| **Male** | | | | | | | | | | | |
| Incidence persons | 1,225 | 1,317 | 1,427 | 1,602 | 1,655 | 1,869 | 1,934 | 1,938 | 2,090 | 2,086 | |
| Male, % | 41.6 | 39.7 | 39.9 | 41.0 | 41.3 | 42.9 | 43.1 | 42.7 | 44.1 | 44.4 | |
| Mean age, years | 56.8±18.5 | 58.2±18.4 | 59.0±17.9 | 59.7±18.2 | 59.2±17.6 | 58.9±18.7 | 59.9±18.1 | 60.3±18.3 | 61.0±18.2 | 60.7±18.9 | |
| Male Incidence rate (per 100,000 person-years) | | | | | | | | | | | |
| Crude rate | 5.0 | 5.3 | 5.7 | 6.3 | 6.5 | 7.3 | 7.5 | 7.5 | 8.1 | 8.0 | |
| Age-standardized rate | 5.4 | 5.6 | 5.8 | 6.4 | 6.2 | 6.9 | 6.8 | 6.6 | 6.9 | 6.7 | |
| **Female** | | | | | | | | | | | |
| Incidence persons | 1,722 | 1,997 | 2,149 | 2,303 | 2,351 | 2,490 | 2,558 | 2,602 | 2,647 | 2,612 | |
| Female, % | 58.4 | 60.3 | 60.1 | 59.0 | 58.7 | 57.1 | 56.9 | 57.3 | 55.9 | 55.6 | |
| Mean age, years | 63.3±16.3 | 63.9±16.6 | 64.0±16.9 | 64.2±17.0 | 64.4±16.5 | 63.9±17.3 | 65.0±17.0 | 65.5±17.5 | 65.8±17.5 | 67.0±17.0 | |
| Female Incidence rate (per 100,000 person-years) | | | | | | | | | | | |
| Crude rate | 7.0 | 8.1 | 8.6 | 9.2 | 9.3 | 9.8 | 10.0 | 10.1 | 10.3 | 10.1 | |
| Age-standardized rate | 6.0 | 6.7 | 7.0 | 7.2 | 7.0 | 7.3 | 7.1 | 7.0 | 6.9 | 6.4 | |

Tables 5-8. Crude incidence rates by age group for other cardiac arrhythmia diagnoses in Korea, (2006-2015).

| Years | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 |
|---|---|---|---|---|---|---|---|---|---|---|
| **Total** (per 100,000 person-years) | | | | | | | | | | |
| 0-39 | 1.2 | 1.3 | 1.4 | 1.6 | 1.5 | 1.8 | 1.7 | 1.8 | 1.9 | 1.8 |
| 40-49 | 4.2 | 4.4 | 4.7 | 4.8 | 4.9 | 5.3 | 5.3 | 4.6 | 4.5 | 4.3 |
| 50-59 | 8.6 | 9.0 | 9.0 | 9.8 | 10.5 | 10.4 | 10.5 | 10.0 | 10.0 | 9.1 |
| 60-69 | 19.3 | 19.4 | 20.4 | 19.8 | 20.2 | 20.3 | 20.1 | 19.8 | 19.7 | 18.7 |
| 70-79 | 34.3 | 38.5 | 38.7 | 39.2 | 38.7 | 40.5 | 38.6 | 38.1 | 39.9 | 39.1 |
| 80+ | 45.9 | 58.8 | 61.0 | 71.3 | 62.4 | 65.1 | 70.3 | 70.3 | 68.2 | 67.1 |
| **Male** (per 100,000 person-years) | | | | | | | | | | |
| 0-39 | 1.4 | 1.4 | 1.3 | 1.6 | 1.6 | 1.9 | 1.7 | 1.8 | 1.9 | 2.1 |
| 40-49 | 4.5 | 3.9 | 4.2 | 4.2 | 4.7 | 5.3 | 5.8 | 4.8 | 4.6 | 4.8 |
| 50-59 | 7.0 | 7.3 | 8.1 | 8.7 | 9.3 | 9.7 | 9.8 | 9.4 | 9.7 | 8.5 |
| 60-69 | 16.8 | 16.8 | 17.8 | 17.4 | 18.0 | 18.4 | 17.2 | 17.7 | 19.0 | 18.1 |
| 70-79 | 28.0 | 35.5 | 35.8 | 35.5 | 35.6 | 37.1 | 35.8 | 35.9 | 37.7 | 37.5 |
| 80+ | 52.2 | 51.3 | 54.8 | 78.6 | 59.1 | 73.4 | 79.3 | 72.7 | 75.0 | 67.3 |
| **Female** (per 100,000 person-years) | | | | | | | | | | |
| 0-39 | 1.0 | 1.2 | 1.4 | 1.5 | 1.4 | 1.8 | 1.6 | 1.7 | 1.8 | 1.4 |
| 40-49 | 3.9 | 4.8 | 5.3 | 5.3 | 5.2 | 5.4 | 4.8 | 4.5 | 4.3 | 3.8 |
| 50-59 | 10.2 | 10.7 | 10.0 | 10.9 | 11.7 | 11.1 | 11.2 | 10.7 | 10.3 | 9.7 |
| 60-69 | 21.5 | 21.7 | 22.8 | 22.0 | 22.1 | 21.9 | 22.7 | 21.8 | 20.4 | 19.3 |
| 70-79 | 38.1 | 40.4 | 40.6 | 41.7 | 40.8 | 42.8 | 40.6 | 39.6 | 41.6 | 40.3 |
| 80+ | 43.3 | 61.8 | 63.5 | 68.3 | 63.8 | 61.8 | 66.6 | 69.3 | 65.3 | 67.0 |

Residential areas were subdivided into 14 groups (Seoul + Incheon, Gyonggi, Daejeon + Sejong + Chungnam, Busan, Gyeongbuk, Gyeongnam, Jeonnam, Daegu, Jeongbuk, Gangwon, Chungbuk, Gwangju, Ulsan, and Jeju) according to data from the Regional Cardiocerebrovascular Center (RCCVC) project.

The residence areas with relatively higher age-standardized incidence rates for cardiac arrhythmia per 100,000 persons were Chungbuk (37.0), Gyeongbuk (36.3), Jeonnam (35.6), and Gwangju (35.0). Seoul/Incheon had the lowest age-standardized incidence rate (28.7 per 100,000 persons) (Tables 5-9). Age-standardized incidence rates were relatively high in Gyeongbuk, Chungbuk, and Daejeon/Sejong/Chungnam for males and in Gwangju, Chungbuk, Jeonnam, and Gyeongbuk for females with respect to HD (Tables 5-10, 5-11).

Tables 5-9. Age-standardized incidence rates for cardiac arrhythmia subtypes by residence areas in Korea, 2015.

| Residence areas | Chungbuk | Gyongbuk | Jeonnam | Gwangju | Gangwon | Daejeon/Sejong/Chungnam | Gyongnam | Jeju | Busan | Jeonbuk | Ulsan | Gyonggi | Daegu | Seoul/Incheon |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Arrhythmia** | 37.0 | 36.3 | 35.6 | 35.0 | 33.9 | 33.9 | 32.5 | 32.1 | 31.3 | 30.7 | 30.3 | 29.6 | 29.0 | 28.7 |
| AF & Flutter | 23.1 | 21.4 | 20.9 | 19.9 | 20.1 | 19.7 | 19.1 | 17.8 | 18.7 | 16.9 | 19.4 | 16.6 | 16.2 | 16.2 |
| Tachycardia | 8.6 | 9.7 | 9.6 | 10.9 | 8.2 | 9.2 | 7.9 | 8.7 | 7.4 | 9.1 | 7.5 | 8.6 | 9.6 | 8.1 |
| Arrhythmia-others | 7.3 | 7.1 | 7.7 | 6.8 | 8.0 | 7.2 | 7.6 | 8.0 | 7.3 | 6.8 | 4.9 | 6.1 | 5.1 | 6.1 |

Tables 5-10. Age-standardized incidence rates for cardiac arrhythmia and cardiac arrhythmia subtypes by residence areas in Korean males, 2015.

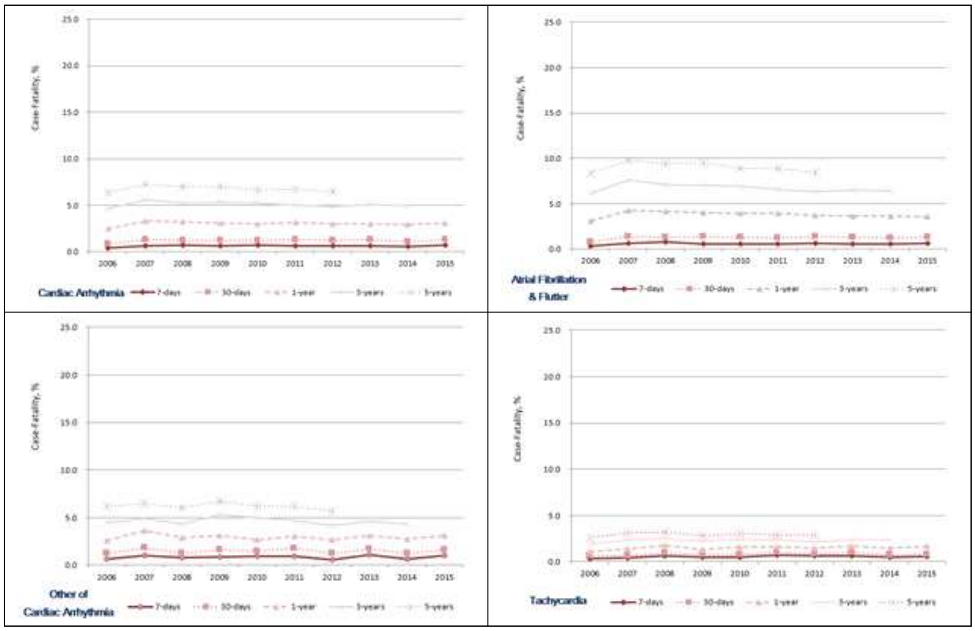
| Residence areas | Gyong buk | Chung buk | Dae jeon/ Se jong/ Chung nam | Jeju | Gang won | Ul san | Jeon nam | Gyong nam | Gwang ju | Bu san | Dae gu | Jeon buk | Gyong gi | Seo ul/ In cheon |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Arrhythmia** | 42.0 | 41.1 | 40.4 | 39.3 | 39.0 | 38.7 | 38.3 | 36.5 | 36.0 | 34.3 | 34.1 | 34.1 | 33.6 | 32.9 |
| AF & Flutter | 28.6 | 28.7 | 26.4 | 23.3 | 24.9 | 28.5 | 24.8 | 23.5 | 22.1 | 23.3 | 21.3 | 20.5 | 21.0 | 20.4 |
| Tachycardia | 9.3 | 7.6 | 8.5 | 8.5 | 7.5 | 7.7 | 9.4 | 7.6 | 10.1 | 7.2 | 9.3 | 9.2 | 8.4 | 7.9 |
| Arrhythmia-others | 6.6 | 7.3 | 7.9 | 10.2 | 8.3 | 4.5 | 7.1 | 7.7 | 6.4 | 6.3 | 5.7 | 7.2 | 6.2 | 6.3 |

Tables 5-11. Age-standardized incidence rates for cardiac arrhythmia and cardiac arrhythmia subtypes by residence areas in Korean females, 2015.

| Residence areas | Gwangju | Chungbuk | Jeonnam | Gyongbuk | Gangwon | Busan | Gyongnam | Daejeon/Sejong/Ghungnam | Jeonbuk | Gyonggi | Jeju | Seoul/Incheon | Daegu | Ulsan |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Arrhythmia** | 34.1 | 33.6 | 32.7 | 31.4 | 29.1 | 28.6 | 28.5 | 28.0 | 27.3 | 25.9 | 25.2 | 24.7 | 24.7 | 22.8 |
| AF & Flutter | 17.9 | 18.3 | 16.9 | 14.8 | 15.4 | 1.0 | 14.9 | 13.4 | 13.2 | 12.4 | 12.8 | 12.1 | 11.8 | 11.5 |
| Tachycardia | 11.7 | 9.5 | 9.9 | 10.3 | 9.1 | 7.5 | 8.2 | 9.9 | 9.1 | 9.0 | 8.6 | 8.3 | 9.8 | 7.3 |
| Arrhythmia-others | 7.1 | 7.2 | 7.9 | 7.7 | 7.5 | 8.1 | 7.4 | 6.7 | 6.6 | 6.0 | 5.8 | 5.8 | 4.6 | 5.1 |

During the last 10 years, 7-day, 30-day, 1-year, 3-year, and 5-year cumulative case-fatality rates for cardiac arrhythmia and its subtypes have changed little (Figure 5-1). Overall, in 2015, the case-fatality rates of AF and flutter were the highest, followed by miscellaneous (other) arrhythmia diagnoses and tachycardia. The 5-year cumulative case-fatality rates for AF and flutter were approximately 10% (Tables 5-12 to 5-14).

Figure 5-1. Trends in case-fatality rates for cardiac arrhythmia and cardiac arrhythmia subtypes in Korea (2006-2015).




(a) Overall rate of cardiac arrhythmia (ICD-10 code: I47~I49)

(b) Atrial Fibrillation & Flutter (ICD-10 code: I48)

(c) others cardiac arrhythmia diagnoses (ICD-10 code: I49)

(d) Tachycardia (ICD-10 code: I47)

Tables 5-12. Trends in case-fatality rates by subtypes of cardiac arrhythmia in Korea (2006-2015).

| Years | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 |
|---|---|---|---|---|---|---|---|---|---|---|
| **Atrial Fibrillation & Flutter (I48)** | | | | | | | | | | |
| 7-day | 0.3 | 0.6 | 0.8 | 0.6 | 0.6 | 0.5 | 0.6 | 0.5 | 0.6 | 0.7 |
| 30-day | 0.8 | 1.4 | 1.3 | 1.4 | 1.3 | 1.2 | 1.4 | 1.3 | 1.2 | 1.4 |
| 1-year | 3.1 | 4.3 | 4.2 | 4.0 | 3.9 | 3.9 | 3.7 | 3.6 | 3.6 | 3.6 |
| 3-year | 6.1 | 7.6 | 7.1 | 7.0 | 6.9 | 6.6 | 6.3 | 6.5 | 6.4 | - |
| 5-year | 8.4 | 9.8 | 9.4 | 9.5 | 8.9 | 8.9 | 8.4 | - | - | - |
| **Cardiac Arrhythmia-Others (I49)** | | | | | | | | | | |
| 7-day | 0.7 | 1.0 | 0.8 | 0.8 | 1.0 | 0.9 | 0.6 | 1.1 | 0.6 | 1.0 |
| 30-day | 1.2 | 1.8 | 1.3 | 1.6 | 1.4 | 1.7 | 1.2 | 1.7 | 1.2 | 1.6 |
| 1-year | 2.6 | 3.6 | 2.9 | 3.1 | 2.6 | 3.1 | 2.7 | 3.1 | 2.7 | 3.1 |
| 3-year | 4.4 | 4.9 | 4.3 | 5.3 | 5.0 | 4.7 | 4.2 | 4.6 | 4.3 | - |
| 5-year | 6.2 | 6.5 | 6.1 | 6.7 | 6.2 | 6.2 | 5.7 | - | - | - |
| **Tachycardia (I47)** | | | | | | | | | | |
| 7-day | 0.4 | 0.4 | 0.6 | 0.5 | 0.5 | 0.7 | 0.6 | 0.6 | 0.5 | 0.6 |
| 30-day | 0.6 | 0.6 | 0.9 | 0.8 | 0.8 | 1.0 | 0.9 | 1.0 | 0.7 | 0.8 |
| 1-year | 1.1 | 1.4 | 1.7 | 1.3 | 1.6 | 1.6 | 1.4 | 1.7 | 1.5 | 1.7 |
| 3-year | 1.9 | 2.4 | 2.4 | 2.2 | 2.3 | 2.3 | 2.1 | 2.4 | 2.3 | - |
| 5-year | 2.6 | 3.1 | 3.2 | 2.8 | 3.0 | 2.9 | 2.9 | - | - | - |

Tables 5-13. Trends in case-fatality rates by subtypes of cardiac arrhythmia in Korean males (2006~2015).

| Years | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 |
|---|---|---|---|---|---|---|---|---|---|---|
| **Atrial Fibrillation & Flutter (I48)** | | | | | | | | | | |
| 7-day | 0.2 | 0.5 | 0.5 | 0.4 | 0.4 | 0.4 | 0.5 | 0.3 | 0.4 | 0.5 |
| 30-day | 0.5 | 1.3 | 1.1 | 0.9 | 1.0 | 0.9 | 1.1 | 0.7 | 1.0 | 1.1 |
| 1-year | 2.2 | 3.0 | 3.2 | 2.9 | 3.1 | 2.6 | 2.8 | 2.2 | 2.6 | 2.7 |
| 3-year | 4.2 | 5.3 | 5.2 | 5.1 | 5.3 | 4.4 | 4.3 | 4.3 | 4.4 | - |
| 5-year | 5.8 | 6.8 | 6.8 | 6.8 | 7.0 | 6.0 | 5.4 | - | - | - |
| **Cardiac Arrhythmia-others (I49)** | | | | | | | | | | |
| 7-day | 0.7 | 1.2 | 0.4 | 0.7 | 0.9 | 1.0 | 0.6 | 1.0 | 0.9 | 1.2 |
| 30-day | 1.3 | 2.0 | 0.8 | 1.7 | 1.2 | 1.7 | 1.1 | 1.5 | 1.2 | 1.9 |
| 1-year | 2.7 | 3.6 | 2.5 | 2.7 | 2.3 | 2.8 | 2.9 | 3.3 | 2.8 | 3.0 |
| 3-year | 3.7 | 4.9 | 3.6 | 4.8 | 4.4 | 4.8 | 4.2 | 4.9 | 4.1 | - |
| 5-year | 5.6 | 6.2 | 5.5 | 6.3 | 5.7 | 5.9 | 5.5 | - | - | - |
| **Tachycardia (I47)** | | | | | | | | | | |
| 7-day | 0.5 | 0.4 | 0.8 | 0.5 | 0.6 | 0.5 | 0.7 | 0.8 | 0.6 | 0.7 |
| 30-day | 0.8 | 0.6 | 1.3 | 0.7 | 1.0 | 0.7 | 1.1 | 1.3 | 0.8 | 1.1 |
| 1-year | 1.2 | 1.3 | 1.7 | 1.1 | 1.8 | 1.4 | 1.8 | 2.1 | 1.5 | 2.0 |
| 3-year | 2.1 | 2.5 | 2.3 | 2.1 | 2.8 | 1.8 | 2.6 | 3.0 | 2.5 | - |
| 5-year | 2.7 | 3.1 | 3.0 | 2.8 | 3.4 | 2.2 | 3.3 | - | - | - |

Tables 5-14. Trends in case-fatality rates by subtypes of cardiac arrhythmia in Korean females (2006~2015).

| Years | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 |
|---|---|---|---|---|---|---|---|---|---|---|
| **Atrial Fibrillation & Flutter (I48)** | | | | | | | | | | |
| 7-day | 0.5 | 0.8 | 1.0 | 0.8 | 0.8 | 0.7 | 0.8 | 0.7 | 0.8 | 0.8 |
| 30-day | 1.0 | 1.6 | 1.6 | 1.9 | 1.7 | 1.7 | 1.7 | 2.0 | 1.5 | 1.6 |
| 1-year | 4.2 | 5.6 | 5.3 | 5.3 | 5.0 | 5.4 | 4.8 | 5.4 | 4.8 | 4.7 |
| 3-year | 8.3 | 10.1 | 9.0 | 9.2 | 8.8 | 9.1 | 8.8 | 9.2 | 8.7 | - |
| 5-year | 11.4 | 13.1 | 12.2 | 12.5 | 11.3 | 12.2 | 12.1 | - | - | - |
| **Cardiac Arrhythmia-others (I49)** | | | | | | | | | | |
| 7-day | 0.7 | 0.9 | 1.0 | 0.9 | 1.0 | 0.8 | 0.5 | 1.2 | 0.4 | 0.9 |
| 30-day | 1.2 | 1.8 | 1.6 | 1.5 | 1.6 | 1.8 | 1.3 | 1.8 | 1.2 | 1.5 |
| 1-year | 2.6 | 3.7 | 3.1 | 3.4 | 2.9 | 3.3 | 2.5 | 2.9 | 2.7 | 3.2 |
| 3-year | 5.1 | 5.0 | 4.8 | 5.6 | 5.4 | 4.6 | 4.2 | 4.5 | 4.5 | - |
| 5-year | 6.7 | 6.7 | 6.5 | 7.0 | 6.6 | 6.4 | 5.9 | - | - | - |
| **Tachycardia (I47)** | | | | | | | | | | |
| 7-day | 0.2 | 0.4 | 0.5 | 0.5 | 0.4 | 0.8 | 0.5 | 0.4 | 0.4 | 0.4 |
| 30-day | 0.4 | 0.6 | 0.7 | 0.9 | 0.6 | 1.2 | 0.6 | 0.8 | 0.6 | 0.6 |
| 1-year | 1.0 | 1.6 | 1.8 | 1.5 | 1.4 | 1.8 | 1.1 | 1.3 | 1.5 | 1.5 |
| 3-year | 1.8 | 2.3 | 2.6 | 2.3 | 1.9 | 2.8 | 1.8 | 1.9 | 2.2 | - |
| 5-year | 2.5 | 3.2 | 3.4 | 2.8 | 2.6 | 3.5 | 2.6 | - | - | - |

The residence area with the highest 30-day case-fatality rates for cardiac arrhythmia were Gangwon, Jeonnam, Daegu, and Jeonbuk (Tables 5-15 and 5-16).

Chungbuk had higher age-standardized incidence rates but lower 30-day case-fatality rates (Tables 5-9, 5-15, 5-16). Jeonnam and Gangwon had relatively higher age-standardized incidence and case-fatality rates for cardiac arrhythmia.

Tables 5-15. Thirty-day cardiac arrhythmia case-fatality rates by residence areas in Korea, 2015.

| Residence areas | Gangwon | Jeonnam | Daegu | Jeonbuk | Jeju | Gyongbuk | Busan | Daejeon/Sejong/Chungnam | Gyonggi | Gyongnam | Gwangju | Seoul/Incheon | Ulsan | Chungbuk |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Arrhythmia** | 2.3 | 2.0 | 1.8 | 1.6 | 1.4 | 1.4 | 1.4 | 1.2 | 1.2 | 1.2 | 1.1 | 1.0 | 1.0 | 0.8 |
| AF & Flutter | 2.8 | 2.5 | 1.5 | 1.4 | 2.2 | 1.5 | 1.2 | 1.7 | 1.2 | 0.7 | 1.6 | 1.0 | 0.4 | 0.8 |
| Tachycardia | 0.6 | 0.9 | 0.4 | 0.0 | 0.0 | 0.3 | 1.6 | 0.5 | 0.8 | 2.2 | 0.6 | 1.0 | 1.0 | 0.0 |
| Arrhythmia-others | 1.9 | 1.2 | 4.4 | 3.2 | 1.3 | 1.8 | 1.8 | 0.8 | 1.9 | 1.4 | 0.0 | 1.1 | 3.1 | 1.1 |

Tables 5-16. One-year cardiac arrhythmia case-fatality rates by residence areas in Korea, 2015.

| Residence areas | Gangwon | Jeonnam | Daegu | Jeonbuk | Gyongbuk | Chungbuk | Gyongnam | Daejeon/Sejong/Ghungnam | Gyonggi | Busan | Gwangju | Ulsan | Seoul/Incheon | Jeju |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Arrhythmia** | 4.5 | 4.4 | 4.0 | 3.5 | 3.4 | 3.2 | 3.1 | 3.0 | 3.0 | 3.0 | 2.7 | 2.4 | 2.3 | 2.0 |
| AF & Flutter | 5.5 | 5.1 | 4.6 | 4.1 | 3.8 | 4.1 | 3.0 | 3.8 | 3.4 | 3.1 | 4.2 | 2.7 | 2.7 | 3.4 |
| Tachycardia | 1.8 | 2.2 | 0.7 | 1.4 | 2.0 | 0.6 | 3.1 | 1.7 | 1.7 | 2.8 | 1.7 | 1.0 | 1.5 | 0.0 |
| Arrhythmia-others | 4.2 | 3.7 | 6.6 | 3.2 | 3.4 | 2.3 | 2.8 | 2.0 | 3.2 | 3.7 | 0.0 | 6.2 | 2.7 | 1.3 |

# Chapter 6. Overall Discussion and Conclusions

## 6.1. Overall Discussion

In Korea, HD is the second-leading cause of death (with a rate of 62.4 persons per 100,000 in 2018) following cancer, and recent trends reveal an increase in incidence (Statistics Korea 2019). There are a variety of ways to measure the population impact of a disease, and one of the most critical measurements is incidence rate (Hong et al. 2009). However, there is a lack of information on incidence rates for HD and its subtypes (as opposed to mortality rates). This is because of the difficulty of detecting incident HD rather than assessing mortality due to the ample availability of representative data on the causes of death from Statistics Korea. The cost of investigating incidence is high in a community cohort, and it is not easy to obtain representative data (Townsend et al. 2016). Additionally, in the current study, incidence had to be calculated from various sources (outpatient, inpatient, out-of-hospital deaths) (Hong et al. 2009). This study showed that crude incidence rates for overall HD, arrhythmia, HF, HD (others diagnoses), pulmonary HD, valvular HD (excluding IHD), and HHD increased between 2006 and 2015. However, age-standardized incidence rates for HD and its subtypes decreased, with the exception of arrhythmia, other HD diagnoses, and pulmonary HD (Tables 6-1, 6-4). During the 10-year study period, the observed decrease in the age-standardized incidence rates for HD was attributable to the reduction in the incidence of IHD, HF, and HHD. The growth of the aging population is an additional reasons for the increasing crude incidence rates (Hong et al. 2009; Kim et al. 2013; Kim et al. 2019).

Among the subtypes of heart disease, other HD diagnoses, valvular HD, and heart failure were the diseases with relatively large increases in 30-day and 1-year case-fatality rates (Tables 6-1 to 6-4).

Tables 6-1. Comparisons of incidence and case-fatality rates for heart disease (HD) and HD subtypes in Korea, 2006-2015.

| Variables | | Incidence Numbers | | Incidence rates | | | | Case-fatality | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Crude | | Age-standardized | | 30-day | | | 1-year | | |
| | | 2006 | 2015 | 2006 | 2015 | 2006 | 2015 | 2006 | 2015 | β | 2006 | 2015 | β |
| HD Total | Total | 115,127 | 125,388 | 233.8 | 241.0 | 223.8 | 171.1 | 2.2 | 2.5 | 0.0161 | 4.3 | 3.9 | 0.0112 |
| | Male | 58,631 | 70,725 | 237.1 | 271.3 | 255.2 | 214.9 | 1.8 | 1.9 | 0.0082 | 3.4 | 3.0 | 0.0033 |
| | Female | 56,496 | 54,663 | 230.5 | 210.5 | 192.9 | 129.0 | 2.6 | 3.1 | 0.0324 | 5.1 | 5.0 | 0.0340 |
| Arrhythmias | Total | 12,156 | 22,325 | 24.7 | 42.9 | 22.6 | 30.1 | 0.9 | 1.3 | 0.0118 | 2.5 | 3.1 | 0.0200 |
| | Male | 5,943 | 11,373 | 24.0 | 43.6 | 24.7 | 34.1 | 0.8 | 1.3 | 0.0175 | 2.0 | 2.6 | 0.0150 |
| | Female | 6,213 | 10,952 | 25.4 | 42.2 | 20.7 | 26.4 | 0.9 | 1.4 | 0.0071 | 2.9 | 3.6 | 0.0265 |
| HD-others | Total | 10,007 | 15,609 | 20.3 | 30.0 | 18.7 | 20.9 | 2.5 | 6.4 | 0.2838 | 5.7 | 9.5 | 0.3729 |
| | Male | 4,722 | 8,028 | 19.1 | 30.8 | 19.7 | 24.6 | 2.8 | 6.4 | 0.2993 | 5.5 | 9.2 | 0.3994 |
| | Female | 5,285 | 7,581 | 21.6 | 29.2 | 17.6 | 17.4 | 2.3 | 6.4 | 0.2650 | 5.9 | 9.8 | 0.3439 |
| Pulmonary HD | Total | 1,799 | 4,471 | 3.7 | 8.6 | 3.4 | 5.9 | 2.6 | 2.8 | 0.0080 | 5.0 | 4.9 | 0.0194 |
| | Male | 698 | 1,716 | 2.8 | 6.6 | 3.1 | 5.4 | 1.7 | 2.6 | -0.0022 | 4.4 | 4.2 | 0.0333 |
| | Female | 1,101 | 2,755 | 4.5 | 10.6 | 3.6 | 6.2 | 3.2 | 2.9 | 0.0136 | 5.4 | 5.4 | 0.0099 |
| Valvular HD | Total | 3,122 | 4,437 | 6.3 | 8.5 | 5.8 | 5.8 | 1.9 | 4.1 | 0.1095 | 4.9 | 7.7 | 0.2152 |
| | Male | 1,347 | 2,074 | 5.4 | 8.0 | 5.6 | 6.2 | 1.8 | 3.8 | 0.0751 | 4.8 | 6.6 | 0.1579 |
| | Female | 1,775 | 2,363 | 7.2 | 9.1 | 5.9 | 5.3 | 2.0 | 4.4 | 0.1405 | 5.0 | 8.6 | 0.2661 |

Tables 6-2. Comparisons of incidence and case-fatality rates for heart disease (HD) and HD subtypes in Korea, 2006-2015 (continued).

| Variables | | Incidence Numbers | | Incidence rates | | | | Case-fatality | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Crude | | Age-standardized | | 30-day | | | 1-year | | |
| | | 2006 | 2015 | 2006 | 2015 | 2006 | 2015 | 2006 | 2015 | β | 2006 | 2015 | β |
| Heart Failure | Total | 13,351 | 18,123 | 27.1 | 34.8 | 25.6 | 21.7 | 3.9 | 6.7 | 0.1184 | 11.1 | 13.0 | 0.2019 |
| | Male | 4,471 | 6,929 | 18.1 | 26.6 | 21.8 | 21.1 | 3.5 | 6.1 | 0.1013 | 10.2 | 11.9 | 0.1627 |
| | Female | 8,880 | 11,194 | 36.2 | 43.1 | 27.4 | 21.4 | 4.1 | 7.1 | 0.1301 | 11.6 | 13.7 | 0.2295 |
| IHD | Total | 80,040 | 82,296 | 162.6 | 158.2 | 143.9 | 103.5 | 1.8 | 1.7 | -0.0179 | 3.3 | 2.8 | -0.0355 |
| | Male | 44,342 | 51,118 | 179.3 | 196.1 | 176.1 | 140.7 | 1.5 | 1.4 | -0.0214 | 2.8 | 2.3 | -0.0368 |
| | Female | 35,698 | 31,178 | 145.7 | 120.1 | 115.1 | 69.1 | 2.1 | 2.3 | -0.0041 | 3.9 | 3.6 | -0.0212 |
| HHD | Total | 8,350 | 6,317 | 17.0 | 12.1 | 15.9 | 7.7 | 2.2 | 3.1 | 0.0097 | 7.2 | 6.4 | -0.0054 |
| | Male | 2,759 | 2,203 | 11.2 | 8.5 | 12.7 | 6.7 | 1.7 | 2.5 | 0.0298 | 5.7 | 5.5 | 0.0148 |
| | Female | 5,591 | 4,114 | 22.8 | 15.8 | 17.3 | 8.1 | 2.5 | 3.4 | 0.0006 | 8.0 | 6.9 | -0.0129 |

Tables 6-3. Changes in patterns of incidence and case-fatality rates for heart disease (HD) and HD subtypes in Korea, 2006-2015.

| Variables | | Incidence Numbers | | Incidence rates | | | | Case-fatality | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Crude | | Age-standardized | | 30-day | 1-year |
| | | 2006 | 2015 | 2006 | 2015 | 2006 | 2015 | β | β |
| HD Total | Total | ↑ | | ↑ | | ↓ | | ↑ | ↑ |
| | Male | ↑ | | ↑ | | ↓ | | ↑ | ↑ |
| | Female | ↓ | | ↓ | | ↓ | | ↑ | ↑ |
| Arrhythmias | Total | ↑ | | ↑ | | ↑ | | ↑ | ↑ |
| | Male | ↑ | | ↑ | | ↑ | | ↑ | ↑ |
| | Female | ↑ | | ↑ | | ↑ | | ↑ | ↑ |
| HD-others | Total | ↑ | | ↑ | | ↑ | | ↑ | ↑ |
| | Male | ↑ | | ↑ | | ↑ | | ↑ | ↑ |
| | Female | ↑ | | ↑ | | ↓ | | ↑ | ↑ |
| Pulmonary HD | Total | ↑ | | ↑ | | ↑ | | ↑ | ↑ |
| | Male | ↑ | | ↑ | | ↑ | | ↓ | ↑ |
| | Female | ↑ | | ↑ | | ↑ | | ↑ | ↑ |
| Valvular HD | Total | ↑ | | ↑ | | ▬ | | ↑ | ↑ |
| | Male | ↑ | | ↑ | | ↑ | | ↑ | ↑ |
| | Female | ↑ | | ↑ | | ↓ | | ↑ | ↑ |

Tables 6-4. Changes in patterns of incidence and case-fatality rates for heart disease (HD) and HD subtypes in Korea, 2006-2015 (continued).

| Variables | | Incidence Numbers | | Incidence rates | | | | Case-fatality | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Crude | | Age-standardized | | 30-day | 1-year |
| | | 2006 | 2015 | 2006 | 2015 | 2006 | 2015 | β | β |
| Heart Failure | Total | ↑ | | ↑ | | ↓ | | ↑ | ↑ |
| | Male | ↑ | | ↑ | | ↓ | | ↑ | ↑ |
| | Female | ↑ | | ↑ | | ↓ | | ↑ | ↑ |
| IHD | Total | ↑ | | ↓ | | ↓ | | ↓ | ↓ |
| | Male | ↑ | | ↑ | | ↓ | | ↓ | ↓ |
| | Female | ↓ | | ↓ | | ↓ | | ↓ | ↓ |
| HHD | Total | ↓ | | ↓ | | ↓ | | ↑ | ↓ |
| | Male | ↓ | | ↓ | | ↓ | | ↑ | ↑ |
| | Female | ↓ | | ↓ | | ↓ | | ↑ | ↓ |

Figure 6-1. Life's Simple 7

(American Heart Association)


Source: Salim et al. Heart disease and stroke statistics-2021 update. Circulation 2021;143:e486.

Major risk factors for cardiovascular disease in the currnet literature review demographic factors (age, sex), health habits (smoking, physical activity, obesity), and the prevalence of metabolic disorders (hypertension, diabetes, hypercholesterolemia) (Figure 6-1) (Kim et al. 2014; Kim et al. 2017; Tran et al. 2017).

The prevalence of obesity, hypertension, diabetes, and hypercholesterolemia, had changed slightly during the study period, in contrast to the prevalence of smoking (Table 6-5; Figures 6-2 to 6-6). From 2007 to 2018, the prevalence of hypercholesterolemia increased more than two-fold; the prevalence of hypertension and diabetes was not large, though both males and females showed a tendency toward an increasing prevalence (Korean National Health Nutrition Examination Survey [KNHANES]).

Although the smoking rate in males decreased during the study period, the smoking rate in females increased, and the rate of physical activity and vegetable and fruit consumption decreased in both males and females. This seems to have worked in the direction of increasing the incidence of HD (KNHANES).

Fortunately, recognition rates, treatment rates, and control rates in all for hypercholesterolemia, hypertension, and diabetes have increased. This may have had an impact in the direction of decreasing HD (Tables 6-5; Figure 6-5 and 6-6).

These trends in risk factors could not explain the decreasing patterns for age-standardized incidence for overall HD, IHD, HF, and HHD over the 10-year study period. The increase in the number of healthy elderly individuals implies resulting increases in crude incidence rates and decreases in age-standardized incidence rates for overall HD and HF.

The extent to which risk factors for HD influenced the incidence and case-fatality rate for HD and its subtypes was not included in the scope of this study; this question needs to be evaluated in future studies.

Tables 6−5. Comparisons of health behaviors and health factors in Korea.

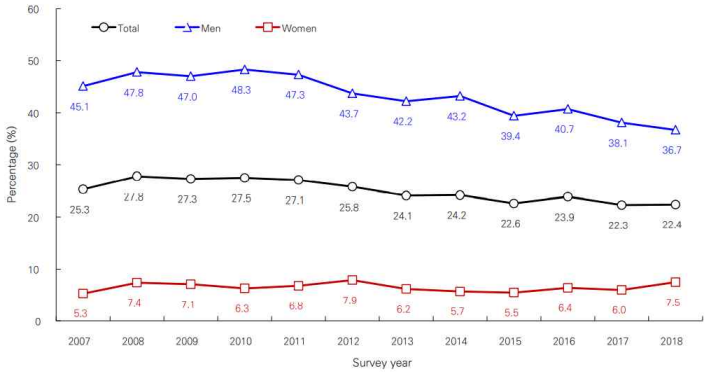
| Health Behaviors | Smoking | | Physical Activity | | Vegetable & Fruits | | Obesity | |
|---|---|---|---|---|---|---|---|---|
| | 2007 | 2018 | 2007 | 2017 | 1998 | 2019 | 2007 | 2018 |
| Total | 25.3 | 22.4 | 58.3 | 48.5 | 39.9 | 28.1 | 31.7 | 34.6 |
| Male | 45.1 | 36.7 | 45.7 | 39.0 | 41.5 | 31.1 | 36.2 | 42.8 |
| Female | 5.3 | 7.5 | 22.0 | 21.6 | 38.6 | 25.1 | 26.3 | 25.5 |

| Health Factors | Hypercholesterol | | Hypertension | | Diabetes | |
|---|---|---|---|---|---|---|
| | 2007 | 2017 | 2007 | 2018 | 2007 | 2018 |
| Total | 10.7 | 21.5 | 24.5 | 26.9 | 9.5 | 10.4 |
| Male | 9.3 | 20.0 | 26.8 | 32.5 | 11.8 | 12.9 |
| Female | 11.5 | 22.6 | 21.7 | 21.3 | 7.2 | 7.9 |

| Medical Cares | Hypercholesterol | | Hypertension | | Diabetes | |
|---|---|---|---|---|---|---|
| | 2007 | 2017 | 2007 | 2017 | 2005 | 2018 |
| Awareness | 38.8 | 58.9 | 66.3 | 69.3 | 68.3 | 71.5 |
| Treatment | 26.9 | 48.7 | 60.3 | 65.5 | 49.0 | 66.2 |
| Control | 20.3 | 41.7 | 42.1 | 48.4 | 23.0 | 31.1 |

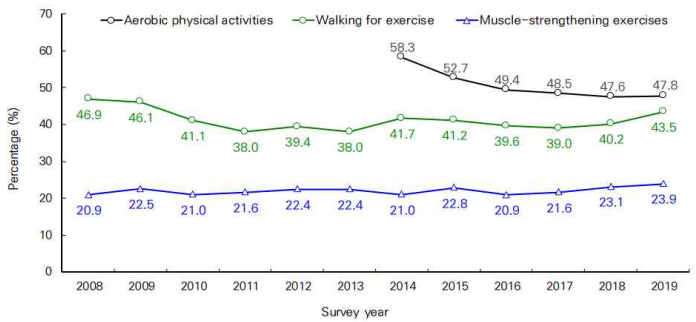
Figure 6−2. Trends in health behaviors in Korea, 2007−2018.

## Trends in current smoking rates




Source: Korea Health Statistics 2018. Korea National Health and Nutrition Examination Survey. http://knhanes.cdc.go.kr/ Trend of current smoking rates among Korean adults aged 19 years and over, 2007-2018.

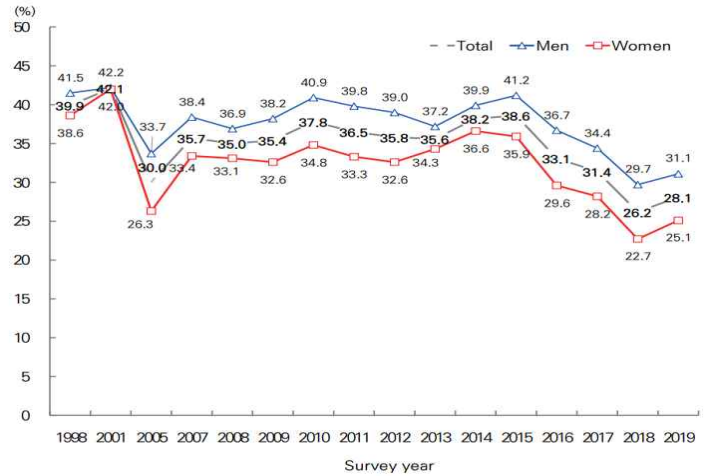
## Trends in physical activity

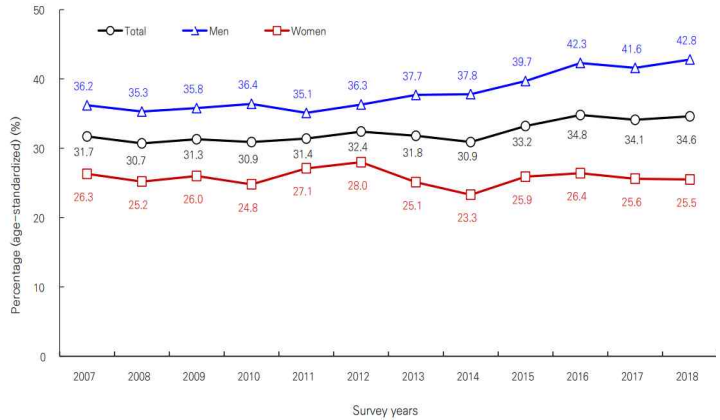



Source: Korea Health Statistics 2019. Korea National Health and Nutrition Examination Survey. http://knhanes.kdca.go.kr/ Rate of physical activity among Korean adults aged 19 years and over, 2008-2019.

Figure 6−3. Trends in health behaviors in Korea, 2007−2018 (continued).

| Trends in the proportion of consuming more than 500 g of vegetables and fruits per day | Trends in the prevalence of obesity |
|---|---|



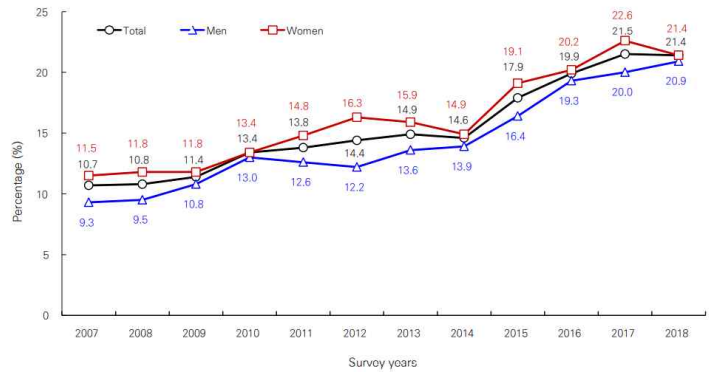




Source: Korea Health Statistics 2019. Korea National Health and Nutrition Examination Survey. http://knhanes.cdc.go.kr/ Trends in the proportion of consuming more than 500g of vegetables and fruits per day, 1998-2019.

Source: Korea Health Statistics 2018. Korea National Health and Nutrition Examination Survey. http://knhanes.cdc.go.kr/ Trends in prevalence of obesity among Korean adults aged 19 years and over, 2007-2018.

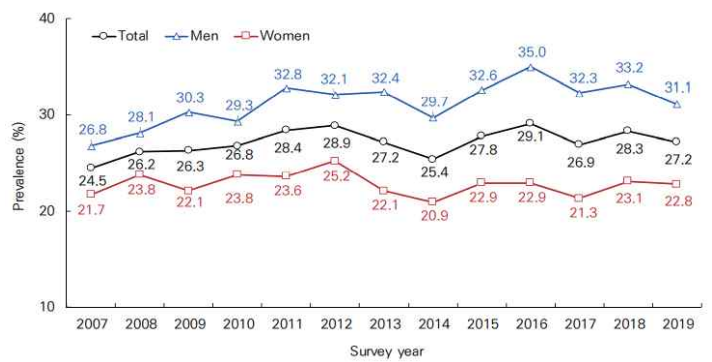
Figure 6−4. Trends in health factors in Korea, 2007−2018.

Trends of Prevalence of Hypercholesterolemia




Source: Korea Health Statistics 2018. Korea National Health and Nutrition Examination Survey. http://knhanes.cdc.go.kr/ Trends of hypercholesterolemia among those aged 30 years and over, 2007-2018.

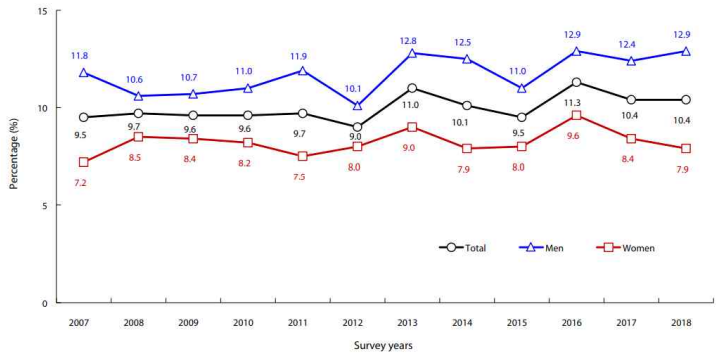
Trends of Prevalence of Hypertension




Source: Korea Health Statistics 2019. Korea National Health and Nutrition Examination Survey. http://knhanes.kdca.go.kr/ Rates of hypertension awareness, treatment, and control among Korean adults aged ≥ 30 years, 2007-2019.

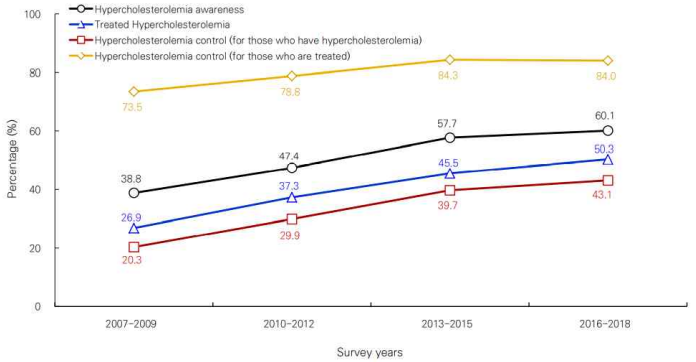
Figure 6−5. Trends in health factors in Korea, 2007−2018 (continued).

## Trends in diabetes prevalence




Source: Korea Health Statistics 2018. Korea National Health and Nutrition Examination Survey. http://knhanes.cdc.go.kr/ Trends in prevalence of diabetes among adults aged 30 years and over, 2007-2018.

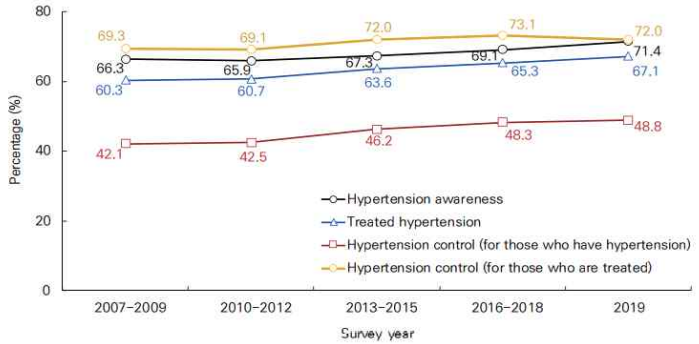
## Trends in hypercholesterolmia awareness, treatment and control



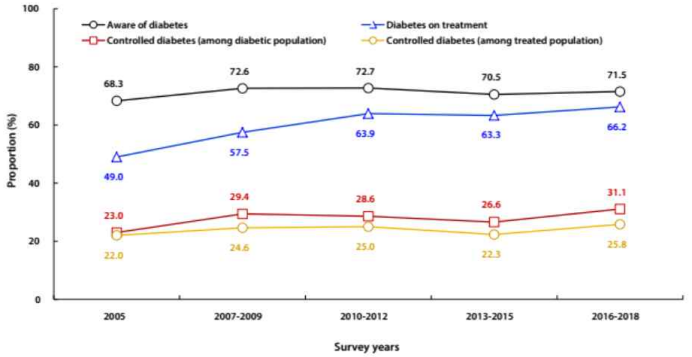

Source: Korea Health Statistics 2018. Korea National Health and Nutrition Examination Survey. http://knhanes.cdc.go.kr/ Trends in awareness, treatment and control of hypercholesterolemia (age ≥ 30 years), 2007-2018.

Figure 6−6. Trends in health factors in Korea, 2007−2018 (continued).

| Trends in hypertension awareness, treatment and control | Trends in diabetes awareness, treatment and control |
|---|---|




Source: Korea Health Statistics 2019. Korea National Health and Nutrition Examination Survey. http://knhanes.kdca.go.kr/ Rates of hypertension awareness, treatment, and control among Korean adults aged ≥ 30 years, 2007-2019.




Source: Korea Health Statistics 2019. Korea National Health and Nutrition Examination Survey. http://knhanes.kdca.go.kr/ Proportions of diabetes awareness, treatment, and control in Korean adults aged 30 years and over, 2005-2018.

To our kowledge, there have been three studies conducted in Korea regarding trends in AMI incidence; these studies used different methods to identify inpatients based on diagnostic codes and time periods, hence making study comparisons difficult. One study examined AMI incidence trends using primary and secondary diagnoses for inpatients diagnosed between 1997 and 2007, and revealed that the age-standardized incidence rates increased from 50.4 per 100,000 persons in 1997 to 78.3 per 100,000 persons in 2007 (Hong et al. 2009). Ather study conducted using primary inpatient diagnoses between 2006 and 2010 revealed that age-standardized incidence rates decreased from 45.7 per 100,000 persons in 2006 to 29.4 per 100,000 persons in 2010 (Kim et al. 2013). The third study (conducted between 2007 and 2016 based primary diagnoses), reported that age-standardized incidence rates decreased from 53.6 per 100,000 persons in 2007 to 38.9 per 100,000 persons in 2011, followed an increase from 39.5 per 100,000 in 2012 to 43.2 per 100,000 in 2016 (Kim et al. 2019). However, it is not appropriate to compare the trends in these results with those of our study because the target disease, diagnosis criteria, and criteria for calculating the incidence were different (i.e., they did not include out-oh-hospital HD deaths).

Our analysis included evaluations of IHD incidence, (not AMI alone; ICD-10 codes for IHD: I20-I23, ICD-10 code for AMI: I21). IHD has three subtypes: angina pectoris (ICD-10 code: I20), MI (ICD-10 codes: I21-I22), and IHD (others diagnoses) (ICD-10 codes: I23-I25). One study on IHD mortality trends, showed a steady increase in mortality from 1985 to 2009 (Lee et al. 2012). However, the research calculated age-adjusted mortality rates based on age-groups; hence, the results of this study could not be compared with the case-fatality rates in our study. Another study calculated the 7-day, 30-day, 90-day, and 1-year and 3-year cumulative AMI case-fatality trends between 2007 and 2016. A decrease in case-fatality rates was noted over the course of 10

years, but this finding was for all-cause fatality and not for death according to HD subtypes, thereby preventing comparison with our results.

The mortality rate for IHD has been gradually decreasing in Western countries since 1964 (age-standardized mortality rates per 100,000 people: 341.4 in 1964, 295.0 in 1970, 254.7 in 1980, 242.6 in 1990, 196.2 in 2000, 141.7 in 2010, and 116.8 in 2017) (Ford et al. 2014; OECD 2020). However, IHD remains the number one cause of death globally, accounting for 16.6% of the world's deaths in 2016, and mortality rates for IHD will continue to increase according to the trends of previous years (13.4% in 2000, 14.5% in 2005, 15.6% in 2010) (WHO 2016). In Korea, although the age-standardized mortality rate decreased after reaching its highest point (in 2002 for males and in 2003 for females) (Lee et al. 2015), deaths and crude mortality rates for IHD have continuously increased. The mortality rate per 100,000 persons increased from 3.0 in 1983 to 30.6 in 2012 for males and from 1.6 in 1983 to 27.3 in 2012 for females (Lee et al. 2015).

As per the data we collected from the Korean population over the course of 10 years (2006-2015), overall trends in the incidence of IHD showed that the incidence and the mean age of IHD increased during this period, but crude incidence rates and age-standardized incidence rates per 100,000 people decreased. However, the incidence of IHD and its subtypes showed different patterns over a 10-year period.

MI is a highly researched disease due to its high fatality and severity as compared to other IHD subtypes. AMI is a serious clinical manifestation of CAD and is particularly associated with a high mortality rate during hospitalization (Zhang et al. 2016). In the UK, the incidence of MI has decreased by 33% among men and by 31% among women (Smolina et al. 2012). Studies in China, Japan, and Singapore have reported that the incidence of IHD has

increased slightly since 2011 (Zhang et al. 2016; Khoo et al. 2014; Ishihara et al. 2015). Many countries, including countries in Asia, have reported on recent trends in the incidence of IHD (Zhang et al. 2016; Smolina et al. 2012; Khoo et al. 2014; McManus et al. 2011; Sugiyama et al. 2015; Ishihara et al. 2015; Taguchi et al. 2017). Three studies reported increasing trends for AMI incidence in Korea (Hong et al. 2009; Kim et al. 2013; Kim et al. 2019), of which one showed that age-standardized incidence rates decreased from 53.6 per 100,000 in 2007 to 38.9 per 100,000 in 2011 and increased from 39.5 per 100,000 in 2012 to 43.2 per 100,000 in 2016 (Kim et al. 2019).

The two major subtypes of AMI, STEMI and NSTEMI, have different outcomes and treatment options (Zhang et al. 2016). According to the most recent data on discharged patients in the United States and Europe, hospitalization for AMI has decreased and the ratio of STEMI to NSTEMI has increased (McManus et al. 2011; Sugiyama et al. 2015). In Western countries, NSTEMI is present in the majority of MI patients, whereas STEMI accounts for 60-80% of patients in Asia (Ishihara et al. 2015; Taguch et al. 2017). In Japan, 77% of all MI patients had STEMI, and this rate increase from 2005 to 2014 (Taguchi et al. 2017). Many studies on MI in Asian countries have noted a sizeable shift in STEMI and NSTEMI ratios, and the incidence of both subtypes is increasing. According to the Korean Acute Myocardial Infarction Registry (KAMIR), STEMI incidence decreased from 64.3% in 2005 to 48.4% in 2018, and the STEMI/NSTEMI ratio reversed in 2012 (Kim et al. 2019; Sim et al. 2017).

This change may have been influenced by the increasing use of cardioprotective drugs, such as statins, ACE blockers, beta-blockers, and aspirin, all of which lower the risk of STEMI (Zhang et al. 2016). Sensitive cardiac-specific analyses, such as high-sensitivity troponin analyses, may have contributed to the increase in NSTEMI by detecting myocardial necrosis in patients

who were previously diagnosed with unstable AP (Kim et al. 2019). There is a high probability of NSTEMI appearing in elderly patients with comorbid diseases (Zhang et al. 2016), and incidence is expected to increase because of the increase in the age of the population as well as the increasing prevalence of cardiovascular risk factors in Korea.

Apart from STEMI and NSTEMI, there is little evidence regarding trends in the incidence of other MI subtypes. In our study, the observed decrease in the age-standardized incidence of MI was due solely to the decrease in the incidence of miscellaneous (other) MI diagnoses; however, the number of occurrences of STEMI and NSTEMI also increased continuously. Trends for MI in Korea are more important because 40% of MI cases are diagnosed as non-specific MI (ICD-10 I21.9, I22.9). Compared to the 8.8% hospitalization rate for miscellaneous (other) MI diagnoses in Beijing (Zhang et al. 2016), our data showed that the tendency to diagnose non-specific MI in Korea was quite high.

There are currently limited data that quantify the prevalence or severity of AP. Unlike patients with acute coronary syndrome (ACS), patients with CAD are mainly managed in an outpatient setting (Kureshi et al. 2017). This may have led us to underestimate the number of patients with AP, as we included only inpatients who were hospitalized with AP. Therefore, it is important to monitor the temporal trends in the incidence for inpatients with AP. Although the incidence of variant AP was lower than that of other AP subtypes, it was similar to that of NSTEMI and STEMI. Thus, it is necessary to investigate the cause of increasing incidence patterns.

The 7-day and 30-day case fatalities of the miscellaneous (other) MI diagnoses were higher than those of NSTEMI and STEMI and showed an increasing trend (Tables 6-7 to 6-11). In

particular, the case-fatality rates for MI in females were relatively higher than those in males; the 7-day case-fatality rate for miscellaneous other (MI) diagnoses was approximately 8%, the 30-day rate was approximately 12%, the 1-year rate was approximately 16%, the 3-year rate was approximately 20%, and the 5-year rate was approximately 23% (Tables 4-32). Although the incidence of MI has decreased (according to several studies that investigated only STEMI and NSTEMI), it is necessary to identify the cause of higher case-fatality rates in women and to continuously monitor changes in case-fatality rates.

Based on these observations, we believe that it is imperative to continuously monitor incidence rates for STEMI, NSTEMI, and variant AP and case-fatality rates for miscellaneous (other) MI diagnoses, STEMI, NSTEMI, and other IHD diagnoses. Tracking MI is particularly important because of its higher incidence and case-fatality rates.

MI is a highly researched disease due to its high fatality and severity compared to other IHD subtypes. AMI is a serious clinical manifestation of CAD and is particularly associated with a high mortality rate during hospitalization. Many countries, including those in Asia, have reported recent trends with respect to the incidence of IHD. According to the most recent data on discharged patients in the United States and Europe, hospitalization for AMI has decreased and the ratio of STEMI to NSTEMI has increased. In Western countries, NSTEMI is present in the majority of MI patients, whereas STEMI accounts for 60-80% of MI patients in Asia. This change may have been influenced by the increasing use of cardioprotective drugs, such as statins, angiotensin-converting enzyme inhibitors, beta-blockers, and aspirin, all of which to lower the risk of STEMI. Sensitive cardiac-specific analyses, such as high-sensitivity troponin analyses, may have contributed to the increase in NSTEMI by detecting myocardial necrosis in patients who were previously diagnosed with unstable AP. There is a high

probability of NSTEMI appearing in elderly patients with comorbid diseases, and its incidence is expected to increase because of the increase in the age of the population and the concomitant increasing the prevalence of cardiovascular risk factors in Korea.

Tables 6-6. Comparisons of incidence and case-fatality rates for ischemic heart disease (IHD) and IHD subtypes in Korea, 2006-2015.

| Variables | | Incidence Numbers | | Incidence rates | | | | Case-fatality | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Crude | | Age-standardized | | 30-day | | | 1-year | | |
| | | 2006 | 2015 | 2006 | 2015 | 2006 | 2015 | 2006 | 2015 | β | 2006 | 2015 | β |
| IHD | Total | 80,040 | 82,296 | 162.6 | 158.2 | 143.9 | 103.5 | 1.8 | 1.7 | -0.0179 | 3.3 | 2.8 | -0.0355 |
| | Male | 44,342 | 51,118 | 179.3 | 196.1 | 176.1 | 140.7 | 1.5 | 1.4 | -0.0214 | 2.8 | 2.3 | -0.0358 |
| | Female | 35,698 | 31,178 | 145.7 | 120.1 | 115.1 | 69.1 | 2.1 | 2.3 | -0.0041 | 3.9 | 3.6 | -0.0212 |
| IHD-others | Total | 17,983 | 20,843 | 36.5 | 40.1 | 32.6 | 25.9 | 1.2 | 1.5 | 0.0137 | 3.1 | 3.2 | 0.0016 |
| | Male | 10,162 | 13,194 | 41.1 | 50.6 | 41.1 | 36.5 | 0.9 | 1.2 | 0.0143 | 2.4 | 2.7 | 0.0035 |
| | Female | 7,821 | 7,649 | 31.9 | 29.5 | 25.0 | 16.3 | 1.5 | 1.9 | 0.0187 | 4.2 | 4.1 | 0.0128 |
| MI | Total | 19,815 | 23,903 | 40.2 | 45.9 | 36.1 | 29.9 | 5.3 | 6.9 | -0.0988 | 8.2 | 6.8 | -0.1601 |
| | Male | 12,534 | 17,353 | 50.7 | 66.6 | 51.3 | 48.3 | 4.0 | 3.6 | -0.0888 | 6.4 | 5.1 | -0.1130 |
| | Female | 7,281 | 6,550 | 29.7 | 25.2 | 22.8 | 13.2 | 7.5 | 8.9 | -0.0136 | 11.5 | 12.4 | -0.0629 |
| AP | Total | 55,065 | 55,971 | 111.8 | 107.6 | 98.3 | 70.5 | 0.4 | 0.4 | -0.0064 | 1.3 | 1.1 | -0.0028 |
| | Male | 29,983 | 33,775 | 121.2 | 129.6 | 117.1 | 92.4 | 0.4 | 0.5 | -0.0001 | 1.2 | 1.2 | 0.0005 |
| | Female | 25,082 | 22,196 | 102.4 | 85.5 | 81.5 | 50.4 | 0.5 | 0.4 | -0.0023 | 1.4 | 1.2 | -0.0071 |

Tables 6-7. Comparisons of incidence and case-fatality rates for ischemic heart disease (IHD) and IHD subtypes in Korea, 2006-2015 (continued).

| Variables | | Incidence Numbers | | Incidence rates | | | | Case-fatality | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Crude | | Age-standardized | | 30-day | | | 1-year | | |
| | | 2006 | 2015 | 2006 | 2015 | 2006 | 2015 | 2006 | 2015 | β | 2006 | 2015 | β |
| NSTEMI | Total | 975 | 7,246 | 2.0 | 13.9 | 1.8 | 9.1 | 5.0 | 4.1 | -0.0852 | 8.9 | 6.4 | -0.1591 |
| | Male | 605 | 4,938 | 2.4 | 18.9 | 2.5 | 13.7 | 4.0 | 3.2 | -0.0892 | 7.4 | 5.2 | -0.1152 |
| | Female | 370 | 2,308 | 1.5 | 8.9 | 1.2 | 4.8 | 6.8 | 6.2 | -0.0381 | 11.4 | 9.2 | -0.1622 |
| STEMI | Total | 4,644 | 7,218 | 9.4 | 13.9 | 8.4 | 9.1 | 4.0 | 4.1 | 0.0481 | 6.9 | 6.0 | 0.0033 |
| | Male | 3,137 | 5,517 | 12.7 | 21.2 | 12.5 | 15.2 | 3.3 | 3.4 | 0.0218 | 5.8 | 4.7 | -0.0097 |
| | Female | 1,507 | 1,701 | 6.1 | 6.6 | 4.7 | 3.5 | 5.7 | 7.5 | 0.2065 | 9.2 | 10.3 | 0.1658 |
| Variant AP | Total | 4,584 | 7,417 | 9.3 | 14.3 | 8.0 | 9.9 | 0.2 | 0.2 | 0.0041 | 0.6 | 0.5 | 0.0020 |
| | Male | 2,607 | 4,438 | 10.5 | 17.0 | 9.5 | 12.2 | 0.2 | 0.2 | 0.0044 | 0.7 | 0.8 | -0.0023 |
| | Female | 1,977 | 2,979 | 8.1 | 11.5 | 6.6 | 7.5 | 0.0 | 0.1 | 0.0031 | 0.4 | 0.1 | 0.0124 |

NSTEMI: non-ST evelation myocardial infarction; STEMI: ST-elevation myocardial infarction.

Tables 6-8. Comparisons of incidence and case-fatality rates for ischemic heart disease (IHD) and IHD subtypes in Korea, 2006-2015 (continued).

| Variables | | Incidence Numbers | | Incidence rates | | | | Case-fatality | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Crude | | Age-standardized | | 30-day | | | 1-year | | |
| | | 2006 | 2015 | 2006 | 2015 | 2006 | 2015 | 2006 | 2015 | β | 2006 | 2015 | β |
| Stable AP | Total | 28,860 | 33,616 | 58.6 | 64.6 | 51.5 | 42.0 | 0.3 | 0.4 | 0.0027 | 1.1 | 1.3 | 0.0042 |
| | Male | 15,329 | 19,748 | 62.0 | 75.8 | 59.9 | 54.1 | 0.3 | 0.5 | 0.0041 | 1.0 | 1.1 | 0.0095 |
| | Female | 13,531 | 13,868 | 55.2 | 53.4 | 44.1 | 31.1 | 0.4 | 0.4 | 0.0018 | 1.2 | 1.3 | -0.0017 |
| Unstable AP | Total | 24,435 | 23,524 | 49.6 | 45.2 | 43.7 | 29.3 | 0.5 | 0.5 | -0.0044 | 1.6 | 1.3 | -0.0083 |
| | Male | 13,988 | 14,849 | 56.6 | 57.0 | 55.0 | 40.4 | 0.4 | 0.4 | -0.0052 | 1.5 | 1.2 | -0.0106 |
| | Female | 10,477 | 8,675 | 42.6 | 33.4 | 33.6 | 19.2 | 0.6 | 0.6 | -0.0020 | 1.8 | 1.5 | -0.0021 |
| MI-others | Total | 13,716 | 10,215 | 27.9 | 19.6 | 25.0 | 12.8 | 5.3 | 6.9 | 0.0161 | 8.5 | 9.6 | 0.0018 |
| | Male | 8,677 | 7,092 | 35.1 | 27.2 | 35.5 | 19.8 | 4.0 | 4.8 | -0.0161 | 6.3 | 6.8 | -0.0384 |
| | Female | 5,039 | 3,123 | 20.6 | 12.0 | 15.8 | 6.3 | 7.8 | 11.5 | 0.1617 | 12.4 | 16.2 | 0.2041 |

Tables 6-9. Changes in the patterns of incidence and case-fatality rates for ischemic heart disease (IHD) and IHD subtypes in Korea, 2006-2015.

| Variables | | Incidence Numbers | | Incidence rates | | | | Case-fatality | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Crude | | Age-standardized | | 30-day | 1-year |
| | | 2006 | 2015 | 2006 | 2015 | 2006 | 2015 | β | β |
| Ischemic Heart Disease | Total | ↑ | | ↓ | | ↓ | | ↓ | ↓ |
| | Male | ↑ | | ↑ | | ↓ | | ↓ | ↓ |
| | Female | ↓ | | ↓ | | ↓ | | ↓ | ↓ |
| IHD-Others | Total | ↑ | | ↑ | | ↓ | | ↑ | ↑ |
| | Male | ↑ | | ↑ | | ↓ | | ↑ | ↑ |
| | Female | ↓ | | ↓ | | ↓ | | ↑ | ↑ |
| Myocardial Infarction | Total | ↑ | | ↑ | | ↓ | | ↓ | ↓ |
| | Male | ↑ | | ↑ | | ↓ | | ↓ | ↓ |
| | Female | ↓ | | ↓ | | ↓ | | ↓ | ↓ |
| Angina Pectoris | Total | ↑ | | ↓ | | ↓ | | ↓ | ↓ |
| | Male | ↑ | | ↑ | | ↓ | | ↓ | ↑ |
| | Female | ↓ | | ↓ | | ↓ | | ↓ | ↓ |

Tables 6-10. Changes in the patterns of incidence and case-fatality rates for ischemic heart disease (IHD) and IHD subtypes in Korea, 2006-2015 (continued).

| Variables | | Incidence Numbers | | Incidence rates | | | | Case-fatality | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Crude | | Age-standardized | | 30-day | 1-year |
| | | 2006 | 2015 | 2006 | 2015 | 2006 | 2015 | β | β |
| NSTEMI | Total | ↑ | | ↑ | | ↑ | | ↓ | ↓ |
| | Male | ↑ | | ↑ | | ↑ | | ↓ | ↓ |
| | Female | ↑ | | ↑ | | ↑ | | ↓ | ↓ |
| STEMI | Total | ↑ | | ↑ | | ↑ | | ↑ | ↑ |
| | Male | ↑ | | ↑ | | ↑ | | ↑ | ↓ |
| | Female | ↑ | | ↑ | | ↓ | | ↑ | ↑ |
| Variant AP | Total | ↑ | | ↑ | | ↑ | | ↑ | ↑ |
| | Male | ↑ | | ↑ | | ↑ | | ↑ | ↓ |
| | Female | ↑ | | ↑ | | ↑ | | ↑ | ↑ |

NSTEMI: non-ST evelation myocardial infarction; STEMI: ST-elevation myocardial infarction.

Tables 6-11. Changes in the patterns of incidence and case-fatality rates for ischemic heart disease (IHD) and IHD subtypes in Korea, 2006-2015 (continued).

| Variables | | Incidence Numbers | | Incidence rates | | | | Case-fatality | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Crude | | Age-standardized | | 30-day | 1-year |
| | | 2006 | 2015 | 2006 | 2015 | 2006 | 2015 | β | β |
| Stable AP | Total | ↑ | | ↑ | | ↓ | | ↑ | ↑ |
| | Male | ↑ | | ↑ | | ↓ | | ↑ | ↑ |
| | Female | ↑ | | ↓ | | ↓ | | ↑ | ↓ |
| Unstable AP | Total | ↓ | | ↓ | | ↓ | | ↓ | ↓ |
| | Male | ↑ | | ↑ | | ↓ | | ↓ | ↓ |
| | Female | ↓ | | ↓ | | ↓ | | ↓ | ↓ |
| MI-others | Total | ↓ | | ↓ | | ↓ | | ↑ | ↑ |
| | Male | ↓ | | ↓ | | ↓ | | ↓ | ↓ |
| | Female | ↓ | | ↓ | | ↓ | | ↑ | ↑ |

Studies on the incidence of arrhythmia in other countries were difficult to find, though the results with respect to the incidence of AF were relatively easy to confirm in studies conducted in Western populations, Japan, and China. However, it was not easy to compare the incidence rates of arrhythmia within this study as most of the studies focusing on AF have targeted a certain age and have been locally based.

The incidence and crude rates for cardiac arrhythmia in the total populations, as well as for male and female patients, have increased significantly over the last 10 years (Tables 6-12 and 6-13). The incidence of arrhythmia has doubled in the last 10 years. The age-standardized incidence rates of arrhythmia have increased in both men and women. During the last 10 years, 7-day, 30-day, 1-year, 3-year, and 5-year cumulative case-fatality rates for cardiac arrhythmia and its subtypes have changed little.

AF is the most common type of cardiac arrhythmia. AF involves a wide spectrum of arrhythmias, including lone AF, paroxysmal AF, and chronic AF. It is likely that AF comprises a spectrum of diseases with no single mechanism adequately explaining AF and its variability (Joung 2011). Therefore, AF is often detected during health screening or accidentally during testing for other diseases as some patients lack clinical symptoms (Joung 2018), particularly, for HD does not cause significant clinical disorders (Joung 2011). The detection rate for AF is low in clinical practice and there is very limited information on the incidence of cardiac arrhythmia in Korea.

Studies on the incidence of arrhythmia in other countries were difficult to find; the results for the incidence of AF were relatively easy to confirm in Western populations, in Japan, and in China. However, it was not easy to compare the incidence rates of arrhythmia with those of this study as most of the studies focusing on AF have targeted a certain age and/or local residents.

AF represents an increasing public health challenge with profound social and economic implications (Ball et al. 2013). It is thought that the increase in the elderly population, improvements in the treatment of ACD, improvement in the treatment of hypertension and diabetes, and decreases in mortality rate contribute in part to the observed trends. AF is clearly associated with considerable morbidity and mortality within populations whose survival from other clinical conditions is improving. New therapeutics have and will continue to be developed with the goal of improving the pharmaceutical management of patients with AF; currently, the acceptance and use of anticoagulation therapy varies widely among countries (Lip et al. 2012).

Tables 6-12. Comparisons of incidence and case-fatality rates by cardiac arrhythmia and cardiac arrhythmia subtypes in Korea (2006-2015).

| Variables | | Incidence Numbers | | Incidence rates | | | | Case-fatality | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Crude | | Age-standardized | | 30-day | | | 1-year | | |
| | | 2006 | 2015 | 2006 | 2015 | 2006 | 2015 | 2006 | 2015 | β | 2006 | 2015 | β |
| Arrhythmia | Total | 12,156 | 22,325 | 24.7 | 42.9 | 22.6 | 30.1 | 0.9 | 1.3 | 0.0118 | 2.5 | 3.1 | 0.0200 |
| | Male | 543 | 11,373 | 24.0 | 43.6 | 24.7 | 34.1 | 0.8 | 1.3 | 0.0175 | 2.0 | 2.6 | 0.0150 |
| | Female | 6,213 | 10,952 | 25.4 | 42.2 | 20.7 | 26.4 | 0.9 | 1.4 | 0.0071 | 2.9 | 3.6 | 0.0265 |
| AF & Flutter | Total | 6,278 | 13,823 | 12.8 | 26.6 | 11.6 | 17.2 | 0.8 | 1.4 | 0.0106 | 3.1 | 3.6 | 0.0217 |
| | Male | 3,264 | 7,563 | 13.2 | 29.0 | 13.8 | 21.7 | 0.5 | 1.1 | 0.0141 | 2.2 | 2.7 | 0.0116 |
| | Female | 3,014 | 6,260 | 12.3 | 24.1 | 9.6 | 13.2 | 1.0 | 1.6 | 0.0091 | 4.2 | 4.7 | 0.0375 |
| Tachycardia | Total | 3,380 | 5,204 | 6.9 | 10.0 | 6.4 | 8.3 | 0.6 | 0.8 | 0.0172 | 1.1 | 1.7 | 0.0192 |
| | Male | 1,682 | 2,415 | 6.8 | 9.3 | 6.7 | 8.0 | 0.8 | 1.1 | 0.0227 | 1.2 | 2.0 | 0.0270 |
| | Female | 1,698 | 2,789 | 6.9 | 10.7 | 6.1 | 8.6 | 0.4 | 0.6 | 0.0136 | 1.0 | 1.5 | 0.0138 |
| Arrhythmia -others | Total | 2,947 | 4,698 | 6.0 | 9.0 | 5.5 | 6.3 | 1.2 | 1.6 | 0.0071 | 2.6 | 3.1 | 0.0023 |
| | Male | 1,225 | 2,086 | 5.0 | 8.0 | 5.2 | 6.4 | 1.3 | 1.9 | 0.0301 | 2.7 | 3.0 | 0.0131 |
| | Female | 1,722 | 2,612 | 7.0 | 10.1 | 5.7 | 6.2 | 1.2 | 1.5 | -0.0108 | 2.6 | 3.2 | -0.0057 |

Tables 6-13. Change patterns of incidence and case-fatality rates by cardiac arrhythmia and cardiac arrhythmia subtypes in Korea (2006-2015).

| Variables | | Incidence Numbers | | Incidence rates | | | | Case-fatality | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Crude | | Age-standardized | | 30-day | 1-year |
| | | 2006 | 2015 | 2006 | 2015 | 2006 | 2015 | β | β |
| Arrhythmia | Total | ↑ | | ↑ | | ↑ | | ↑ | ↑ |
| | Male | ↑ | | ↑ | | ↑ | | ↑ | ↑ |
| | Female | ↑ | | ↑ | | ↑ | | ↑ | ↑ |
| AF & Flutter | Total | ↑ | | ↑ | | ↑ | | ↑ | ↑ |
| | Male | ↑ | | ↑ | | ↑ | | ↑ | ↑ |
| | Female | ↑ | | ↑ | | ↑ | | ↑ | ↑ |
| Tachycardia | Total | ↑ | | ↑ | | ↑ | | ↑ | ↑ |
| | Male | ↑ | | ↑ | | ↑ | | ↑ | ↑ |
| | Female | ↑ | | ↑ | | ↑ | | ↑ | ↑ |
| Arrhythmia -others | Total | ↑ | | ↑ | | ↑ | | ↑ | ↑ |
| | Male | ↑ | | ↑ | | ↑ | | ↑ | ↑ |
| | Female | ↑ | | ↑ | | ↑ | | ↓ | ↓ |

## 6.2. Conclusions

Between 2006 and 2015, the crude incidence rates for overall HD have changed little, but the age-standardized incidence of HD has declined markedly. The reduction in IHD rates has contributed to this. However, incidence rates have increased for arrhythmia, miscellaneous (others) HD diagnoses, and pulmonary HD and case-fatality rates have increased for HF, valvular HD, and miscellaneous (other) HD diagnoses.

For IHD, the crude and age-standardized incidence rates for IHD, stable AP, unstable AP, and MI decreased during the course of the study. However, the incidence of NSTEMI, STEMI, and variant AP increased, and the incidence of NSTEMI increased dramatically over the last 10 years. The 5-year cumulative case-fatality rate for MI in women was approximately 23%.

Incidence, crude incidence rates, and age-standardized incidence rates for cardiac arrhythmia in both men and women increased significantly over the last 10 years. Incidence and crude rates for AF and flutter increased more than two-fold, and rates of both tachycardia and miscellaneous (other) arrhythmia diagnoses increased. However, the case-fatality rates for cardiac arrhythmia and its subtypes have changed little over the last 10 years.

Korea established the first comprehensive plan for preventing and treating cardiovascular disease in 2018 and is striving for improving cardiovascular disease management in all directions. The main strategies for implementation include improving public awareness, increasing the prevalence of healthy lifestyle choices, strengthening the management of high-risk groups, preventing disease, strengthening emergency response and treatment capabilities in the local community, establishing a patient persistence management system, and strengthening infrastructure, research, and research capability. To understand the current status of cardiovascular disease and to evaluate policy effects, it is

necessary to establish a representative monitoring system for the occurrence of cardiovascular disease, risk factors, and causes of disease. Monitoring continuously is important to reach these goal.

Therefore, we believe that it is essential to continuously monitor the incidence and case-fatality rates for HD and its subtypes, IHD and its subtypes, and cardiac arrhythmia, and its subtypes according to the same criteria. Our observations will be helpful for physicians and public health officials to modify public health priorities and recommend strategies for managing the spread of cardiovascular disease in Korea.

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# List of Abbreviations

| | |
|---|---|
| AMI | Acute Myocardial Infarction |
| AP | Angina Pectoris |
| AF | Atrial Fibrillation |
| CAD | Coronary Artery Disease |
| CHD | Coronary Heart Disease |
| HD | Heart Disease |
| HF | Heart Failure |
| HHD | Hypertensive Heart Disease |
| ICD-10 | International Classification Disease, 10th Revision |
| IHD | Ischemic Heart Disease |
| KAMIR | Korean Acute Myocardial Infarction Registry |
| MI | Myocardial Infarction |
| NHIS | National Health Insurance Service |
| NSTEMI | Non-ST elevation myocardial infarction |
| STEMI | ST-elevation myocardial infarction |

# Abstract in Korean

**연구배경** :

심장질환 특히, 허혈성 심장질환은 전 세계 사망의 16%를 차지하는 주요원인 1순위임. 서구 국가에서는 1990년대부터 1970년대까지 심장질환으로 인한 사망률이 급격히 증가하였고, 1970년대와 2000년대까지 높은 사망률을 유지하다가, 2000년대 이후 감소하는 추세를 보였음. 특히 미국에서 관상동맥질환은 1960년대 후반에 사망률에 정점을 찍고 지난 40년간 지속적으로 감소하고 있음

유럽 등 서구 국가에서는 1950년대 미국 프래밍햄 연구, 영국 화이트홀 연구 등 관상동맥 심장질환과 관련된 다수의 연구를 수행하였으나 심장질환의 정의와 모집단의 불일치와 같은 변이로 사망률, 이환율, 위험요인에 대한 정보가 부정확하고 국제적으로 비교하기가 어려웠음

보다 정확하고 국제적인 비교가 가능한 심장질환 역학지표를 산출하기 위해 1980년대 초부터 1990년대까지 유럽을 중심으로 세계보건기구는 21개 국가를 대상으로 '심혈관질환의 추세 및 결정요인에 대한 다국적 모니터링 연구'를 진행하여 심장질환 발생률과 치명률, 위험요인의 10년 추이를 조사함

미국심장협회에서는 2006년 이후 심장질환과 뇌졸중 역학지표에 대한 통계자료를 2021년 현재까지 매년 연례보고서로 발간하고 있음. 여기에는 심혈관질환의 건강행동, 건강요인과 위험요인, 심뇌혈관질환(심장질환, 뇌졸중, 심장리듬 이상, 심장마비, 관상동맥질환, 심근증, 심부전, 판막성질환, 뇌졸중 등), 건강결과(서비스의 질, 의료시술, 경제적 비용) 등이 포함됨

한국에서 심장질환은 암에 이어 사망원인 2위이며 2000년 이후 심장질환 사망률은 지속적으로 증가하고 있음. 한국에서도 2005년부터 '한국심근경색 등록사업', 2008년 '급성심장정지조사', '급성심부전증 등록사업'을 수행하고 있지만, 심장질환 전체와 심장질환 다양한 아형을 세부적으로 살펴보거나, 대표성을 가진 인구집단을 대상으로 역학적 자료를 확보하기에 어려움이 있음

심장질환 사망률의 변화는 발생률의 변화, 치명률의 변화 또는 두

가지 모두에 영향을 받음. 체계적 문헌검색 결과, 현재 한국에서는 심장질환 사망률 30년 추이 연구와 급성심근경색 혹은 허혈성심장질환의 발생률 추이에 대한 연구는 있었으나, 급성심근경색과 허혈성 심장질환 외 일반 인구를 대상으로 대표성을 지닌 심장질환 전체와 세부 아형 (허혈성 심장질환, 부정맥성 심장질환, 심부전, 고혈압성 심장질환, 폐성 심장질환, 판막성 심장질환, 기타 심장질환 등)의 발생률과 치명률 추이를 살펴본 연구는 부족했음

심장질환은 원인과 증상, 치료방법, 예후가 다른 다양한 심장질환 아형을 포함하므로, 심장질환 주요 아형별 발생률과 치명률의 장기적인 추이를 파악하는 것은 그 동안 수행되었던 심장질환건강 관리정책의 결과를 평가하고 피드백을 제공하며, 보건학적 우선순위를 재설정하고 이에 따라 자원을 할당하는데 통찰력을 제공할 수 있음

**연구목적** :

이 연구는 전체 심장질환과 그 세부 아형, 허혈성 심장질환과 그 세부 아형, 부정맥성 심장질환과 그 세부 아형의 발생률과 치명률에 대한 한국의 10년간 (2006년~2015년) 국가적 추이를 거시적으로 조망하고자 하였음

**연구방법** :

2003년~2015년 심장질환 입원환자의 국민건강보험공단 진료비 청구자료와 2006년~2017년 통계청 사망원인통계자료 중 심장질환으로 사망한 사람을 대상으로 비식별화된 개인번호를 연계하여 분석함. 발생률 산출을 위한 분모는 각 연도별 건강보험통계연보의 의료보장인구(건강보험+의료급여)를 기준으로 하였고, 연령표준화 발생률은 통계청에서 사망원인통계 작성 시 2005년 주민등록연앙인구를 표준인구로 사용하기 때문에 이와 동일하게 2005년 주민등록연앙인구를 표준인구로 활용하여 직접법으로 산출함. 치명률은 심장질환 최초 입원일과 심장질환으로 인한 사망일과의 차이를 기준으로 7일, 30일, 1년, 3년, 5년의 구간을 나누어 누적치명률을 산출함. 각 지표는 성별, 연령별, 14개 지역별로 구분하여 산출하였음

심장질환은 입원환자 주상병명을 기준으로 하였고, 제 10차 질병분류코드 I00~I09, I11, I13, I20~I52로 정의함. 발생자는

심장질환과 심장질환 아형별 최초 입원환자이거나 해당 질환을 원인으로 입원이용 없이 사망한 사람(통계청 사망자료 이용)으로 정의하였고, 2006년의 경우 2003~2005년 3개년간 wash-out 기간을 거침. 발생률이 상대적으로 높은 허혈성 심장질환과 부정맥성 심장질환은 추가적으로 세부 아형별 발생률과 치명률을 분석함

통계적인 추이분석은 Cochran-Armitage trend test를 이용함

**연구결과** :

2015년 기준 심장질환 전체 발생자 수는 125,388명이었고, 허혈성 심장질환 82,296명, 부정맥성 심장질환 22,325명, 심부전 18,123명, 기타 심장질환 15,609명 순이었음

2006년~2015년까지 심장질환 전체와 남자 심장질환의 발생자 수, 조발생률은 증가하였지만, 여성의 심장질환 발생자 수, 조발생률은 감소하였고, 남녀 모두 연령표준화 발생률은 감소하였음. 30일, 1년 치명률은 증가하는 경향을 보였으나 그 크기는 미미함

심장질환 아형별로는 고혈압성 심장질환의 경우 발생자 수, 조발생률, 연령표준화 발생률 모두 감소함. 허혈성 심장질환의 경우 전체와 남자의 발생자 수, 조발생률은 증가하였지만, 연령표준화 발생률은 감소하였음. 그 외 부정맥성 심장질환, 기타 심장질환, 폐성 심장질환, 판막성 심장질환, 심부전 등 다수의 심장질환의 경우 발생자 수와 조발생률은 증가함. 단, 심부전과 여자 판막성 심장질환의 경우 연령표준화 발생률은 감소함

심장질환 연령표준화 발생률이 가장 높은 지역은 전남이 인구 10만명 당 206.8명으로 가장 높았고, 부산 203.4명, 충북 198.9명, 광주 196.6명 순이었음. 대구는 발생률이 가장 낮아 인구 10만명 당 144.8명이었음. 남녀 모두에서 전남, 부산, 충북, 광주는 심장질환과 세부 아형의 높은 연령표준화 발생률을 보였음. 전남과 강원은 발생률과 치명률이 상대적으로 높은 지역이었고, 부산과 광주는 발생률은 높은 반면 치명률은 상대적으로 낮은 지역이었으나, 대구는 발생률은 낮은 반면 치명률은 상대적으로 높은 지역이었음

2015년 기준 허혈성 심장질환 아형별 발생자 수는 안정형 협심증 33,616명, 불안정형 협심증 23,524명, 기타 심근경색 10,215명, 변이형 협심증 7,417명, 비ST상승 심근경색 7,246명, ST상승 심근경색

7,218명 순이었음

협심증, 심근경색, 기타 허혈성 심장질환의 경우 연령표준화 발생률은 감소하는 것으로 나타났지만, 비ST상승 심근경색, ST상승 심근경색, 변이형 협심증에서는 발생자 수, 조발생률, 연령표준화 발생률이 증가하였음. 특히 남자 비ST상승 심근경색의 연령표준화 발생률은 2006년 인구 10만명 당 2.7명에서 2015년 14.8명으로 약 5배 이상 증가함

치명률의 경우 여성 비ST상승 심근경색의 30일, 1년 치명률과 여성 기타 심근경색의 30일, 1년 치명률의 상대적으로 높은 증가를 보였으나, 다른 허혈성 심장질환 세부 아형의 치명률은 감소하거나 증가 폭이 크지 않았음

2015년 기준 심방세동과 조동의 발생자 수는 13,823명, 발작성 빈맥은 5,204명, 기타 부정맥성 심장질환은 4,698명임

부정맥 심장질환은 발생자 수, 조발생률, 연령표준화 발생률, 7일 치명률, 30일 치명률 모두 증가하는 경향을 보임

**결론** :

전체 심장질환 연령표준화 발생률 감소의 추이는 허혈성 심장질환, 고혈압성 심장질환, 심부전의 발생률 감소가 영향을 미친 것으로 판단됨. 특히 발생자 비중이 상대적으로 큰 허혈성 심장질환의 세부 아형인 협심증의 영향이 큰 것으로 보임. 단, 연령표준화 발생률을 제외한 심장질환 전체의 발생자 수와 조발생률은 증가하고 있음

심방세동과 조동, 비ST상승 심근경색, ST상승 심근경색, 기타 심장질환, 변이형 협심증의 연령표준화 발생률이 상대적으로 크게 증가하고 있고, 여성의 비ST상승 심근경색과 기타 심근경색의 30일, 1년 치명률이 지속적으로 증가하고 있음

사회적으로 또한 경제적으로 심장질환 질병부담의 감소를 위해 심장질환과 그 세부 아형, 허혈성 심장질환과 그 세부 아형, 부정맥성 심장질환과 세부 아형의 발생률과 치명률을 동일한 기준에 따라 연도별로 지속적으로 모니터링하는 것은 중요함. 이 연구는 임상의와 보건의료 정책입안자들이 심장질환 관련 보건의료 정책의 우선순위를 재설정하고, 심장질환 관리와 예방방안을 모색하는데 도움이 될 수 있음

# 감사문

저를 끝까지 포기하지 않아주신 정해원 교수님, 조성일 교수님께 진심으로 감사드립니다. 인생에서 너무나 큰 은혜를 입었습니다. 지난 20년간 저를 끈질긴 인내와 사랑으로 지켜봐 주시고 옆에서 지켜주신 장신이 박사님, 김수영 교수님께 감사드립니다. 부족한 저의 연구를 탁월한 식견으로 조금은 부끄럽지 않은 결과물로 만들어 주신 정효지 교수님, 조영태 교수님, 하진 서기관님께 감사드립니다. 오랜 시간 실망시켜 얼굴뵙기조차 죄송스러운 김철웅 교수님과 이상이 교수님께 포기하지 않았다는 소식을 전해드릴 수 있음에 감사드립니다.

능력적으로나 인격적으로나 부족한 저에게 오랜 기간 배려해 주시고 참아주시고 끊임없이 기회를 주신 건강보험공단과 건강보험연구원 가족들에게도 감사드립니다.

내가 제일 사랑하는 엄마 이정례님, 아빠 서충일님, 같이 있어주는 것 만으로도 힘이 되던 동생 서수인, 서효인, 서효영, 서효현, 큰 선물인 조카 최수연, 최재윤, 그리고 항상 나의 곁에 있어주는 흰눈이, 까미, 꼬미와 작지만 소중한 개인적인 기쁨을 함께하고 싶습니다.

저의 인생에 함께해 주셔서 그 덕분에 지금까지 살아가고 있습니다. 진심으로 감사드립니다.