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Special Issue

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Addressing Cardiovascular Diseases Challenges in South Korea: Strategies to Improve Outcomes

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AUTHOR'S SUMMARY

This proposal is official position of the Korean Society of Cardiology to contribute to the establishment and improvement of comprehensive and effective cardiovascular disease policies and management. This paper was prepared by a committee of experts in various cardiovascular fields, and identifies the current state and issues in cardiovascular disease management from a clinical expert's perspective and proposes policies for improvement in major cardiovascular diseases in South Korea. This proposal underscores the necessity for disease-specific policy improvements, research, and investment.

ABSTRACT

Cardiovascular diseases (CVDs) pose a significant public health challenge in South Korea. This paper attempts to assess the current status of major cardiovascular risk factors and representative CVDs, and proposes policies and strategies to improve CVDs outcomes. It addresses key issues related to hypertension, dyslipidemia, ischemic heart disease, atrial fibrillation, sudden cardiac death, heart failure and valvular heart disease. The high-priority strategies for improving CVDs outcomes include raising public awareness, emphasizing prevention, ensuring equitable access to care, increasing investment in CVDs research, enhancing healthcare provider education, and incentivizing care for high-risk patients care. To implement those strategies, this paper proposes policies for both government and academic societies.

Keywords: Cardiovascular diseases; Health policy; Health education; Secondary prevention; Health equity; Research

INTRODUCTION

Current challenges and gaps in national policies

Cardiovascular diseases (CVDs) are a major public health challenge in South Korea, characterized by high prevalence and low awareness, compared with their importance. The burden of CVDs is increasing as the population ages and the prevalence of risk factors increase. The Korean Society of Cardiology (KSC) has identified room for modification and improvement in national policies. Currently, the government has made a very limited policy investment, and existing policies prioritize acute care for ischemic heart disease (IHD) rather than a comprehensive approach to the prevention, diagnosis, treatment, long-term management, and research of CVD.

While this paper primarily focuses on cardiovascular diseases, it is important to note that cerebrovascular diseases share common risk factors such as hypertension, dyslipidemia, smoking, and physical inactivity, and they are also affected by policies targeting CVD risk factors. This overlap underscores the need for an integrated approach when addressing shared risk factors.

Economic and social burden of cardiovascular diseases

The 2019 Global Burden of Disease study indicates that CVDs is the third-largest contributor to disease burden in South Korea, following cancer and musculoskeletal disorders.[1)]

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According to the *2023 Chronic Disease Fact Book*, heart disease ranks as the second most-common cause of death, and its mortality rates have increased during the past decade.[2] Although advances in heart disease treatment have lowered its age-standardized mortality rates, the total number of deaths from CVDs continues to rise due to an aging population and the growing prevalence of CVDs.[3]

In 2023, the population aged 65 and over was projected to reach 9.5 million, accounting for 18.4% of the total South Korean population. That figure is expected to continue rising, reaching 20.3% by 2025, at which point South Korea will transition into a super-aged society.[4] Because the risk of CVDs increases with age, its incidence is rising alongside this rapid aging in the population.

South Korea's healthcare system is facing significant financial strain due to surging medical expenditure, particularly for treating CVDs. In 2022, a staggering 83 trillion South Korean won (KRW), constituting 80.9% of South Korea's total healthcare expenditure, was attributed to non-communicable diseases. Notably, treating circulatory diseases emerged as the most expensive category, consuming 12.7 trillion KRW, surpassing even cancer treatment, which cost 9.4 trillion KRW.[2]

Moreover, the growing prevalence of hypertension and dyslipidemia, major CVDs risk factors, among young South Koreans raises serious concerns because it could lead to a surge in CVDs and related healthcare costs, posing significant social and economic challenges for the country.[5] It is important to acknowledge that other risk factors, such as smoking and physical inactivity, also play a critical role in the development of CVDs and warrant further attention.

Disparities in cardiovascular diseases

Disparities in CVDs in South Korea can be observed across region, socioeconomic status, sex, and age.[6][7] Significant attention is already being given to managing acute myocardial infarction (AMI) and addressing regional differences. Mortality from CVDs is worse in non-metropolitan areas, likely due to population profiles, unhealthy lifestyle habits, pre-existing conditions, and limited healthcare access.[5] The uneven distribution of medical resources and specialists, especially in rural regions, might contribute to higher death rates from CVDs.[8-10] The scarcity of specialists is further exacerbated by the limited number of doctors in rural regions and insufficient expertise in preventive measures and disease management.[11-13]

Cardiovascular disease research and related policies

Research investment for CVDs is relatively small compared with other significant disease categories such as cancer, and it focuses on developing therapeutics rather than prevention and management. Although clinical research has shown remarkable growth and achievements, outcomes and progress in basic and translational research lag. Strategic investment policies and goals for CVDs research need to be established and implemented.[14] Additionally, the absence of comprehensive national statistics hinders our understanding of the overall status of CVDs and complicates the development of management directions and achieving consensus. Although progress has been made through governmental and academic registries, continued efforts to produce national statistics are crucial.

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Purpose of this study

This paper addresses the current status of major cardiovascular risk factors and diseases to prioritize policy improvements. Rather than providing an overview of the whole spectrum of CVDs, it focuses on target policy recommendations for selected CVDs.

This policy proposal advocates for an integrated approach that expands societal and policy attention to major CVDs and improves overall management. This involves raising awareness, prioritizing resources, and tailoring policy interventions to address the specifics of treating each CVD.

CARDIOVASCULAR DISEASES IN SOUTH KOREA

Hypertension

Burden of disease & outcomes

Globally, hypertension stands at the top position among primary modifiable risk factors that contribute to CVDs (**Figures 1** and **2**).[13)15)16)] In adults with hypertension, managing blood pressure (BP) significantly lowers the risk of CVDs.[17)18)] Therefore, hypertension is one of the most consequential and remediable threats to the health of individuals and society.

Among adults aged 30 years and older, the prevalence of hypertension is 32.9%, and as age increases, the prevalence of hypertension tends to rise even further. The highest medical expenses for a single disease were attributed to essential hypertension (3.4 trillion KRW, 4.2%), diabetes (2.3 trillion KRW, 2.8%), and chronic kidney disease (2.1 trillion KRW, 2.5%).

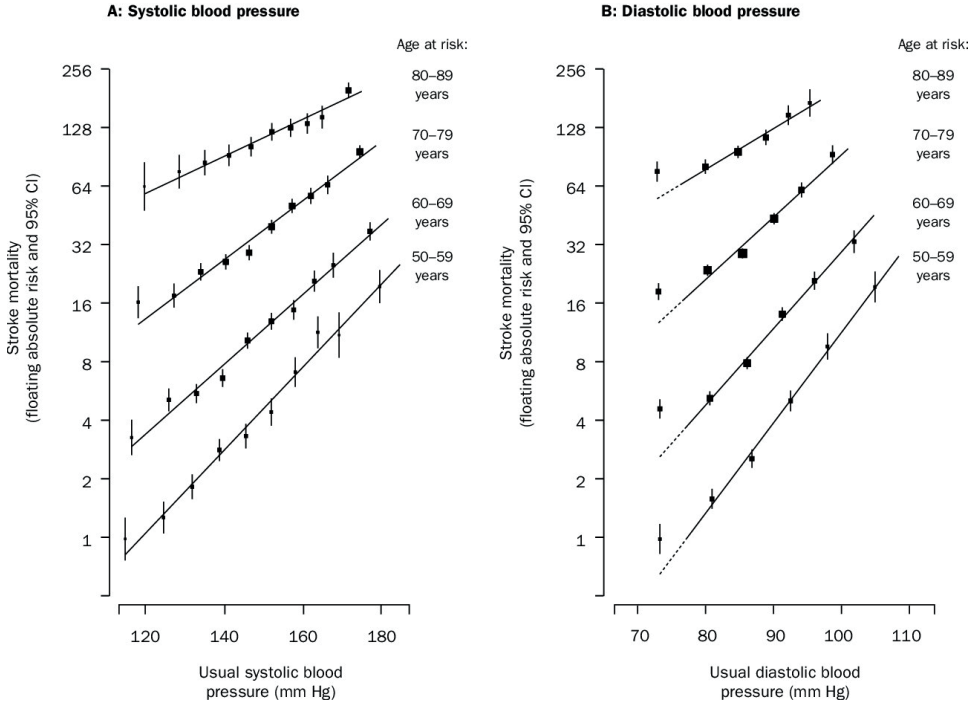

Figure 1. Relationship between stroke mortality rate in each decade of age and usual BP at the start of that decade.[15)]
BP = blood pressure; CI = confidence interval.

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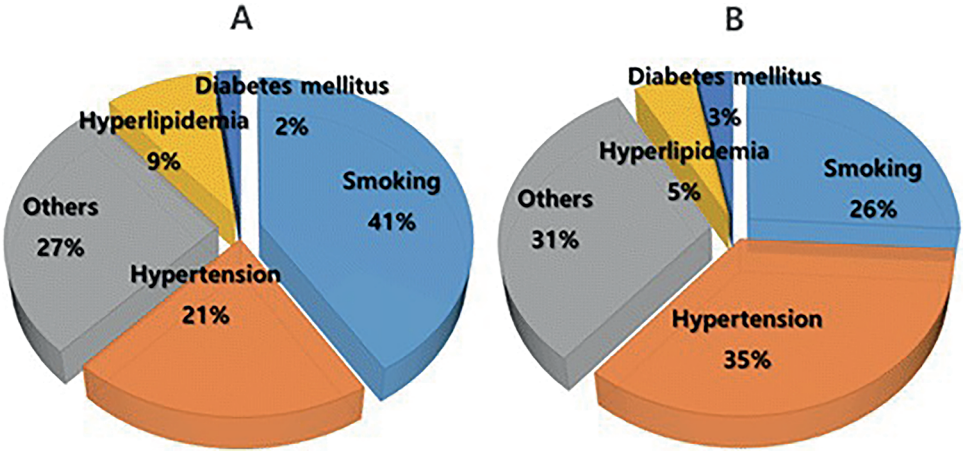

Figure 2. Attribution of hypertension and other cardiovascular risk factors for the coronary artery disease (A) and cerebrovascular diseases (B) in Korean male population (Korean Medical Insurance Corporation study).[16]

However, 1 out of 4 individuals with hypertension are unaware of their high BP, and three out of ten are not receiving treatment. Additionally, about 44% of hypertensive patients do not achieve their target BP.[19]

Prevention of hypertension in South Korea

The 2022 guidelines of the Korean Society of Hypertension (KSH) recommend screening for hypertension every two years as a class I recommendation for the general health checkup program of the National Health Insurance Service (NHIS).[20] The NHIS enrollees are screened once or twice a year to detect cancer and cardiovascular and cerebrovascular diseases at an asymptomatic stage. Efforts to raise awareness of hypertension among the general population are ongoing at the societal level. Since 2017, the May Measurement Month (MMM) has been the world's largest public BP measurement campaign, inspired by the World Hypertension Day (May 17). Led by the KSH and endorsed by the Korean Centers for Disease Control and Prevention and the NHIS, the Korean MMM has been implemented in collaboration with local governments since 2019. The campaign is promoted through a social media BP measurement challenge, a YouTube contest, online video promotion, and social media channel operation that are all intended to raise awareness about hypertension, particularly among young patients and female patients.[21] Continued implementation of such campaigns in collaboration with local governments and organizations is expected to help establish meaningful hypertension management policies.

Management of hypertension in South Korea

In 2022, the hypertension treatment and control rates among South Korean adults with diagnosed hypertension increased to 65% and 47%, respectively, reflecting significant improvements since the early 2000s.[22][23]

The KSH is working to significantly enhance awareness and treatment of high BP. It updates hypertension treatment guidelines every 4 years and annually produces a hypertension fact sheet.[21][24] It also hosts yearly training sessions for private practitioners, residents, and public health center staff. In collaboration with a government project, it develops and provides educational content for patients with hypertension, focusing on the proper technique for measuring BP. It also works with the National Health and Nutrition Examination Survey to ensure the accuracy of BP measurements via thorough education and monitoring.[25]

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Additionally, the KSH promotes home BP measurement and distributes diagrams for accurate self-monitoring.

Major issues

The hypertension control rate has improved significantly in those aged 60 years and older, but younger age groups (20–39 and 40–49 years) have shown little change. In 2018, the overall awareness and treatment rates for hypertension among all adults were 67%, and 63%, respectively, but they were only 17% and 14% among adults aged 20 to 39 years old with hypertension.[26)27)]

Short clinic times in South Korea hinder effective hypertension management, which requires detailed patient education, lifestyle counseling, medication adjustment, and monitoring for side effects.[28)29)]

The unavailability of key antihypertensive medications such as methyldopa, labetalol, and hydralazine in South Korea challenges hypertension management during pregnancy.[29)] These drugs are safe and effective, but they have been discontinued due to low profitability and demand. Similarly, eplerenone and other mineralocorticoid receptor antagonists, which are important for resistant hypertension, have not been introduced in South Korea for the same reasons.[30-32)]

Policy priorities and suggestions for improvement

Low rates of awareness and treatment among young adults with hypertension indicate that a targeted approach might be needed to address hypertension in this population. Tailored public health interventions and educational programs could play a pivotal role in addressing this gap and enhancing the management of hypertension among young adults in South Korea. Short clinic times can be a barrier to elaborate hypertension management in South Korea. Strategies to address this challenge include implementing more efficient clinic workflows, using team-based care with other healthcare professionals such as nurses and pharmacists, and embracing telemedicine for follow-up consultations, especially for stable patients. Additionally, patient education can be supplemented with digital resources that can be accessed outside of clinic hours. Recently, IT technology using mobile device represents a significant advancement in hypertension management, offering the potential for continuous, convenient, and less intrusive BP monitoring. The integration of BP measurements using smartwatches and other wearables might open a new field of dynamic evaluation of BP.[33)]

Despite being recommended in guidelines, some medications cannot be prescribed in South Korea, which hinders effective and scientifically based hypertension treatment. To solve these problems, it is essential to revise drug pricing policies and enhance government involvement to ensure that all crucial medications are available to treat hypertension in South Korea.

According to the second comprehensive plan for managing cardiovascular and cerebrovascular diseases, published by the Ministry of Health and Welfare in 2023, policy-driven efforts to enhance the management of chronic conditions, including hypertension, achieved only about 67% of the set targets. The lack of implementation effectiveness was cited as the primary reason for that low achievement level. Improvements have been made in public awareness and health practices and the enhancement of management for pre-existing conditions such as high-risk diseases and hypertension, including expanding the target population, improving management rates, and introducing regional education centers. In treatment, hospitals are expected to make their own investments. However, relative to preventive and rehabilitative efforts, support is insufficient.

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The second comprehensive plan also showed that government funds (approximately 350 million KRW per center) have consistently supported preventive management programs. However, funding for the operational expenses of the healthcare system has been subject to gradual reductions and was eventually discontinued. Although the legal establishment and formulation of comprehensive plans provide a basis for promotion, there are shortcomings in expanding policy outreach, including budget allocation.[12]

According to the 2015 European Society of Cardiology (ESC), health lifestyle intervention, the health insurance industry in European countries is increasingly providing higher reimbursement to providers who adhere to clinical guidelines and provide high-value, evidence-based care.[32][34][35] Additionally, the industry is creating incentives for individuals to adhere to health life behaviors.[36]

To establish effective and informed policies regarding hypertension, it is crucial to actively incorporate the medical professional's evidence-based opinions. Ensuring a proactive and collaborative implementation of these policies necessitates urgent consideration of reasonable pricing under the well-balanced health insurance coverage system.

Dyslipidemia

Burden of disease & outcomes

Dyslipidemia is defined as an increased level of total cholesterol, low-density lipoprotein (LDL)-cholesterol, or triglycerides; a low plasma concentration of high-density lipoprotein (HDL)-cholesterol; or a combination of those features, and it is a crucial correctable predictor of coronary artery disease.[33] The burden of dyslipidemia has increased during the past 30 years. The prevalence of dyslipidemia in Korea is 40–48% and vary according to the definition of low HDL-cholesterolemia in women.[37]

Prevention, management, and major issues

Lifestyle modification and lipid-lowering drugs are mainstay to control dyslipidemia and have decreased its cardiovascular consequences in the past decades.[38] Guidelines recommend more aggressive lipid-lowering therapy, especially in high-risk patients, under the slogan of "lower is better." Despite the clinical importance of dyslipidemia control, the real-world LDL-C goal attainment rates in all high-risk patients are less than 50% (**Figures 3** and **4**).[39] Currently, statins are the standard first line measure of dyslipidemia treatment, and they have been shown to decrease major vascular events and total mortality by 22 and 10%, respectively, for every 1.0 mmol/L reduction in LDL cholesterol levels.[40] Recently, lipid-lowering agents against novel targets including PCSK9 with diverse delivery routes have been developed and some of them were introduced to clinical practice.

Major issues

The prevalence of hypercholesterolemia has increased more than 2 times between 2007 and 2020. Major causes underlying increasing prevalence of dyslipidemia include westernized nutrition and lifestyle. Management of these risk conditions in vulnerable individuals is needed.

Although awareness and treatment rates increased in the past several years, dyslipidemia is still under-recognized and under-treated in Korea like in many countries. Thus, improving diagnosis and treatment rates is important. In addition, as treatment target of cholesterol is getting stricter, proper education and encouragement for patients, especially at high cardiovascular risk is needed.

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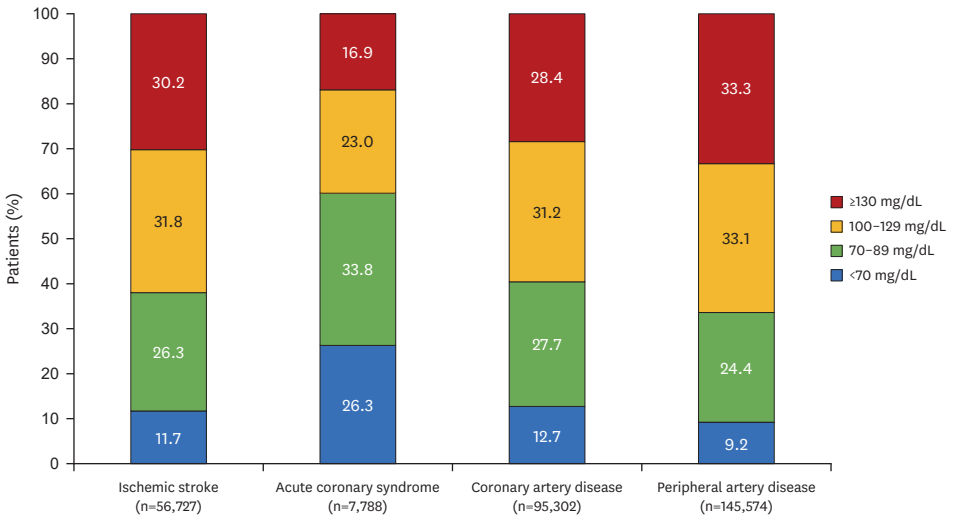

Figure 3. LDL-cholesterol goal attainment rates in high-risk patients by target LDL-cholesterol level.
Adapted from Yang et al. *Lipids Health Dis* 2020;19:5.[39]
LDL = low-density lipoprotein.

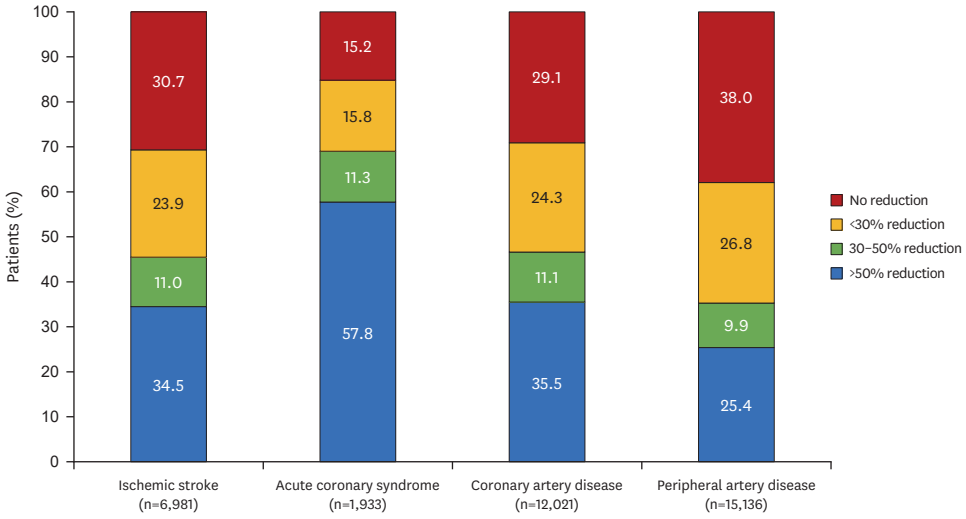

Figure 4. LDL-cholesterol goal attainment rates in high-risk patients by LDL-cholesterol reduction rate.
Adapted from Yang et al. *Lipids Health Dis* 2020;19:5.[39]
LDL = low-density lipoprotein.

Policy priorities and suggestions for improvement

Dyslipidemia has long been recognized as a significant risk factor for CVDs. However, studies are ongoing, and many topics, including the optimal goal of treatment, are still being debated. The pharmacologic treatment of dyslipidemia is one of the fastest-growing fields in pharmaceutical development. Along with other chronic diseases, the low rates of awareness and treatment maintenance among the general population underscores the need of interventions at the society level such as campaigns and educational programs. Moreover, based on numerous studies, the optimal goal of treatment goal is rapidly modified, which leads to an update of the lasted knowledge for physicians. Both pharmacologic treatment and educational campaigns for both the general population and medical service providers should be given deep consideration, because a multifactorial approach is essential to dyslipidemia treatment.

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Numerous current studies are focusing on new agents intended to lower lipid levels and decrease the morbidity and mortality of CVDs. We need to revise the treatment guidelines for dyslipidemia to reflect Korea-specific lipid-lowering approaches, in association with efficient policies that prioritize patient outcomes and reductions in cardiovascular risk.

Considering the limited medical resources available, it is essential for the health care professionals engage in the health policy–making process to select the best policy.

Ischemic heart disease and acute coronary syndrome

Strategic solutions for the cardiovascular intervention specialist shortage

The burden of IHD, especially AMI, has been steadily increasing for the past 20 years, and CVD is currently the second most-common cause of mortality in South Korea. Mortality from AMI has not changed much in the past 10 years, but 30-day fatalities from AMI in South Korea are higher than its mean value of the Organization for Economic Co-operation and Development countries. As the population ages, the incidence of risk factors for atherosclerosis will increase, unleashing a flood of atherosclerotic CVDs in the near future. Existing regional disparities in the incidence and mortality of IHD and a shortage of cardiologists, especially interventional cardiologists, will lead to a large cardiovascular healthcare problem in South Korea.

Therefore, healthcare professionals, government policy makers, and the community must work together, making sustained and united efforts to reduce the burden of CVDs in South Korea.

Navigating the future: challenges and trends in cardiovascular caregiver supply and demand

As the number of physicians and hospitals performing cardiovascular intervention procedures increases, demand for appropriate treatment in accordance with standard guidelines is also increasing, which aligns with the requirements of the Health Insurance Review and Assessment Service for ideal procedures. Therefore, promoting and educating providers about proper procedures is an urgent matter. The present Intervention Procedure Certification System establishes standards for medical services based on scholarly reflection and specialized information and recognizes providers who meet those standards. This system formalizes the level of intervention services by setting guidelines to ensure the health and safety of patients and the professionalism and working conditions of medical practitioners. To achieve its objectives, the certification system recommends fair regulations for intervention procedures and provides voluntary educational programs to enable qualitative improvement. Ensuring the working conditions of intervention practitioners is essential for the stable development of services. Moreover, promoting healthcare services aligned with enhanced professionalism is crucial. Several advanced countries, including the United States and Japan, have presented intervention procedure guidelines through their respective associations. They operate certification systems that recognize members who comply with the guidelines as certified intervention specialists. Ultimately, the peer group review and assessment systems of those academic societies are intended to protect both patients and procedure-performing physicians. The proposed guidelines for suitable intervention environments contribute to the fundamental goal of ensuring protection for both patients and physicians. However, a recently issued CVD fact sheet revealed regional disparities in CVDs mortality rates exist in South Korea due to demographic, socioeconomic, and medical resource factors. As of February 2024, the Intervention Procedure Certification System recognizes 467 cardiovascular intervention specialists. Among them, 24 (5.1%) are aged 65 or older, 77 (16.5%) are aged 60 or older, and only 24 (5.1%) are younger than 40. Among the 443 certified individuals who are younger

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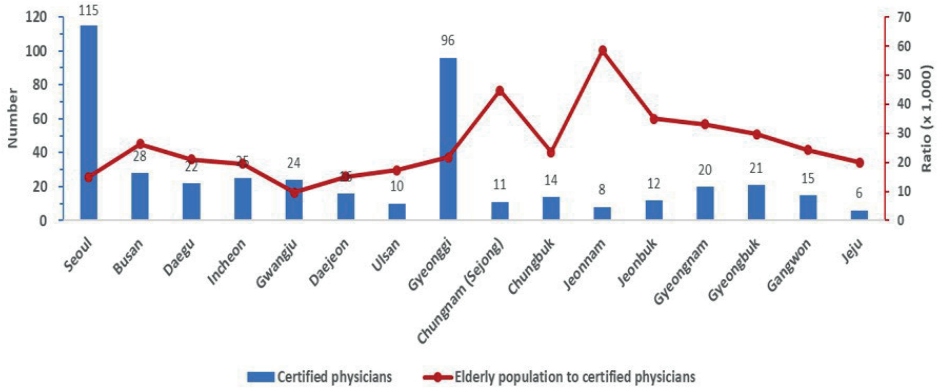

Figure 5. The number of certified physicians under 65 and the ratio of the elderly population (65 and older) to certified physicians, categorized by administrative districts in Korea.

than 65, 336 (75.8%) work in the metropolitan area and major cities. In other words, certified physicians are aging along with the population, which raises concerns about the availability of quality interventional procedures, particularly in emergency situations, for patients outside the metropolitan area and major cities. The number of certified cardiovascular intervention specialists is inadequate to the distribution of elderly people in South Korea, particularly in the Chungnam and Jeonnam provinces (**Figure 5**). Lastly, the lack of effective pre-hospital screening tools for acute coronary syndrome causes the exhaustion of limited healthcare personnel. Current symptom-based screening tools for 119 teams in Korea have a low positive predictive value of 6%, leading to inefficient use of limited resources according to the Busan-Gyeongnam regional cardiovascular center data. For example, many suspected myocardial infarction cases overwhelm emergency centers, with only a small fraction being confirmed. To address this, implementing 12-lead electrocardiograms (ECGs) combined with rapid point-of-care-testing kit of cardiac enzyme in pre-hospital care can improve diagnostic accuracy. Artificial intelligence-driven analysis and timely coordination with emergency centers will ensure effective resource use and better patient outcomes.

Proposal for enhancing the number of interventional cardiology specialists

The prevalence of IHD is currently increasing in South Korea, as it is in other countries around the world.[41-43] Although interventional procedures are the cornerstone of treatment for IHD and the annual number and complexity of such procedures are increasing, the number of physicians specializing in them is declining. Physicians certified to perform high-complexity interventions are a core resource in cardiovascular healthcare. Unfortunately, this resource is aging, and its distribution is disproportionately concentrated in metropolitan areas. The causes of the physician shortage can be summarized as follows: (1) lengthy training period to be interventional procedure specialists; (2) relatively low salary for the complexity of the procedures, which deters physicians from pursuing the lengthy training; (3) lack of specialized support staff to treat severe cases; (4) frequent medical incidents and disputes; and (5) physician exhaustion or burn-out due to long hours, a high burden of work, and insufficient time for resting.

Therefore, policy changes should be implemented to ensure that patients with IHD can be adequately treated in the near future with acceptable range of outcome disparities. First, the value of performing high-risk procedures, such as a primary percutaneous coronary intervention, for patients on the edge of life and death should be recognized, and

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reimbursement should be raised drastically. Second, unless clearly illegal behavior can be proven, the burden of judicial risk for interventional cardiologists should be alleviated by considering the higher mortality nature of emergent CVDs. Those changes would make it easier for young doctors to pursue a career in interventional cardiology. Third, enhancing collaboration between regional cardiovascular centers and local governments are crucial for addressing the disproportionate distribution of interventional cardiologists compared to metropolitan areas. The reduction of regional discrepancies in critical healthcare provision will also require the fortification of patient transfer system, which could be achieved through the creation of extensive healthcare networks. This strategy would help to ensure a more equitable distribution of healthcare resources and improve access to specialized care across different regions. Fourth, we need to ensure that rapidly evolving intervention-related devices (e.g., Impella, intravascular lithotripsy) are quickly brought into the country to provide access to cutting-edge treatments. Finally, to address all those issues, the government should lead and support research for policy-making and establishing evidence in patients with IHD.

Disorders of heart rhythm (atrial fibrillation and sudden cardiac death)

Burden of disease & outcomes

Within the broad spectrum of heart rhythm disorders, we focus on atrial fibrillation (AF) and sudden cardiac death (SCD) because of their clinical and socioeconomic impact. Among the various arrhythmias, AF stands out as the most common, especially in the elderly. It predominantly affects the elderly population and can lead to critical health problems, including ischemic stroke or heart failure (HF).[44] More concerning are the major cardiovascular comorbidities that escalate with AF, such as HF, stroke, and CVDs, which will lead to significant public health and economic burdens. Kim et al.[45] reported that the prevalence of AF approximately doubled in the past decade, and the prevalence rate is projected to be 5.81% by 2060 (**Figure 6**).

Roh et al.[46] reported that the incidence of out-of-hospital cardiac arrest in South Korea increased during the past decade (**Figure 7**). In addition, the overall incidence of SCD is higher in the elderly population (**Figure 8**).[47] According to updated data from the KOSIS, the number of patients using emergency medical services due to SCD was 35,018 in 2022, for a rate of 68 per 100,000 individuals. That rate has shown a steady increase from 55 per 100,000 in 2012. Among those cases, males constituted 64% and females 36%, with individuals older than 80 years accounting for 33% of the total. Despite efforts to improve outcomes, the survival discharge rate remains dismally low, standing at only 8% in 2022. According to the NHIS coded database, the reported incidence of SCD was 16.1 per 100,000 person-years from

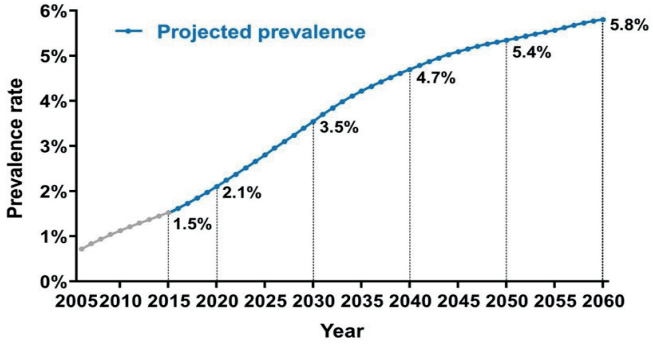

Figure 6. Projected prevalence rate of atrial fibrillation.
Adapted from Kim et al. *Am Heart J* 2018;202:20-6.[45]

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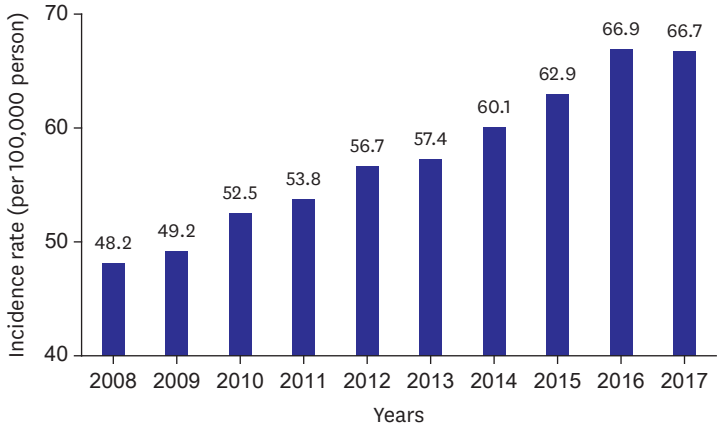

Figure 7. Annual trends in age- and sex-adjusted incidence of out-of-hospital cardiac arrest per 100,000 person-years. Adapted from Roh et al. *Korean Circ J* 2021;51:866-74.[46]

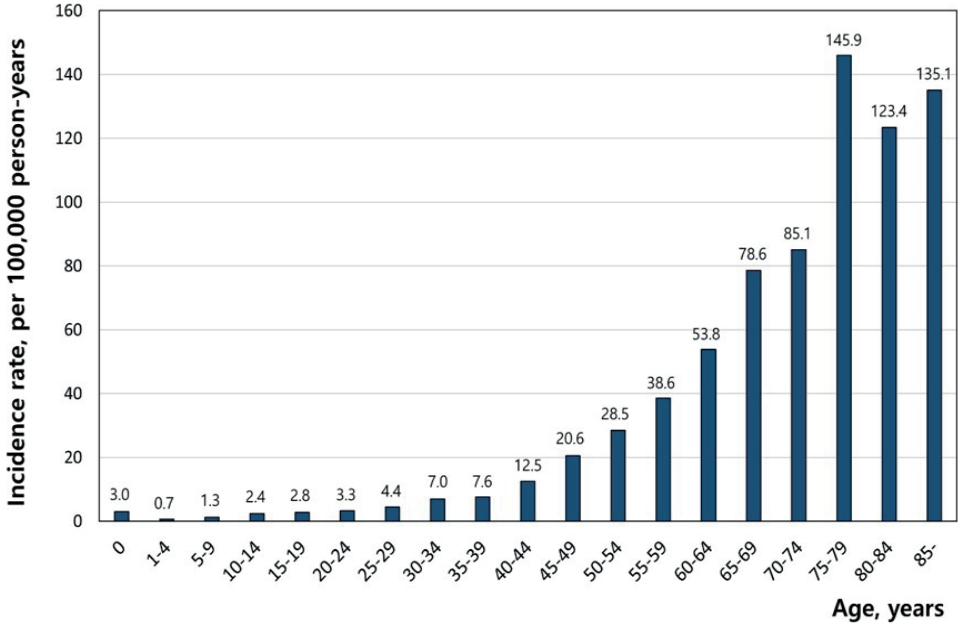

Figure 8. Annual age-related distribution of sudden cardiac arrest incidence per 100,000 person-years. Adapted from Roh et al. *PLoS One* 2020;15:e0242799.[47]

2002 to 2013. Among them, coronary artery disease and cardiomyopathy were the primary causes of SCD, accounting for 60% and 14%, respectively. The rate of cryptogenic sudden death, including inherited primary arrhythmia syndrome (IPAS), was 15% in patients with SCD.[48] Of the total 4,649 implantable cardioverter-defibrillator (ICD) implantations in South Korea from 2007 to 2015, 21.1% were for IPAS.[49][50] The annual number of ICD implantations has increased following an update to the reimbursement criteria and guidelines, but it is still low in South Korea.[51]

Prevention, management and major issues

The current management of AF is guided by the ABC pathway ('A' anticoagulation/avoid stroke; 'B' better symptom management; 'C' cardiovascular and comorbidity optimization) that was conceptualized by the 2020 ESC clinical guideline.[52][53] Direct oral anticoagulants (DOACs) have been covered by insurance in South Korea since 2013, and they are now in common use.

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The use of DOACs, which are convenient and safer than vitamin K antagonists, benefits AF patients. The majority of mortality in AF patients is associated with HF rather than stroke due to the improvement of anticoagulation.[54] About 5,000 AF ablation procedures were performed in 49 centers in 2020. The number of AF catheter ablation cases has steadily increased. Although the proportion of high-risk patients has increased, complications have consistently decreased.[55] Catheter ablation is more effective than drug therapy at restoring a normal heart rhythm, and it improves the survival rate in certain groups.[56][57] Catheter ablation for AF in patient with HF also reduces a death or hospitalization.[58][59] Furthermore, growing evidence supports that early rhythm control improves clinical outcomes.[60-62] Thus, future AF treatment should move toward early rhythm control based on early diagnosis.

Preventing and improving the outcomes of SCD will require enormous social effort. If cardiopulmonary resuscitation is performed immediately, the survival rate of SCD increases by 2 times, and it increases by 4 times when a collapse is observed. However, most SCDs (65%) occur in non-public places such as homes. Defibrillation therapy using ICD is highly effective in terminating a life-threatening ventricular arrhythmia (VA). Catheter ablation is also a therapeutic option for VA. The management of IPAS involves a combination of medication, lifestyle modification, and ICD therapy. The risk of SCD varies depending on underlying cardiac conditions, family history, genetic variation, and the other factors. Therefore, personalized risk stratification for SCD should be incorporated into clinical practice to improve outcomes.

Policy priorities and suggestions for improvement

Guidelines from the ESC, the Canadian Cardiovascular Society, and the Asia Pacific Heart Rhythm Society (APHRS) all recommend opportunistic screening for AF by pulse palpation or ECG in people aged 65 years and older.[52][63][64] The Korean Heart Rhythm Society has also endorsed this recommendation. The unique aspects in Korea, including the low cost associated with ECG screening, the very rapid growth of the elderly population, and the expected increase in healthcare costs associated with AF and its cardiovascular comorbidities, underscore the importance of incorporating ECG screening into the national health screening program for individuals aged 65 years and older.

The underutilization of oral anticoagulation in patients with AF remains a significant issue. A recent report indicates that a considerable number of eligible patients do not receive this essential treatment.[65] To address this problem, it is crucial to educate both physicians and patients on the importance of oral anticoagulation. Policy support for research on the net clinical benefit of oral anticoagulation in Korean patients with AF at low to intermediate stroke risk could also help to advance the management of AF-related stroke.[66] Concurrently, it is imperative to discuss revising the insurance reimbursement criteria for DOAC, which currently rely exclusively on the CHA_2DS_2-VASc score.

Improving survival from SCD requires a multifaceted approach that includes community education and training, widespread access to emergency medical services, prompt initiation of cardiac resuscitation, the availability of automated external defibrillation, effective coordination of care, and comprehensive post-resuscitation care. As shown by the APHRS and Heart Rhythm Society expert consensus guidelines,[67] the development and implementation of medical guidelines tailored to Korean conditions are essential for optimizing healthcare delivery. South Korea's ICD implantation rate for the primary and secondary prevention of SCD is half to one-fifth of that in Japan, New Zealand, Hong Kong,

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and Singapore, all nations in the Asia-Pacific region with similar economic sizes.[68] Efforts are thus needed to increase the rate of ICD implantation to prevent SCD, as recommended in medical guidelines.

While this paper primarily focuses on clinical aspects, we acknowledge that public health measures, including expanding access to automated external defibrillators, increasing public education on CPR, and enhancing emergency response services such as 119, are also crucial components of SCD prevention. Future research to further explore the public health aspects as well as clinical practice strategy is needed in more depth.

Heart failure

Burden of disease & outcomes

The global prevalence of HF is rapidly increasing, and it is closely associated with high morbidity and mortality, especially in the elderly population.[69][70] According to the 2022 Korean Heart Failure Fact sheet, the prevalence of HF increased from 0.77% in 2002 to 2.58% in 2020 (**Figure 9**).[71] The prevalence of HF tends to rapidly increase with age, especially after age 50. In 2020, the prevalence was less than 1% among people younger than 50 years, and it increased sharply to 4.7%, 10.6%, and 18.6% among those in their 60s, 70s, and 80s or older, respectively (**Figure 10**). Thus, age is the most important risk factor for HF. The incidence of HF also increased from 2003 to 2020. The incidence rate of HF was 482 per 100,000 persons in 2003 and 609 per 100,000 persons in 2020.[71] However, the age-standardized incidence decreased significantly from 824 in 2003 to 572 per 100,000 persons in 2020. In particular, the decline in age-standardized incidence was greater in females (from 961 to 564 per 100,000 persons) than males (from 678 to 580 per 100,000 persons) during the same period.[71]

The mortality rates for HF in the general population are increasing in South Korea.[72] The overall mortality rate for HF increased rapidly from 3.0 per 100,000 persons in 2002 to 15.6 per 100,000 persons in 2020.[73] The age-standardized mortality rate also increased from

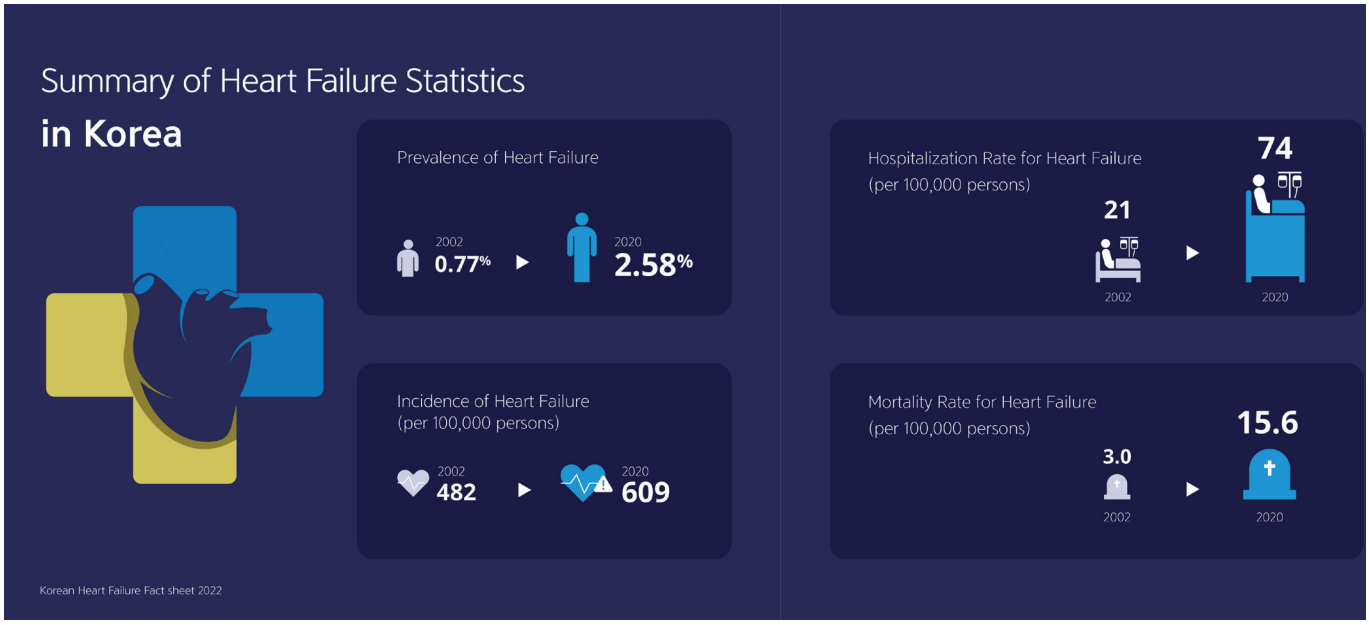

Figure 9. Summary of heart failure statistics.
Source: The Korean Society of Heart Failure, 2022 Korean Heart Failure Fact Sheet.

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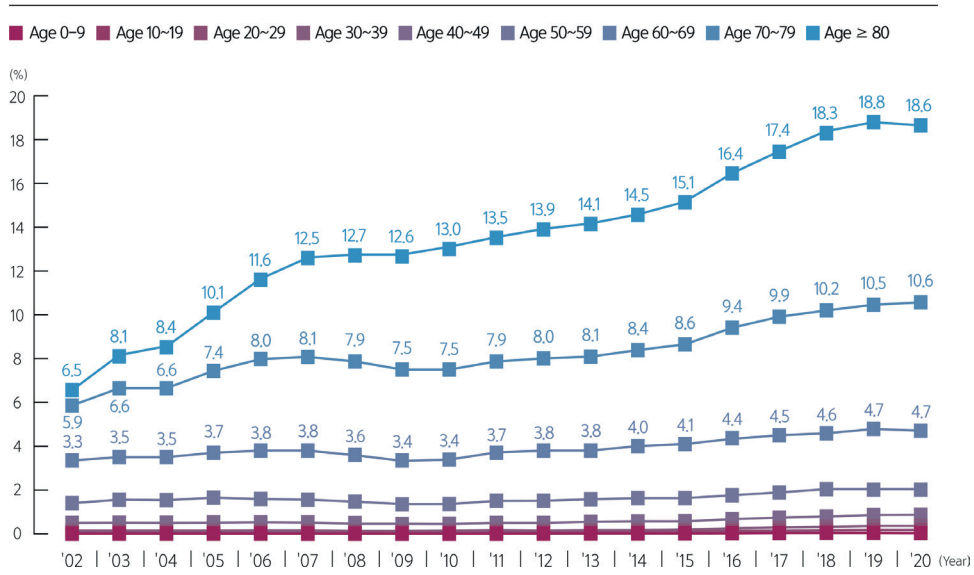

Figure 10. Age-specific prevalence of heart failure.
Source: The Korean Society of Heart Failure, 2022 Korean Heart Failure Fact Sheet.

7.0 per 100,000 persons in 2002 to 13.8 per 100,000 persons in 2020. The mortality rate from any cause among patients with HF was 4.9% in 2002 and 5.8% in 2020 (**Figure 11**). The 1- and 5-year survival rate in all patients with HF was 91% and 79%, respectively. However, the survival rates differed significantly between inpatients and outpatients with HF. Whereas the 1- and 5-year survival rates for inpatients with HF were 84% and 66%, respectively, the 1- and 5-year survival rates in outpatients with HF were 96% and 88%, respectively.[71]

Prevention, management and major issues

Prevention and management of the precursor disease of HF are crucial for reducing its prevalence.[74] The recent universal classification of HF categorizes its stages as follows: stage A for patients at risk without clinical signs or symptoms, stage B for patients without HF but with abnormal heart structure or function, stage C for patients with signs or symptoms, and stage D for those with severe advanced symptoms refractory to therapy.[75]

Effective prevention strategies focus on four main levels. Primordial prevention aims to prevent risk factors from developing. Primary prevention focuses on stopping disease onset in high-risk individuals. Secondary prevention aims to prevent disease recurrence in those already diagnosed with the condition. Tertiary prevention is geared toward halting disease progression and managing complications in individuals already diagnosed.[76]

Contemporary efforts concentrate on reducing residual risk in stage C and D HF patients. Despite the increasing availability of guideline-directed therapies, survival rates for HF with reduced ejection fraction (HFrEF) remain low. Additionally, effective treatments for HF with preserved ejection fraction (HFpEF) are limited.[77][78] Thus, there is an urgent need to focus on

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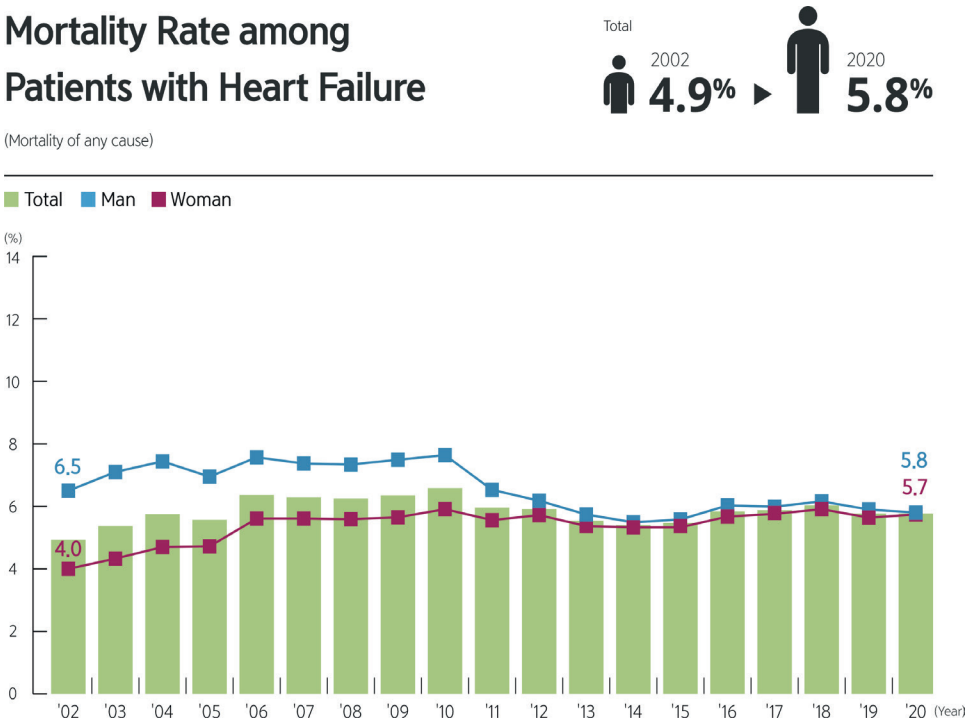

Figure 11. Mortality rate among patients with heart failure.
Source: The Korean Society of Heart Failure, 2022 Korean Heart Failure Fact Sheet.

primary and primordial prevention to intercept HF before irreversible myocardial changes occur. Because no curative therapies are available once HF symptoms develop, prevention, particularly for HFpEF, is crucial for improving outcomes through risk prediction.[77][78] Hypertrophic cardiomyopathy (HCM), often considered at least stage B HF, benefits from ongoing management advances such as ICD and anticoagulation. Despite progress, HCM remains a significant concern due to risks such as SCD, AF, left ventricular outflow tract (LVOT) obstruction, and HF progression.[79] Initial management of symptomatic dynamic LVOT obstruction involves medical treatment with negative inotropes, and septal reduction therapy is considered if symptoms persist. The newly approved myosin inhibitor mavacamten shows potential benefit, but further Korea-specific data are needed. Additionally, conventional cardiovascular healthy lifestyle measures, including regular physical activity, moderating alcohol intake, and managing comorbidities, have been shown to improve outcomes in HCM.[79][80]

Policy priorities and suggestions for improvement

The levels of evidence for drug use in HF are almost identical across the 2021 ESC guidelines, the 2022 American College of Cardiology/American Heart Association guidelines, and the 2022 Korean Society of Heart Failure guidelines.[81][82] The use of the four pillars of medication to improve survival in HFrEF have a class I level of evidence, which is consistent with findings from various studies. Moreover, the guidelines actively recommend up-titration of these medications.[83]

A major recent issue in HF treatment concerns disease category that tertiary hospitals are required to manage severe HF patients, particularly those with pulmonary edema. HF is currently classified as a general disease rather than a specialized disease group, which is a crucial indicator for the designation of tertiary hospitals. This classification limits the ability

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of experts in tertiary hospitals to provide specialized care. Given the high mortality rates and the need for intensive, continuous treatment, it is essential that severe HF be reclassified as a specialized disease group. This reclassification would ensure that patients receive expert care and appropriate reimbursement for the advanced treatments required to manage this condition. Key indicators, such as the significant reduction in mortality and readmission rates with standard treatment protocols (up to 60% as reported in studies) and the financial impact of reducing hospital admissions (a 96% reduction in per-patient costs), underscore the need for this change.

Another issue is that the period of benefit coverage for HF patients is limited, resulting in patients with severe HF not receiving adequate insurance-based treatments. Additionally, the reimbursement rates are low, making it difficult to hire enough HF specialists, particularly at tertiary hospitals. Therefore, efforts from both the government and academic societies are necessary. A new classification system beyond the current ICD framework for severe HF patients is needed to ensure sufficient reimbursement support for these patients.

Lastly, the management of HF patients who are elderly or frail. Elderly HF patients tend to be female and have a lower body mass index than younger HF patients. Lowering the BP of frail elderly patients has been shown to have adverse effects.[84)85)] Drug titration in HF patients recommends up-titration based on a systolic BP target of 100 mmHg, but no evidence supports that target in frail elderly patients, and clinical practice reveals that titrating medication based on BP in elderly patients often leads to numerous discomforts.[86)87)] Therefore, future research and attention on medication use in frail elderly patients is needed.

Valvular heart diseases

Burden of disease & outcomes

Valvular heart disease (VHD) is a significant burden on the adult population, particularly those older than 65, with profound implications for cardiac function, quality of life, and healthcare utilization.[88)] Despite advances in medical care, effective pharmacological therapies for moderate to severe VHD remain elusive, underscoring the importance of timely identification and intervention to mitigate adverse outcomes.[89)90)] Epidemiologic investigations into VHD prevalence encounter inherent challenges, primarily stemming from the reliance on echocardiographic assessments and clinical data and the potential for underestimation, particularly in resource-limited settings. Recent trends indicate a notable rise in the incidence of calcific aortic valve disease and primary mitral regurgitation, predominantly in high-income nations.[91)92)]

The epidemiology of VHD in South Korea has changed significantly due to demographic aging, socioeconomic development, and advances in medical infrastructure. In the past, rheumatic valve disease was the focus, but now degenerative valve disease is becoming mainstream.[93)] Initiatives such as the Korean Valve Survey (KVS) registry, spearheaded by the Korean Society of Echocardiography, are providing insight into the current status of the prevalence, diagnosis, treatment, and prognosis for each type of VHD (**Figures 12** and **13**).[94)95)] The evolving healthcare landscape, characterized by the aging population and enhanced accessibility to medical services, necessitates renewed attention to the spectrum of VHD etiologies. The intrinsic challenges in accurately assessing VHD prevalence underscore the imperative for routine screenings and periodic evaluations intended to identify at-risk individuals and preempt the progression of mild disease states to more severe manifestations.

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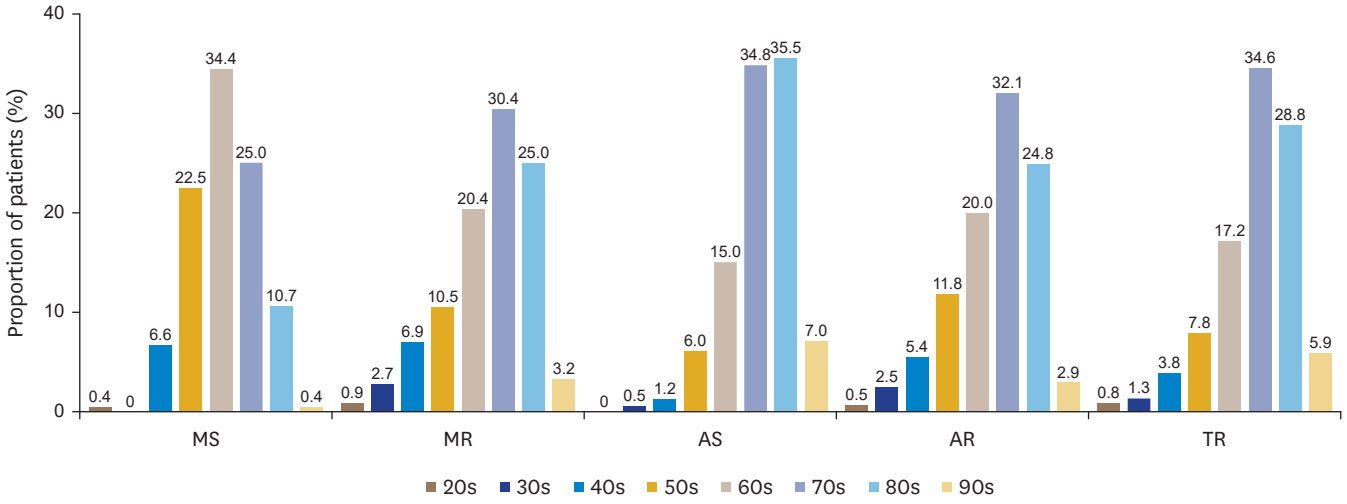

Figure 12. The types of valvular heart disease by age group.
Source: Choi et al. *J Cardiovasc Imaging* 2023;31:51-61.[94]
AR = aortic regurgitation; AS = aortic stenosis; MR = mitral regurgitation; MS = mitral stenosis; TR = tricuspid regurgitation.

Prevention, management, and major issues

The major treatments for severe VHD are conservative and interventional, such as surgical or transcatheter intervention. In the KVS registry,[94] The 30.7% of patients with severe VHD underwent valve-related interventions that varied across the different types of severe VHD: mitral stenosis (MS), primary or secondary mitral regurgitation (MR), aortic stenosis (AS), aortic regurgitation (AR), and tricuspid regurgitation (TR). The intervention rate was the highest in AS at 43.7% and lowest in TR at 7.2%. The overall in-hospital mortality rate for these patients was 5.3%, with the highest mortality observed in patients with secondary severe MR (9.0%) or severe TR (7.5%), indicating poorer prognoses for those conditions. In each type of VHD, patients who received intervention had more severe symptoms and worse echocardiographic parameters than those who received conservative treatment.

For severe MS, mitral valve replacement (MVR) was performed in 15.2% of patients, and percutaneous mitral valvuloplasty (PMV) was performed in 4.1% of patients. Patients who received PMV were younger and had higher body mass indexes, lower creatinine levels, and higher creatinine clearance rates, suggesting a healthier overall patient profile. In severe primary MR, approximately 31% of patients received interventions, and the rates of MVR and MV repair were similar (16.6% and 14.8%). Younger, more symptomatic patients with fewer comorbidities were more likely to undergo those procedures. In cases of severe secondary MR, interventions were less common. For severe AS, interventions were more common, with 43.7% of patients undergoing surgical aortic valve replacement (SAVR) or transcatheter aortic valve replacement (TAVR). Patients undergoing SAVR were generally younger, and those in the TAVR group exhibited more symptoms. Severe AR treatment mainly involved SAVR, with a subset undergoing TAVR, especially when severe AR was combined with significant AS. For severe TR, tricuspid valve interventions were infrequent, and the patients who underwent surgery were notably younger and less burdened by comorbidities than those receiving conservative care.

Preventing VHD primarily involves leading a healthy lifestyle, managing existing health conditions, and being vigilant about symptoms that could indicate heart problems. Regular check-ups with a healthcare provider can also play a key role in prevention.

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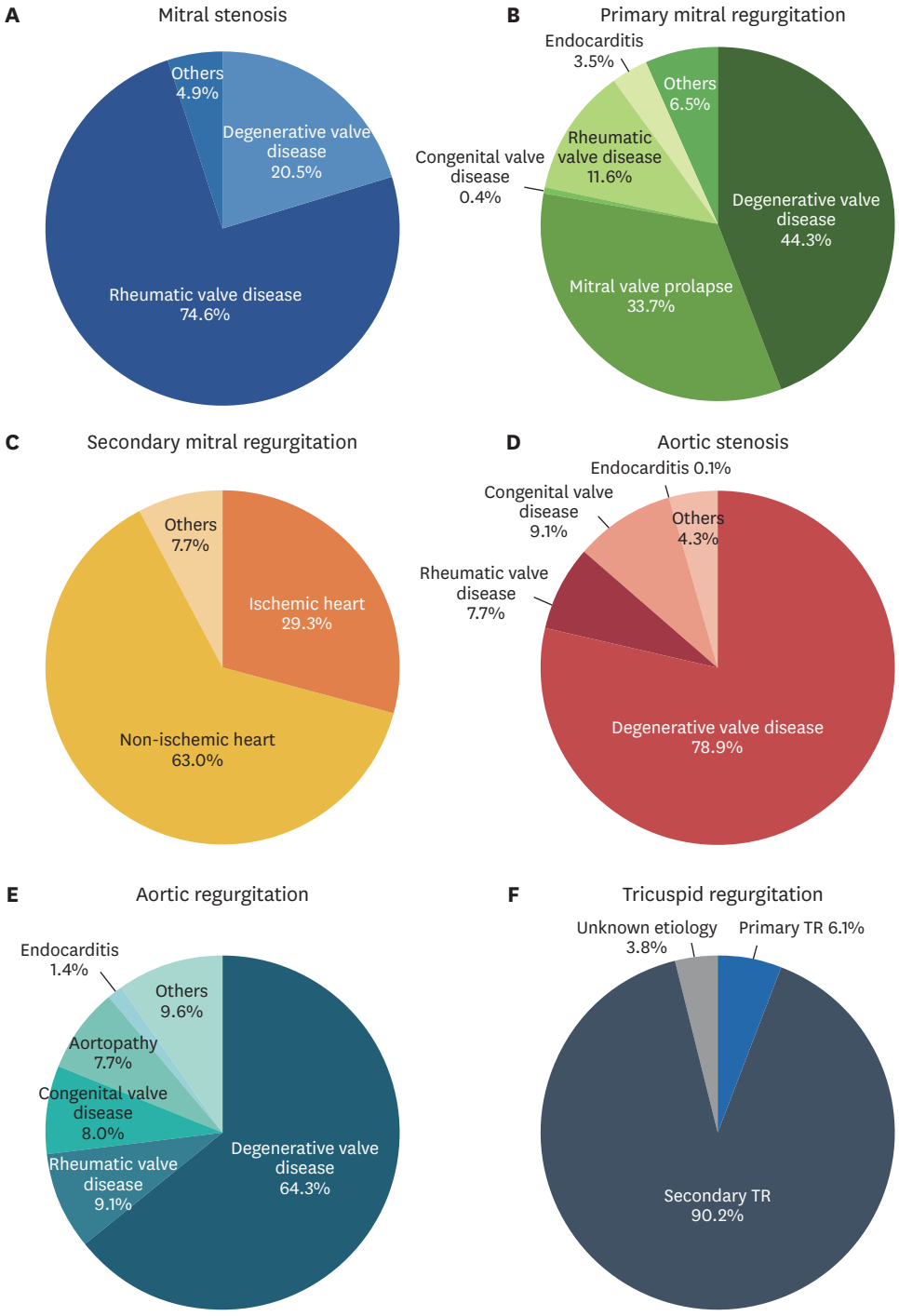

Figure 13. Etiology of each valvular heart disease. Pie charts showing the distribution of the etiology of mitral stenosis (A), primary mitral regurgitation (B), secondary mitral regurgitation (C), aortic stenosis (D), aortic regurgitation (E), and tricuspid regurgitation (F) in Korea.
Source: Choi et al. *J Cardiovasc Imaging* 2023;31:51-61.[94]

Recently, significant advances in interventional techniques, such as TAVR, mitral valve repair, and tricuspid valve repair, have revolutionized the treatment landscape for patients with a high or prohibitive surgical risk. As those techniques continue to evolve and improve, they are increasingly being used in earlier stages of valvular disease.[96] Identifying the right candidates

for transcatheter interventions remains challenging. The decision-making process involves assessing surgical risk, the anatomical suitability of the valves, and the potential benefits and risks of the procedure. This complexity requires a thorough evaluation by a multidisciplinary heart team.

Policy priorities and suggestions of management

VHD is characterized by scarce data, limited research, and low general awareness compared with other CVDs. Randomized clinical trials investigating VHD have been performed since the introduction of devices to relieve stenosis or reduce regurgitation. Potential disparities in care and outcomes according to sex and socioeconomic status were reported in US data and similar findings could be expected in other countries, including Korea.[97]

A barrier to establishing policy priorities is that in the general population, VHD is a hidden medical problem. Cardiac imaging examinations, particularly echocardiogram, are needed to diagnose VHD.[94] But it is still questionable whether screening for VHD in elderly people can improve their survival or quality of life. The increasing availability of handheld ultrasound machines and the application of artificial intelligence algorithms is likely to lower costs.[97]

Despite the proven clinical benefits of new percutaneous treatments for VHD, such as TAVR and transcatheter edge-to-edge repair (TEER) for severe secondary mitral regurgitation in other countries, Korea's current reimbursement criteria remain both inequitable and outdated, even when compared to neighboring Asian nations. Revising these criteria is essential to align with modern clinical practices and international standards. Currently, the physician fees are insufficient to support the adequate recruitment of specialized professionals, and there is no mechanism to incorporate patients' perspectives in the heart team discussion, which is composed solely of cardiologists and cardiac surgeons. Therefore, revisions are required to modernize reimbursement policies, ensure fair physician fee, and implement shared decision-making (SDM) that enables patients to actively participate in their treatment decisions.

As treatment options for VHD expand and the population of elderly patients with multiple comorbidities grow, SDM becomes increasingly vital. This patient-centered approach, combined with physician-recommended treatments, ensures that individual needs of patients are met.[97]

Furthermore, considering the high prevalence of frailty in patients with VHD and its association with poor outcomes after valve procedures, individualized follow-up is needed to assess the needs and care of individual patients. Better information is needed to guide patients through all aspects of their care, ensuring that they feel empowered to recognize potential signs of deterioration in their condition and seek help accordingly (**Figure 14**).[98]

Government policies should cover education of the general population and non-cardiology physicians, medical or surgical interventions for patients with poor socioeconomic status, and prolonged care for patients after an intervention. Considering the expected increase in the incidence of VHD and its effects on the survival and life quality of patients, screening studies funded by the government could help to improve disease care on a national level. Furthermore, policies are needed to make the use of heart valve teams administratively easy without absurd reimbursement requirements.

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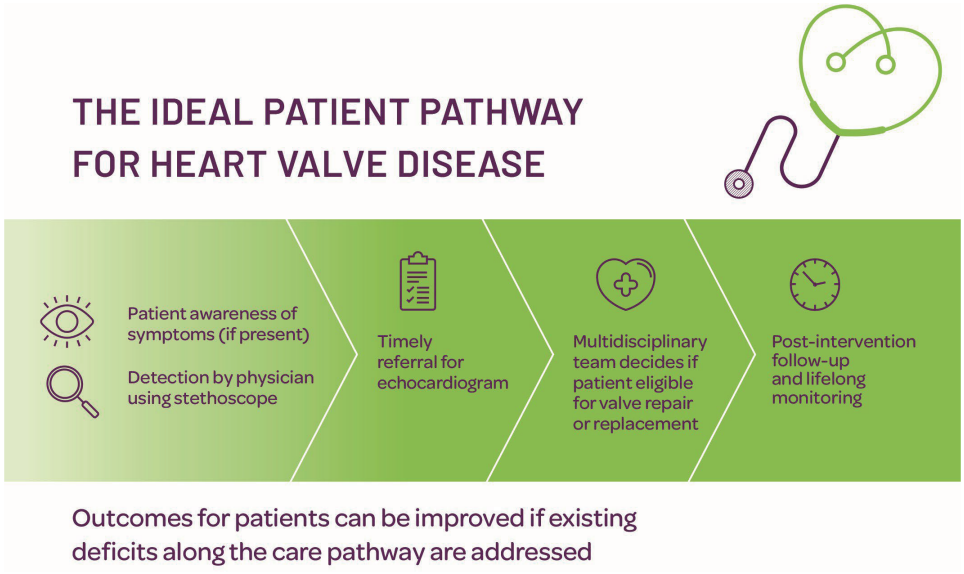

Figure 14. The ideal patient pathway for valvular heart disease.
Adapted from Sitges et al. *Eur Heart J Open* 2021;1: oeab034.[98] Written permission has been obtained from the copyright holder for its use in this publication.

KEY ISSUES AND FUTURE STRATEGIES FOR CARDIOVASCULAR DISEASE

Key issues for individual cardiovascular disease

CVDs are a major public health issue in Korea, characterized by high prevalence, increasing risk factors, and an aging population. This paper has addressed unmet needs for cardiovascular policy and CVD management.

Hypertension and dyslipidemia are the most-common cardiovascular risk factors, and they both have significant gaps between awareness and treatment. Initiatives such MMM have helped improve the management of hypertension, but challenges persist, including short clinic times, limited medication availability, and inadequate funding for preventive care. Recommendations include enhancing CVD management policies, increasing funding for preventive measures, implementing local awareness campaigns, and improving healthcare infrastructure to better manage hypertension. Leveraging IT technology could mark a new era in hypertension care by actively integrating mobile devices for continuous and dynamic BP evaluation.

For the management of dyslipidemia, the challenges include achieving personalized risk stratification and balancing the economic costs and benefits of novel therapies. Policy priorities should include establishing a Korea-specific risk-based management program that combines pharmacologic treatments, lifestyle modifications, and educational campaigns.

The prevalence of IHD is rising in South Korea, and mortality rates for AMI remain high. Challenges include a shortage of interventional cardiologists and disparity of regional access to care. Proposals to improve outcomes include fairer reimbursement, legal protections for high-risk patient care, and government initiatives to reduce regional disparities. Increased investment in research for CVD and support for the rapid use of new technologies and equipment for high-risk patient care is crucial for improving patient outcomes.

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Treatment of AF follows the ABC pathway. The role of early rhythm control needs more attention. SCD management focuses on immediate resuscitation, ICD therapy, and personalized risk stratification. Increasing ICD implantation rates and improving community awareness are essential steps in improving outcomes.

The management of HF faces several key issues, particularly regarding prevention, classification, and treatment. Effective strategies must prioritize primordial and primary prevention to avert irreversible myocardial changes, especially in HFpEF, for which effective treatments remain scarce. Furthermore, the classification of severe HF as a general disease hinders specialized care in tertiary hospitals, where expertise and appropriate reimbursement are essential for managing complex cases. Low reimbursement rates exacerbate challenges in hiring HF specialists, while limited insurance coverage restricts access to necessary treatments for severe patients. Additionally, managing elderly or frail HF patients poses unique challenges, as standard drug titration practices based on BP targets may lead to adverse effects in this population. Addressing these issues requires collaboration between government and academic societies, alongside a reevaluation of classification and reimbursement systems to improve outcomes for HF patients.

The key issues for VHD include a lack of data and research, outdated reimbursement criteria, and insufficient physician fees, which hinder access to effective treatments and specialized care. Additionally, disparities in care, a lack of shared decision-making, and the high prevalence of frailty among patients highlight the urgent need for comprehensive reforms in public education, policy, and patient-centered care approaches.

KOREAN SOCIETY OF CARDIOLOGY POLICY PROPOSALS

This document highlights the need for an integrated policy approach to address the full spectrum of CVDs in Korea. It calls for comprehensive actions by policymakers, societal organizations, and academic societies to improve CVD management, increase CVD awareness, and reduce the health burden of CVD. Emphasis is placed on public awareness campaigns, equitable access to healthcare, and addressing the economic and social effects of CVD.

Proposals for policymakers

- Develop and execute an integrated strategy for CVD that enhances prevention and treatment across all stages of CVD and addresses real world challenges.
  - **Expand the policy target beyond acute care.**
  - **Establish a concrete budget allocation for CVD policies.**
  - **Develop a social consensus for funding priorities.**
  - **Build a dedicated CVD division in the Ministry of Health and Welfare** that will have clear accountability for developing and implementing national initiatives to enhance CVD prevention and management.
  - **Establish a collaborative system** among relevant government agencies, non-government agencies, and local authorities for the effective prevention and management of CVD.

- Expand and innovate to address the workforce shortage that has significantly compromised CVD services.
  - **Incentivize high-risk patient care** by ensuring adequate compensation and establishing legal protections.

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- **Launch government initiatives** to address and mitigate disparity in CVD care and outcomes.
- **Develop effective pre-hospital screening tools** for acute conditions to optimize the utilization of limited healthcare personnel.
- **Provide a supply and support plan for interventional cardiologists** to address shortages and ensure equitable access to essential healthcare.

- Promote advances in clinical practice and prevention across the entire CVD spectrum.
  - **Implement a reimbursement model** that provides adequate, comprehensive coverage from prevention to cardiac rehabilitation.
  - **Integrate cardiac rehabilitation as a critical component of CVD care** by expanding access to cardiac rehabilitation programs, particularly for rural and underserved areas.
  - **Invest more in public awareness of CVD.**
  - **Support healthcare provider education and training** on the latest CVD treatment protocols and advanced interventional techniques.
  - **Provide a secure healthcare environment** by improving rural healthcare facilities and ensuring the availability of essential medications for CVD management.

- Implement comprehensive innovations throughout CVD research to improve outcomes.
  - **Invest more in CVD research.**
  - **Develop a plan for the long-term strategic funding of CVD research.**
  - **Establish and support standardized nationwide health data collection and management systems,** and establish links among key data.

Proposals for academic societies

- **Support and initiate nationwide CVD clinical research.**
- **Develop and disseminate clinical guidelines.**
- **Promote interdisciplinary collaboration to improve CVD outcomes.**
- **Develop and propose CVD policies** to address real-world issues and improve CVD outcomes.
- **Support patients and raise awareness.**

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