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Korea Heart Disease Fact Sheet 2020: Analysis of Nationwide Data

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AUTHOR'S SUMMARY

The Korean Society of Cardiology has recently published the Korea Heart Disease Fact Sheet 2020 to provide overview of the cardiovascular disease (CVD) burden and its temporal changes. CVD mortality, hospitalization, and risk factor distributions were analyzed from nationwide databases. Over the last decade, CVD mortality and hospitalization have increased, while their age-standardized rates have declined. In addition, a considerable proportion of adults had multiple risk factors, which markedly increased with older age. Thus, concerted efforts should be continued to address the rising burden of CVD in Korea.

ABSTRACT

Background and Objectives: Cardiovascular disease (CVD) is the leading cause of death and disability worldwide. To provide an overview of the temporal trends in the burden of CVD, the Korean Society of Cardiology has published the Korea Heart Disease Fact Sheet in 2020.
Methods: We analyzed anonymized data of the Causes of Death Statistics, National Health Insurance Claims Database, and Korea National Health and Nutrition Examination Survey to assess mortality, hospitalizations, and risk factors for CVD.
Results: The CVD mortality decreased until 2010, then steadily increased up to 123 per 100,000 persons in 2018. Since 2002, the number and rate of CVD hospitalization have continued to grow. In 2018, approximately 12.1 million Korean adults had hypertension, 4.3 million had diabetes, 8.7 million had hypercholesterolemia, 14.9 million had obesity, and 8.8 million were currently smoking. The number of risk factors increased markedly with older age; 58.4% of adults age ≥70 years had ≥2 risk factors.
Conclusions: CVD mortality and hospitalization have gradually increased in the last decade, and a substantially high proportion of adults were carrying more than 1 cardiovascular risk factor in 2018. With the rapid population aging, a continued increase in CVD appears inevitable in Korea. Concerted and sustained approaches are essential to achieve early prevention and reduce the burden of CVD.

Keywords: Circulatory system; Heart diseases; Hospitalization; Mortality; Risk factors

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INTRODUCTION

Cardiovascular disease (CVD) is the leading cause of death worldwide, accounting for nearly one-third of all deaths.[1][2] The same holds true for Korea, where heart disease has been the leading cause of death for nearly a decade.[3] Since a significant portion of CVD is preventable, the importance of adequate prevention strategies has long been emphasized.[4] To implement such strategies and subsequently reduce the burden of CVD, magnitude and temporal trends in mortality, morbidity, and risk factors of CVD need to be clearly identified. In Korea, the Statistics Korea (formerly the National Statistical Office) has annually released anonymized data on the causes of death since 1983 based on the death registry.[3] The temporal trend in CVD mortality has been repeatedly reported with this data.[5-7] On the contrary, nationally representative data on CVD morbidity are extremely limited, making it difficult to accurately assess the incidence and prevalence of CVD in Korea. Although there have been several studies estimating the burden of CVD using the National Health Insurance claims data that cover the entire Korean population,[8-13] most of the studies were confined to specific disease categories, such as myocardial infarction (MI),[8)9)] cerebrovascular diseases,[10)11)] or heart failure (HF).[12)13)] Moreover, substantial heterogeneity in study methods makes it inappropriate to compare their results directly. Regarding cardiovascular risk factors, fact sheets describing the prevalence and management status of hypertension, diabetes, dyslipidemia, obesity, and metabolic syndrome have been published by affiliated academic societies of Korea.[14-18] Nonetheless, comprehensive data summarizing the overall status of CVD in Korea has not been reported yet. Thus, we analyzed the temporal trends in CVD mortality, hospitalization, and risk factors based on nationally representative datasets on behalf of the Korean Society of Cardiology.

METHODS

Ethical statement
The present study complied with the Declaration of Helsinki and was approved by the Institutional Review Board of Yonsei University Health System, Seoul, Korea (No. 4-2020-0207). Informed consent was waived since this is a retrospective study of de-identified administrative data.

Classification of circulatory system diseases
All diseases of circulatory system were categorized into heart diseases, cerebrovascular diseases, and other circulatory diseases. Heart diseases were further classified into subcategories, including ischemic heart diseases (IHD), HF, and hypertension. MI was considered a subcomponent of IHD. The overall classification scheme and corresponding International Classification of Diseases-10 (ICD-10) codes are presented in **Table 1**.

Table 1. Classification of cardiovascular diseases

Disease category	ICD codes (10th revision)
All diseases of circulatory system	I00–I99
Heart diseases	I00–I13, I20–I28, I30–I51
Ischemic heart diseases	I20–I25
Myocardial infarction	I21–I23
Heart failure	I50
Hypertension	I10–I13
Cerebrovascular diseases	I60–I69
Other circulatory diseases	I15, I52, I70–I99

ICD, International Classification of Diseases.

Assessment of cardiovascular disease mortality

The Korean Statistical Information Service-Microdata Integrated Service (KOSIS-MDIS) covers the entire resident-registered population and a portion of unidentified individuals in Korea. Based on mortality data provided by the KOSIS-MDIS, we calculated the annual CVD mortality rate between 1983 and 2018. In addition, age-standardization was performed by the direct method to adjust for changing population structures over time. Specifically, the standardization was performed with the population structure of the resident-registered population in 2018 as a reference, separately by sex.

Assessment of cardiovascular disease hospitalizations

Using National Health Insurance Big Data (NHIBD), we evaluated the magnitude and temporal trends of CVD hospitalizations between 2002 and 2018 among adults aged ≥20 years covered by the National Health Insurance.[19] For each year, we estimated the number of people hospitalized for CVDs. Then, CVD hospitalization rate was defined as the number of people hospitalized for CVD over the total number of insured people in that year. Age-standardized hospitalization rates were calculated with the direct method based on the population structure of insured people in 2018. As a diagnosis code for hospitalization can be recorded either as a primary diagnosis or other diagnoses, numbers of adults hospitalized for CVDs were estimated separately based on (1) primary diagnosis and (2) all diagnoses during hospitalization.

Assessment of cardiovascular risk factors

Using the Korea National Health and Nutrition Examination Survey (KNHANES) data, we assessed the current CVD risk factor distribution among adults aged ≥20 years who completed the KNHANES in 2018. The five major CVD risk factors included hypertension, diabetes, hypercholesterolemia, obesity, and current smoking (**Table 2**). We estimated the number of adults with each risk factor based on the weighted prevalence calculated from the KNHANES data. The number of adults with dyslipidemia was also assessed. Subsequently, we categorized the participants by the number of major risk factors (0, 1, 2, and ≥3) and examined its distribution by age and sex. All analyses of the KNHANES data accounted for the complex survey design adopted in the KNHANES to generate nationally representative estimates for the noninstitutionalized Korean population.[20]

Statistical analysis

All statistical analyses were performed using SAS version 9.4 (SAS Institute Inc., Cary, NC, USA) and R version 4.0.3 (R Foundation for Statistical Computing, Vienna, Austria).

Table 2. Definition of cardiovascular risk factors

Risk factor	Definition
Hypertension	(1) Systolic blood pressure ≥140 mmHg or
	(2) Diastolic blood pressure ≥90 mmHg or
	(3) Taking antihypertensive agent
Diabetes	(1) Fasting blood glucose ≥126 mg/dL or
	(2) Taking oral hypoglycemic agent or under insulin therapy
Hypercholesterolemia	(1) Total cholesterol ≥240 mg/dL or
	(2) Taking lipid-lowering agent
Obesity	Body mass index ≥25 kg/m^2
Current smoking	Has smoked ≥100 cigarettes in lifetime and is currently smoking

Additionally, dyslipidemia was defined as (1) low-density lipoprotein cholesterol ≥160 mg/dL or (2) triglyceride ≥200 mg/dL or (3) high-density lipoprotein cholesterol <40 mg/dL or (4) taking lipid-lowering agent.

RESULTS

Cardiovascular disease mortality

The mortality rate due to all diseases of circulatory system declined until 2010 and steadily increased afterward up to 123 per 100,000 persons in 2018 (**Figure 1**, **Supplementary Table 1**). Such shift is most likely due to population aging, as the age-standardized mortality rate has continued to decrease even after 2010 (**Supplementary Figure 1**). There was also a transient peak in circulatory system diseases mortality around 1994 when the ICD system was revised from 9th to 10th revision. In the last decade, mortality due to heart diseases, IHD, HF, and hypertension have increased. During the same period, mortality due to MI has been stagnant, whereas cerebrovascular diseases mortality has declined (**Figure 1**, **Supplementary Table 1**). Further details on the 36-year trend of mortality from diseases of circulatory system in Korea are presented elsewhere.[21]
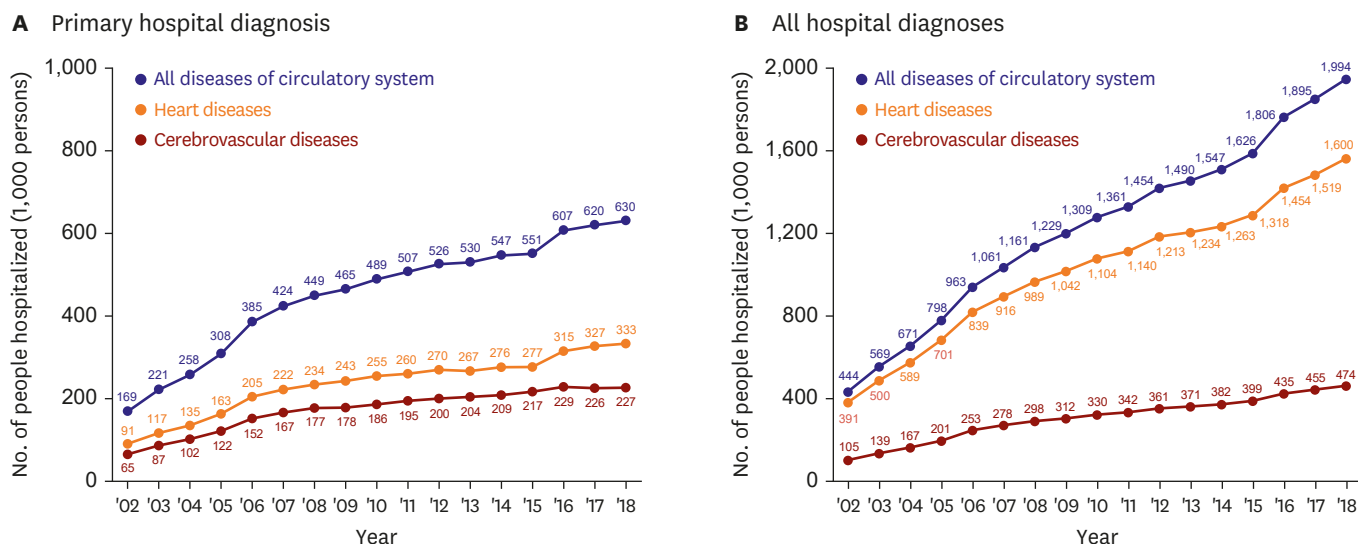
Hospitalization for cardiovascular diseases

Since 2002, the numbers of adults hospitalized for all diseases of circulatory system, heart diseases, and cerebrovascular diseases have consistently escalated based on both primary and all hospital diagnoses (**Figure 2**). Between 2002 and 2018, the number of people hospitalized increased 3.7 fold (from 169 thousand to 630 thousand) for all circulatory system diseases, 3.7 fold (from 91 thousand to 333 thousand) for heart diseases, and 3.5 fold (from 65 thousand to 227 thousand) for cerebrovascular diseases based on primary diagnosis (**Figure 2A**). Based on all hospital diagnoses, the number increased 4.5 fold (from 444 thousand to 1,994 thousand) for all circulatory system diseases, 4.1 fold (from 391 thousand to 1,600 thousand) for heart diseases, and 4.5 fold (from 105 thousand to 474 thousand) for cerebrovascular diseases (**Figure 2B**).

The hospitalization rate for all circulatory system diseases based on primary diagnosis also increased to 1,455 per 100,000 persons in 2018 (**Figure 3A**, **Supplementary Table 2**). The

Figure 1. Changes in cardiovascular disease mortality rate, 1983–2018.
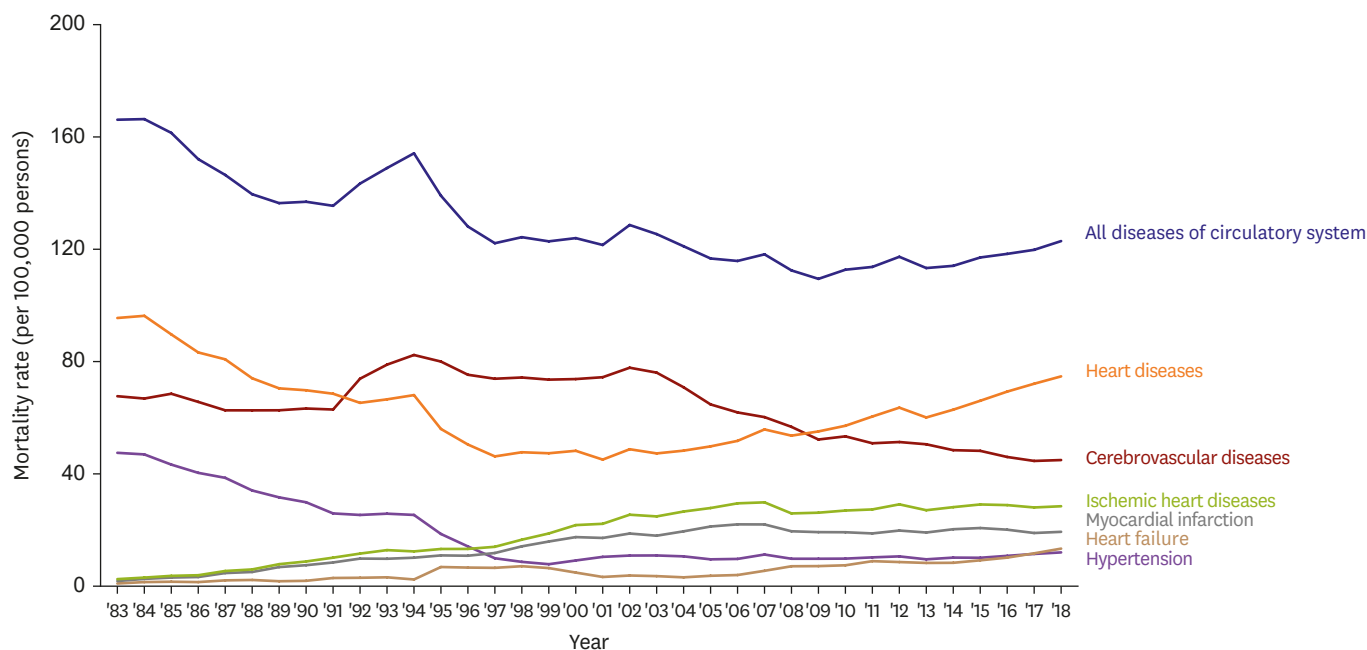
A Primary hospital diagnosis


B All hospital diagnoses

Figure 2. Changes in the number of people hospitalized for cardiovascular disease, 2002–2018. Estimated based on (A) primary diagnosis and (B) all diagnoses during hospitalization.

hospitalization rates for heart diseases and those for cerebrovascular diseases increased until 2016; after that, the heart diseases hospitalization rate continued to grow, while the cerebrovascular diseases hospitalization rate started to decline. Among heart diseases, the hospitalization rate due to HF exhibited the greatest increase (3.5-fold), followed by hypertension (2.7-fold), IHD (2.6-fold), and MI (1.9-fold) (**Figure 3A**, **Supplementary Table 2**).

Again, such trends could be attributed in part to population aging in Korea. The age-standardized hospitalization rates for all circulatory system diseases and their components had continually risen until 2009. (**Figure 3B**, **Supplementary Table 3**) Since then, the hospitalization rates for all circulatory system diseases, heart diseases, and cerebrovascular diseases have slowly declined. At the same time, the hospitalization rate for hypertension also decreased steadily, while the rate for HF declined until 2015 and increased thereafter. The hospitalization rate for IHD remained stagnant until 2012 then fluctuated. On the contrary, the hospitalization rate for MI decreased until 2011 then increased afterward (**Figure 3B**, **Supplementary Table 3**).

Cardiovascular risk factors

In 2018, approximately 12.1 million adults had hypertension, 4.3 million had diabetes, 8.7 million had hypercholesterolemia, 14.9 million were obese, and 8.8 million were currently smoking (**Figure 4**). The proportion of people with ≥2 risk factors rapidly increased with older age, ranging from 14.7% in the age group of 20-29 years to 58.4% in the age group of ≥70 years. Moreover, 27.8% of people aged ≥70 years had 3 or more cardiovascular risk factors (**Figure 5A**). This age-related trend was apparent in both sexes. Whereas men had a greater number of risk factors until age 70, the number surpassed among women at age >70 years (**Figure 5B and C**).

A Crude rate

B Age-standardized rate
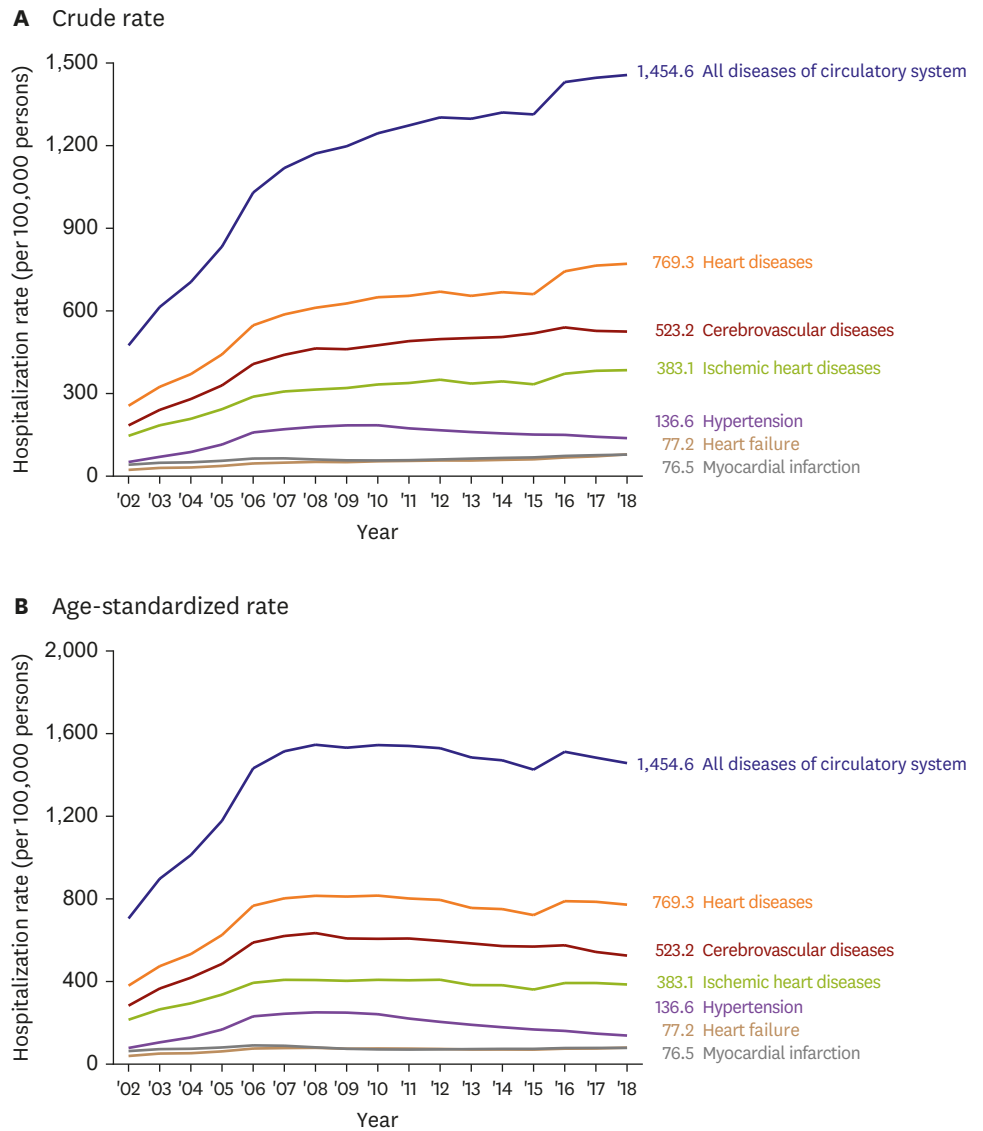
Figure 3. Changes in cardiovascular disease hospitalization rate, 2002–2018. (A) Crude rate. (B) Age-standardized rate. Age-standardization was performed by direct method with the population structure of insured people in 2018 as a reference.
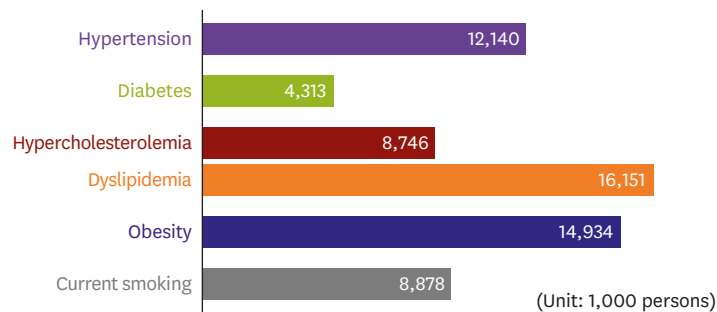
Figure 4. Number of Korean adults with each cardiovascular risk factor, 2018.
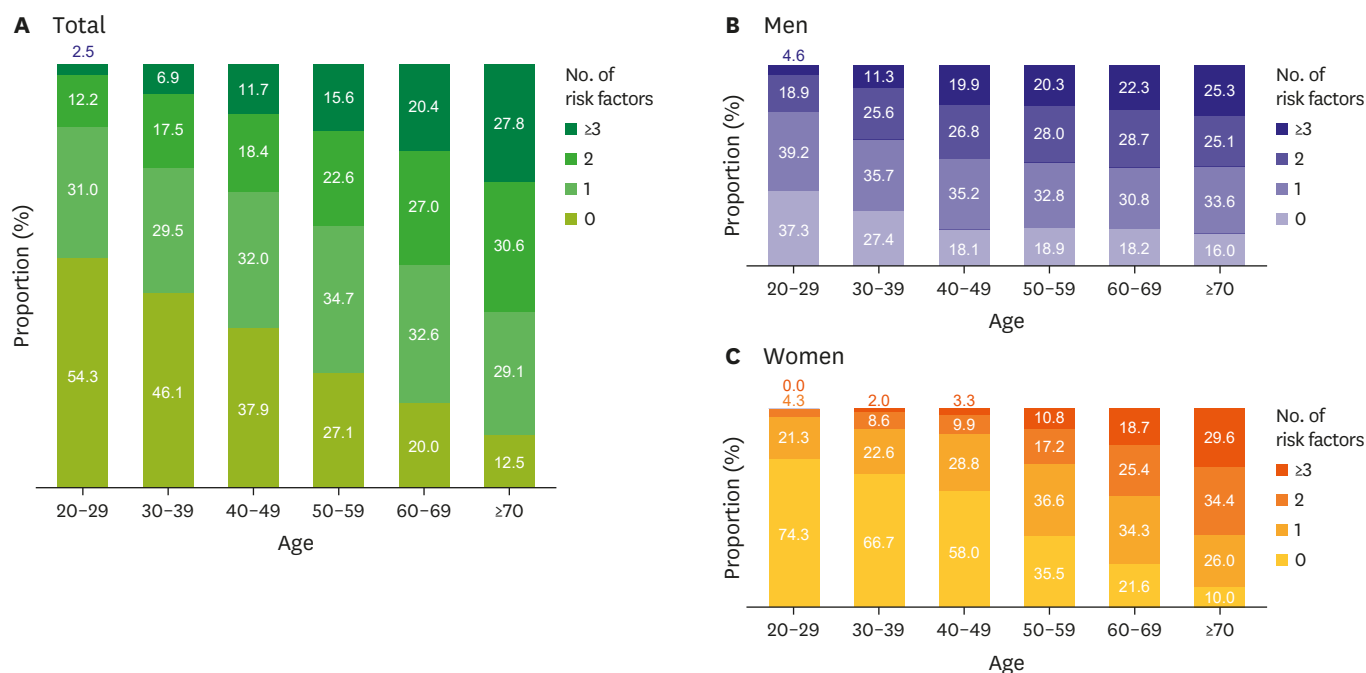
Figure 5. Number of cardiovascular risk factors by sex and age, 2018. (A) In all sex. (B) In men. (C) In women.

DISCUSSION

CVD mortality has increased during the last decade in Korea. Such increment was mainly driven by heart diseases, while mortality due to cerebrovascular diseases has declined over the past 2 decades. Hospitalization for CVD has also continually increased, with every CVD category showing a 2-3-fold increase between 2002 and 2018. Age-standardization revealed that the aforementioned increases in mortality and hospitalization were attributable, at least in part, to the population aging in Korea. As to cardiovascular risk factors, a high proportion of Korean adults were carrying more than one risk factor, and the number of risk factors escalated with older age.

Considering the rapid population aging in Korea, the continued increase in CVD hospitalization and mortality appears inevitable. Moreover, the age-dependent distributions of cardiovascular risk factors imply an even greater burden predicted in the future. Thus, concerted and sustained efforts are crucial among healthcare professionals, policymakers, and the general population themselves to achieve early prevention and subsequently reduce the burden of CVD in Korea.

SUPPLEMENTARY MATERIALS

Supplementary Table 1
Changes in cardiovascular disease mortality rate, 1983–2018

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Supplementary Table 2
Changes in cardiovascular disease hospitalization rate, 2002–2018

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Supplementary Table 3
Changes in age-standardized cardiovascular disease hospitalization rate, 2002–2018

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Supplementary Figure 1
Changes in age-standardized cardiovascular disease mortality rate, 1983–2018. (A) In men. (B) In women. Age-standardization was performed by the direct method with the population structure of the resident-registered people in 2018 as a reference, separately for men and women.

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Supplementary Data
Heart Disease Fact Sheet 2020

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