HRS COMMITTEE DOCUMENT

Statement from the Asia Summit: Current state of arrhythmia care in Asia

Wataru Shimizu, MD, PhD (Co-Chair),[1*†] Fred M. Kusumoto, MD, FHRS (Co-Chair),[2‡] Michael-Joseph F. Agbayani, MD,[3§] Sirin Apiyasawat, MD,[4¶] Minglong Chen, MD, PhD, FHRS,[5#**] Chi Keong Ching, MBBS, FHRS,[6††] Jong-Il Choi, MD, MHS, PhD,[7‡‡] Van Buu Dan Do, MD, FHRS,[8] Dicky A. Hanafy, MD, PhD,[9§§] Jodie L. Hurwitz, MD, FHRS,[10‡] Sofian Johar, MA, MBChB, PhD, FHRS,[11¶¶] Jonathan M. Kalman, MBBS, PhD, FHRS,[12##] Aamir Hameed H. Khan, MBBS,[13***] Pichmanil Khmao, MD,[14†††] Andrew D. Krahn, MD, FHRS,[15‡] Tachapong Ngarmukos, MD,[4¶] Son Thai Binh Nguyen, MD,[16] Nwe Nwe, MS,[17§§§] Seil Oh, MD, PhD, FHRS,[18‡‡] Kyoko Soejima, MD,[19†] Martin K. Stiles, MBChB, PhD, FHRS,[20##] Hsuan-Ming Tsao, MD,[21¶¶¶] Saruul Tseveendee, MD[22###]

From the [1]Nippon Medical School, Tokyo, Japan, [2]Mayo Clinic Jacksonville, EP and Pacing Services, Jacksonville, Florida, [3]Philippine Heart Center, Quezon City, Philippines, [4]Ramathibodi Hospital, Bangkok, Thailand, [5]Jiangsu Province Hospital, Nanjing, Jiangsu, China, [6]National Heart Centre Singapore, Singapore, [7]Korea University Medical Center, Seoul, Republic of Korea, [8]Tam Duc Cardiology Hospital Joint Stock Company, Ho Chi Minh City, Vietnam, [9]PJN Harapan Kita, Jakarta, Indonesia, [10]North Texas Heart Center, Dallas, Texas, [11]Gleneagles JPMC, Kg Kiarong, Brunei Darussalam, [12]Royal Melbourne Hospital, Melbourne, Victoria, Australia, [13]Aga Khan University Hospital, Karachi, Pakistan, [14]Khmer Soviet Friendship Hospital, Phnom Penh, Cambodia, [15]Division of Cardiology, University of British Columbia, Vancouver, British Columbia, Canada, [16]FV Hospital, Ho Chi Minh City, Vietnam, [17]Yangon General Hospital, Yangon, Myanmar, [18]Seoul National University Hospital, Seoul, Republic of Korea, [19]Kyorin University School of Medicine, Tokyo, Japan, [20]Waikato Hospital, Hamilton, New Zealand, [21]National Yang Ming University Hospital, Yi-lan, Taiwan, and [22]National Heart Centre Singapore, Ulaanbaatar, Mongolia.

On May 27, 2022, the Asia Pacific Heart Rhythm Society and the Heart Rhythm Society convened a meeting of leaders from different professional societies of healthcare providers committed to arrhythmia care from the Asia Pacific region. The overriding goals of the meeting were to discuss clinical and health policy issues that face each country for providing care for patients with electrophysiologic issues, share experiences and best practices, and discuss potential future solutions. Participants were asked to address a series of questions in preparation for the meeting. The format of the meeting was a series of individual country reports presented by the leaders from each of the professional societies followed by open discussion. The recorded presentations from the Asia Summit can be accessed at https://www.heartrhythm365.org/URL/asiasummit-22. Three major themes arose from the discussion. First, the major clinical problems faced by different countries vary. Although atrial fibrillation is common throughout the region, the most important issues also include more general issues such as hypertension, rheumatic heart disease, tobacco abuse, and management of potentially life-threatening problems such as sudden cardiac arrest or profound bradycardia. Second, there is significant variability in the access to advanced arrhythmia care throughout the region due to differences in workforce availability, resources, drug

This paper was jointly developed by *Heart Rhythm O²*, *Journal of Arrhythmia* and jointly published by Elsevier Inc and John Wiley and Sons Australia, Ltd. The articles are identical except for minor stylistic and spelling differences in keeping with each journal's style. Either citation can be used when citing this article.
*Representative of the Asia Pacific Heart Rhythm Society. †Representative of the Japanese Heart Rhythm Society. ‡Representative of the Heart Rhythm Society. §Representative of the Philippine Heart Rhythm Society. ¶Representative of the Thai Electrophysiology Club (a subsidiary of the Thai Heart Association). #Representative of the Chinese Society of Pacing and Electrophysiology. **Representative of the Chinese Society of Arrhythmias. ††Representative of the Heart Rhythm Association Singapore. ‡‡Representative of the Korean Heart Rhythm Society. §§Representative of the Indonesian Heart Rhythm Society. ¶¶Representative of the Brunei Cardiac Society. ##Representative of the Cardiac Society of Australia and New Zealand. ***Representative of the Pakistan Heart Rhythm Society. †††Representative of the Cambodian Heart Association. §§§Representative of the Cardiac Society of Myanmar Medical Association. ¶¶¶Representative of the Taiwan Heart Rhythm Society. ###Representative of the Mongolian Heart Rhythm Society. **Address reprint requests and correspondence:** Dr Fred Kusumoto, Department of Cardiovascular Disease, Mayo Clinic, 4500 San Pable Avenue, Jacksonville, FL 32224. E-mail address: kusumoto.fred@mayo.edu.

https://doi.org/10.1016/j.hroo.2023.08.005

availability, and national health policies. Third, collaboration in the area already occurs between individual countries, but no systematic regional method for working together is present.

KEYWORDS Arrhythmia; Asia; Pacific; Electrophysiology; Global; Summit

ABBREVIATIONS **AF** = atrial fibrillation; **APHRS** = Asia Pacific Heart Rhythm Society; **CIED** = cardiac implantable electronic device; **CRT** = cardiac resynchronization therapy; **GDP** = gross domestic product; **ICD** = implantable cardioverter defibrillator; **OECD** = Organization for Economic Cooperation and Development; **OHCA** = out-of-hospital cardiac arrest; **SCD** = sudden cardiac death; **SVT** = supraventricular tachycardia; **VA** = ventricular arrhythmia

1. Asia Pacific region

The Asia Pacific region is a large and diverse group of countries usually defined as those countries on the western side of the Pacific Ocean and is often further subdivided into East Asia, North Asia, Southeast Asia, Oceania (Australasia, Polynesia, Micronesia, Melanesia), and the Indian subcontinent.[1] Depending on the definition used, there are approximately 5 billion people who live in the region and make up most of the world population.[2]

In 2010, the Asia Pacific Heart Rhythm Society (APHRS) began collecting annual information on disease burden of arrhythmias and related clinical issues, availability of specialized therapies for arrhythmias, and workforce information from their member representatives and published the collated results in the APHRS White Book.[3] Using these data and other sources, Figure 1 provides an estimate of the percentage of gross domestic product (GDP) used for healthcare for individual countries. There is a significant range for different countries in the region (from 2% to 10%).[3-6]

Use of nonpharmacologic therapies for arrhythmia care for different countries is shown in Figures 2 and 3. As shown in Figure 2, a wide range of cardiac implantable electronic device (CIED) implantation rates are observed, with the highest implant utilization in countries where a higher percentage of the GDP is directed to healthcare (Japan and New Zealand). The CIED implant rates in Japan and New Zealand are 598 per million and 720 per million, respectively. For comparison, one study from a rural county in the United States estimated that the CIED implant rate is 890 per million, and Germany has the highest reported CIED implant rate in Europe with an estimate of 1698 per million.[7,8] Low rates of CIED implantation are observed in countries where workforce issues are present. For example, in Pakistan and the Philippines, only a small percentage of the general population are physicians and, among physicians, only a very small percentage implant CIEDs Table 1. Use of ablation follows a similar pattern, with the highest ablation rates reported by Japan and New Zealand. While in most countries ablations for arrhythmias other than atrial fibrillation (AF) make up most ablation procedures, in Japan and South Korea a larger percentage of ablations are performed for the treatment of AF Figure 3.

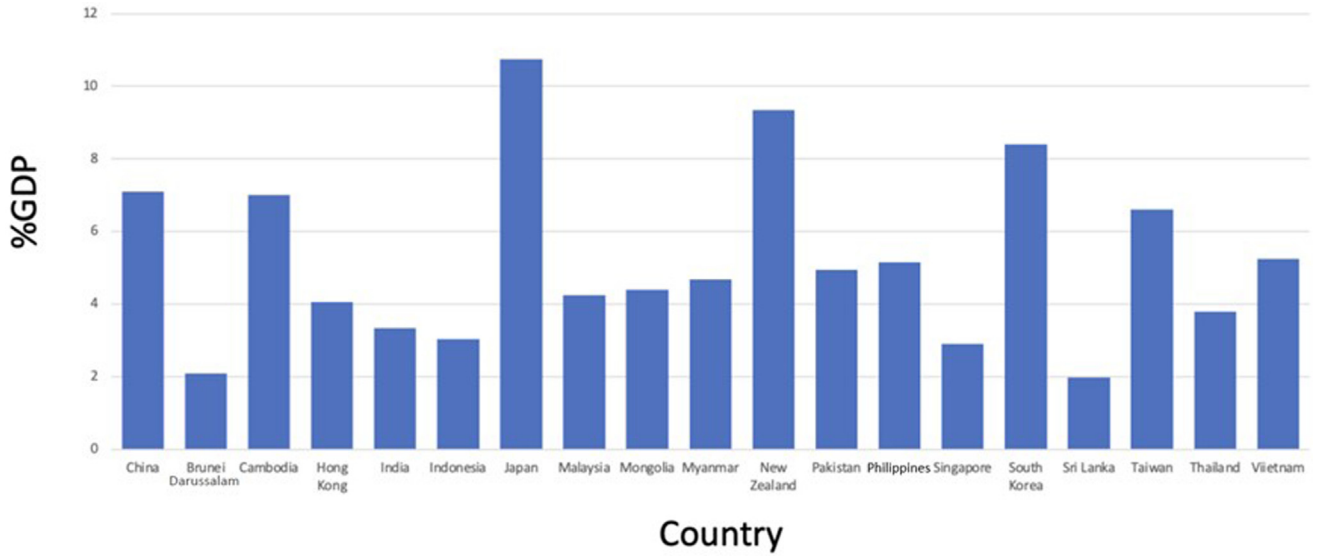

Figure 1 Estimated percentage of a country's gross domestic product (GDP) spent on healthcare. When multiple years were available, the past 5 years were averaged to account for year-to-year variability.[3-6]

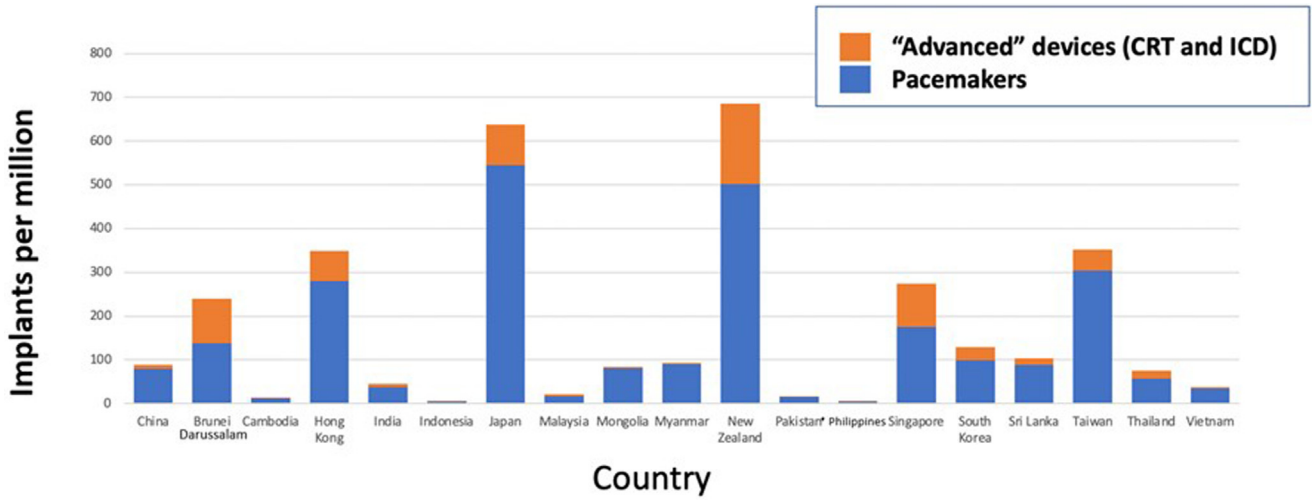

Figure 2 Cardiac implantable electronic device implant rates (implants per million) for different countries in the Asia Pacific region divided by pacemakers and "advanced" devices including cardiac resynchronization therapy (CRT) and implantable cardioverter defibrillators (ICDs) in 2020 (*Pakistan) and 2021.[3-6]

2. Individual country reports

2.1. Brunei Darussalam

Brunei Darussalam is situated on the northwestern coast of Borneo in Southeast Asia and has a population of approximately 440,000 according to the 2021 census.[9] Healthcare for citizens is largely free at the point of care, with permanent residents entitled to subsidized care. Other individuals rely on insurance or pay out of pocket.

There are few published data on the prevalence of arrhythmias in Brunei Darussalam, but approximately 25.3% of stroke patients had AF, which is comparable to findings in a matched German population.[10] In addition, other data suggest that survival from cardiac arrests remains very low (1.4%), with low rates of bystander cardiopulmonary resuscitation.[11] According to the 2022 APHRS White Book, 61 pacemakers, 18 cardiac resynchronization therapy (CRT) devices, and 27 implantable cardioverter defibrillators (ICDs) were implanted. A total of 102 ablation procedures were performed, mostly for AF, supraventricular tachycardia (SVT), and premature ventricular contractions.[3] Lead extraction using powered tools is available, although numbers are low. A 3-dimensional mapping system is available for use, and the rates of conduction system pacing are increasing. On a per capita basis, the numbers of implanted devices and procedures performed indicate reasonable access to therapy.

2.2. Cambodia

Cambodia is located in Southeast Asia with a total population of around 17 million.[12] The improvement in healthcare (both public and private sectors) has resulted in an increased life expectancy of 70 years in 2021.[13] Universal health coverage is a huge challenge in Cambodia, and out-of-pocket expenditure remains as high as 60%. However, several years ago, the

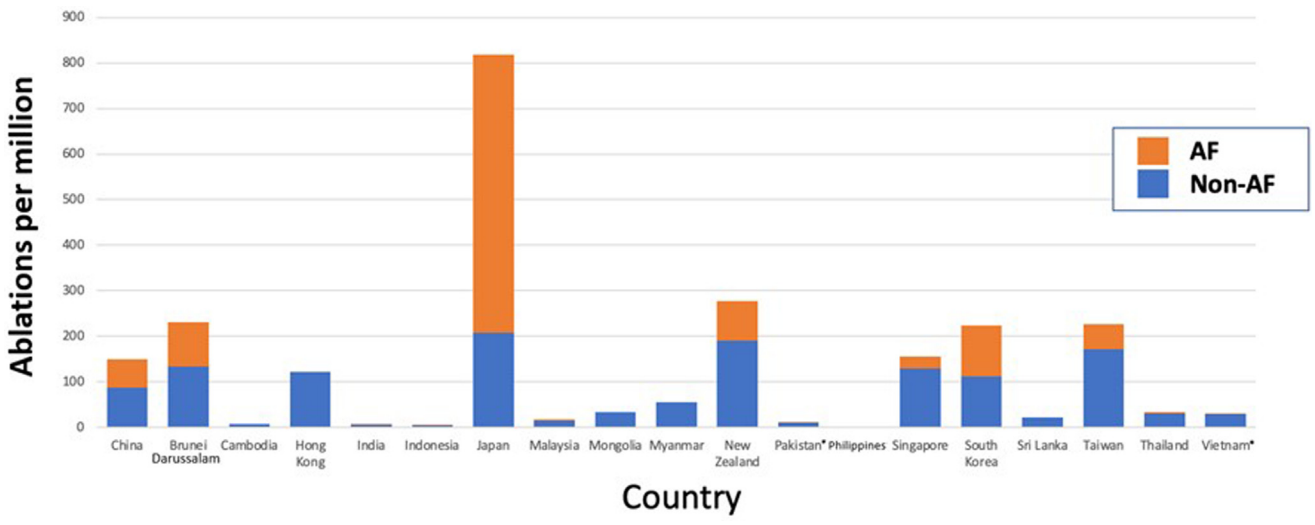

Figure 3 Catheter ablation procedures (procedures per million) for different countries in the Asia Pacific region divided by atrial fibrillation (AF) ablation and non-AF ablation procedures for 2020 (*Pakistan and Vietnam) and 2021.[3-6]

Table 1 Percentage of physicians in the general population and percentage of physicians who implant pacemakers and perform ablation

Country	Percentage of physicians in the general population	Percentage of physicians who implant pacemakers	Percentage of physicians who perform ablation
Brunei Darussalam	0.15%	0.75%	0.15%
Cambodia	NA	NA	NA
China	0.29%	0.10%	0.08%
Hong Kong	0.21%	NA	NA
India	0.10%	NA	0.01%
Indonesia	0.08%	0.05%	0.01%
Japan	0.13%	NA	1.55%
Malaysia	0.00%	3.69%	1.38%
Mongolia	0.38%	0.05%	0.01%
Myanmar	0.01%	5.41%	3.35%
New Zealand	0.32%	0.30%	0.13%
Pakistan	0.04%	0.02%	0.00%
Philippines	0.12%	0.04%	0.00%
Singapore	0.28%	0.16%	0.13%
South Korea	0.25%	0.09%	0.08%
Sri Lanka	0.09%	0.06%	0.05%
Taiwan	0.22%	1.81%	0.11%
Thailand	0.06%	NA	NA
Vietnam	0.11%	0.12%	0.04%

NA = not available.

Royal Government of Cambodia created the National Social Security Fund designed to provide social health insurance to all employed adults in the country with the greater access to care including invasive therapeutic procedures for life-threatening emergency conditions.[14]

Cardiovascular disease is a major burden for the Cambodian healthcare system, although heart rhythm disorders remain underrecognized in provincial and rural areas. A verbal survey among the cardiologists in tertiary hospitals found that the majority of patients with arrhythmias including tachyarrhythmias (SVT, AF, ventricular arrhythmia [VA]) and bradyarrhythmias frequently presented with disabling symptoms and at a relatively late stage with critical conditions such as arrhythmia induced-cardiomyopathy, ischemic stroke, and cardiac arrest. In contrast to developed countries, rheumatic heart disease (mitral stenosis) is still one of the leading causes of AF in adults. Recently, cardiologists and other physicians have become increasingly aware of genetic diseases associated with sudden cardiac death (SCD) such as Brugada syndrome and long QT syndrome.

A total of 6 centers with 12 electrophysiologists are located solely in one city (Phnom Penh) and provide invasive management in arrhythmia care such as CIED implantation (6 centers) and radiofrequency catheter ablation (3 centers). However, interventional procedures remain relatively limited due to multiple factors including patient understanding and financial constraint. In the future, it will be key to educate medical professionals and patients about arrhythmias through social media and other communication platforms and to negotiate with national health insurance systems for the reimbursement of interventional arrhythmia procedures.

2.3. China

China has a large population of around 1.4 billion people.[15] With the efforts of healthcare providers and improving healthcare policies, the current average life expectancy has reached as high as 77 years.[15] However, cardiac death continues to be the leading cause of all-cause mortality in China. Among the causes of cardiac death, cardiac rhythm disorders, either idiopathic or associated with underlying cardiovascular disease, are important contributors. The incidence of SCD is 5.4 million per year, and efforts are underway to target prevention and improve emergency management.[16] Public campaigns for screening high-risk patients, more widespread availability of automatic external defibrillators, and efforts to broadly teach cardiopulmonary resuscitation to the general public are being implemented. The number of ICDs for both primary and secondary prevention is only 5000 per year in China.[3] China has approximately 20 million patients with AF, with the prevalence of 1.6% in the adult population.[17] Of note, 50% are in the rural areas where

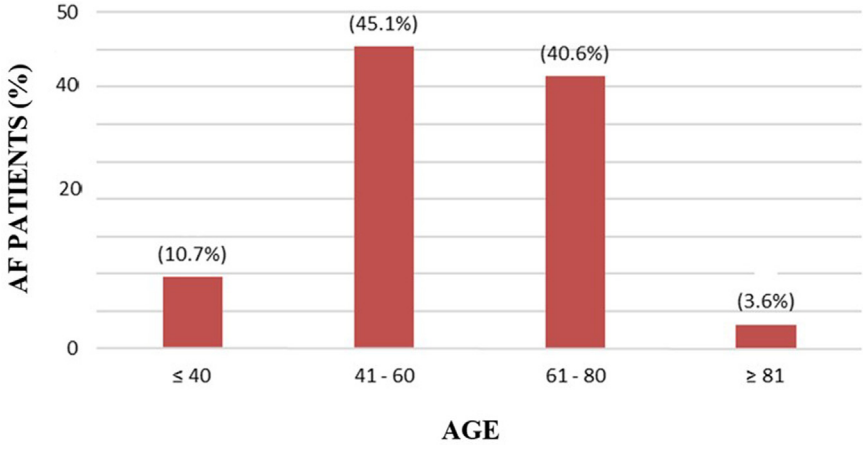

Figure 4 Age distribution of atrial fibrillation (AF) patients in Indonesia (n = 896).[19]

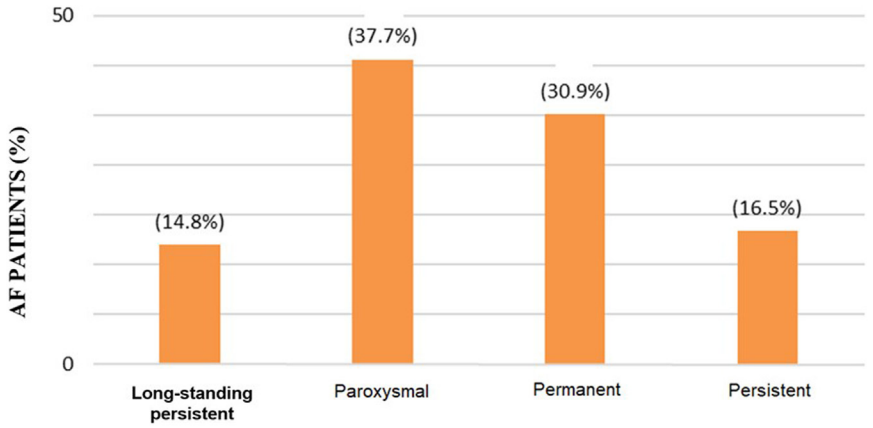

Figure 5 Classification of atrial fibrillation (AF) patients in Indonesia (n = 896) based on standard definitions. Long-standing persistent: >1 year. Paroxysmal: AF episode duration <1 week. Permanent: persistent AF with no future attempt for rhythm control. Persistent: AF duration >1 week.[19]

medical resources are less available.[17] AF screening and management programs are being implemented as pilot programs in different regions to generate evidence to support more widespread strategies for the identification and optimal management of AF. A similar strategy of developing chest pain centers significantly shortened the door-to-balloon time in patients with acute myocardial infarction.[18] Strategies to optimize identification and treatment for heart failure and valvular heart disease are also being implemented.

2.4. Indonesia

Similar to developed countries, AF in Indonesia is also the most common arrhythmia encountered in clinical practice. However, data from a national registry showed that in Indonesia patients are younger, with the majority between 41 and 60 years old Figure 4, and permanent AF is common (31%) Figure 5.[19] AF distribution varies depending on ethnicity. Based on risk factors, the reported prevalence of AF is lower than expected, suggesting the possibility of underidentification. Approximately 56% of male and 43% of female patients were candidates for anticoagulant therapy (sex independent CHA_2DS_2VASc score ≥ 2). When anticoagulation is prescribed, warfarin is used because direct oral anticoagulants are not covered by national health insurance. However, the time in therapeutic range with warfarin treatment is only 37%.[19,20] The availability of test facilities that can measure the international normalized ratio (INR) is limited and not well distributed in Indonesia, which has led to the reluctance of primary care physicians to prescribe warfarin. The prevalence of hypertension in all provinces ranges from 22% to 39.6% Figure 6.[20] All of these factors likely contribute to why stroke is the highest cause of mortality in Indonesia. In response, the Indonesian Heart Rhythm Society routinely conducts AF campaigns to

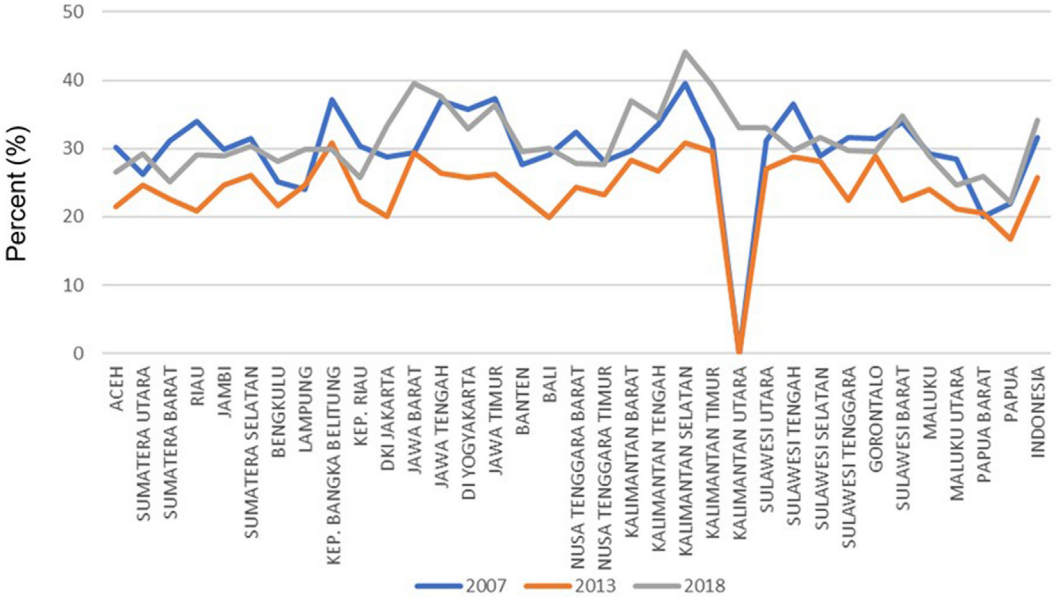

Figure 6 Prevalence of hypertension as risk factor for atrial fibrillation in all provinces in Indonesia. DI = Daerah Istimewa; DKI = Daerah Khusus Ibukota; KEP = Kepulauan.[20]

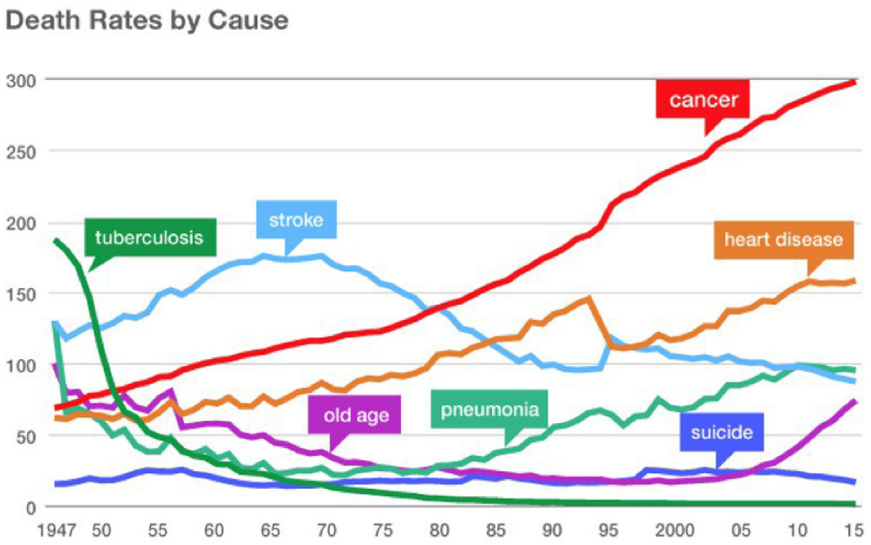

Figure 7 Death rates (defined as number of deaths per 100,000 people) by cause in Japan. Created by Nippon.com based on the vital statistics report published in 2018 by the Ministry of Health, Labour, and Welfare.

educate people on the importance of AF screening and treatment.

Indonesia spends approximately 2%–3% of its GDP on healthcare.[20] In 2014, the Indonesian government introduced a national health insurance system to address the fragmented healthcare system and resolve the country's healthcare inequality; this system currently provides coverage for 92% of the population.[20] However, minimal reimbursement is a critical issue, and currently only single-chamber pacemakers and simple cardiac ablation procedures utilizing resterilized catheters are supported. The lack of funds for complex procedures is a burden for hospitals because national health insurance system participants are not allowed to contribute additional costs. Procedures within this category include implantation of CIEDs such as dual-chamber pacemakers, CRT, and ICDs and ablation procedures that require complex mapping systems.

Finally, there are only 42 cardiac electrophysiologists in 14 centers that are distributed unevenly (located in 13 of 34 provinces) and serve a population of more than 270 million

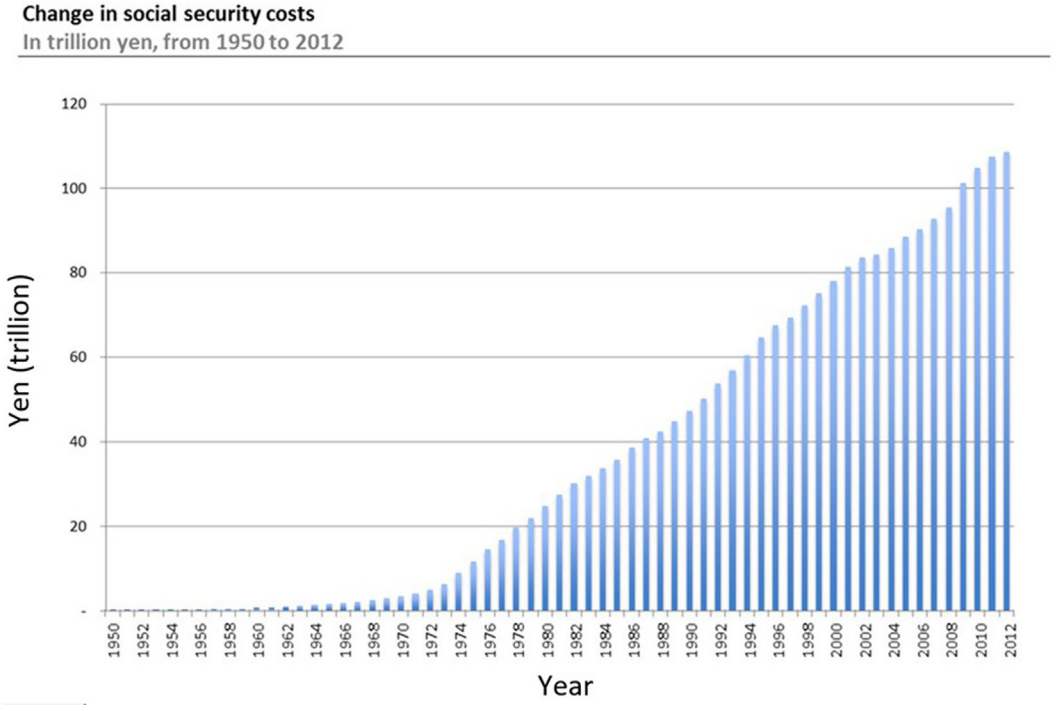

Figure 8 Change in social security costs in Japan in Japanese Yen (in 2012, average exchange rate was 1 yen = 0.0115 USD).[23]

Table 2 Ablation procedures and device implantation during 2015-2020 in Myanmar

	2015	2016	2017	2018	2019	2020
Ablation procedures						
AF	3	13	13	11	13	8
Other SVTs	481	561	672	891	945	555
VA	46	44	66	58	76	38
Device implantation						
PPM	485	515	554	648	641	509
ICD	16	21	33	24	37	22
CRT	18	4	10	13	11	1

AF = atrial fibrillation; CRT = cardiac resynchronization therapy; ICD = implantable cardioverter defibrillator; PPM = permanent pacemaker; SVT = supraventricular tachycardia; VA = ventricular arrhythmia.

people.[3] Complex ablation procedures can be performed in only 50% of those electrophysiology centers. The availability of arrhythmia drugs and their distribution is another challenge.

2.5. Japan

Heart disease, in particular heart failure and AF, has been an increasing cause of death in Japan Figure 7.[21] The Stroke and Cardiovascular Disease Control Act was implemented in 2019 with specific aims that include promoting the prevention of stroke, heart disease, and other cardiovascular disease while advancing the development of a system that provides rapid and appropriate treatment to extend healthy life expectancies and reduce the financial burdens of medical treatment and long-term care.

Since 1961, Japan has had a system for universal health coverage that allows every citizen equal access to necessary and high-quality medical treatment by paying only a certain percentage of the medical cost. The current healthcare system faces various issues, such as increase in the elderly population, decrease in the working-age population, and a burden on the healthcare system caused by emergencies and expensive treatment, all of which lead to increased costs Figure 8.[22,23] Between 2008 and 2013, health spending increased from 8.5% to 10.2% of the GDP, which is higher than the 2013 average of 8.9% for Organization for Economic Cooperation and Development (OECD) countries. The medical device market in Japan was estimated in 2012 as $32 billion, an increase of 8.7% from 2011.[23] Other reasons for the increase include longer hospital stays, and lower generics share in Japan than in other OECD countries (28% vs 48%).

One specific prominent clinical issue in Japan is that inherited arrhythmias such as Brugada syndrome are a significant cause of SCD. Brugada syndrome is common in Southeast Asia, and some cases of previously described SCD syndromes such as Lai Tai in Thailand or Pokkuri in Japan are thought to be Brugada syndrome.[24] Prevalence of Brugada syndrome with type 1 electrocardiogram is significantly higher in Asia (0.15%–0.27% in Japan) than in Europe or the United States.[25] Inherited arrhythmias including Brugada syndrome account for approximately 10% of SCD in Japan, and Brugada syndrome accounts for 10% of ICDs implanted for primary prevention and 7% of ICDs implanted for secondary prevention.[26] The annual lethal cardiac event rate in Brugada syndrome patients with a history of ventricular fibrillation/anomalous coronary artery was approximately 8%–11%. Moreover, a prospective Japanese Brugada syndrome multicenter registry reported that the Brugada syndrome probands with a pathogenic *SCN5A* mutation, especially a mutation located in the pore region, had a higher cardiac event rate than those without *SCN5A* mutations.[27]

Table 3 Arrhythmia claims vs claims for arrhythmia-related procedures in the Philippines

	No. of claims for SVT[38]	No. of claims for ablation[38]
2017	1121	25
2018	1149	19
	No. of claims for bradyarrhythmia[39]	**No. of claims for pacemaker implantation[39]**
2017	958	549
2018	1144	683
	No. of claims for ventricular arrhythmias[40]	**No. of claims for ICD implantation[40]**
2017	1282	50
2018	1480	45

Table 4 Volume of CIED and ablation procedures for the years 2017-2020 in Singapore

	2017	2018	2019	2020
Population (thousands)	5612	5638	5703	5685
Pacemakers (per million)	143	155	162	160
CRT (per million)	32	33	36	31
ICD (per million)	67	70	61	72
Ablations (per million)	150	169	169	127
AF/AFL (%)	42	47	41	42
PVC/VT (%)	13	13	16	12

AF = atrial fibrillation; AFL = atrial flutter; CIED = cardiac implantable electronic device; CRT = cardiac resynchronization therapy; ICD = implantable cardioverter defibrillator; PVC = premature ventricular contraction; VA = ventricular arrhythmia; VT = ventricular tachycardia.

2.6. Mongolia

Mongolia is the world's most sparsely populated country with 3.4 million people in 1.6 million square kilometers.[28] Cardiovascular disease is thought to be the leading cause of death, accounting for approximately 34% of deaths.[28] The most prevalent conditions are coronary artery disease, heart failure, and AF. The first dedicated electrophysiology laboratory was established in 2016, and since then 727 ablation (700 SVT, 12 AF, 15 VT) procedures have been performed.[3] In addition, approximately 200 cardiac devices are implanted annually. Challenges remain, including a lack of physicians and staff trained in electrophysiology.

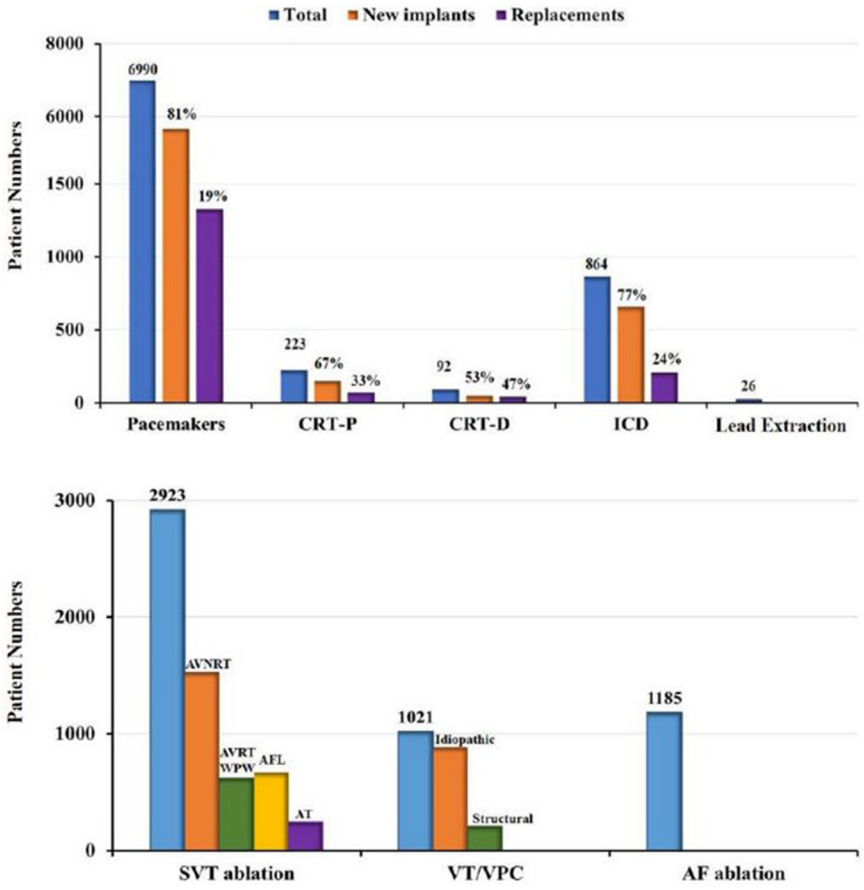

Figure 9 Annual patient numbers of device and ablation procedures of Taiwan in 2020. **Top:** Estimated annual cardiac implantable electronic device implants in Taiwan by device type stratified by total, new implant, and replacement. **Bottom:** Annual patient numbers of ablation procedures in Taiwan in 2020. AF = atrial fibrillation; CRT-D = cardiac resynchronization therapy with defibrillator, CRT-P = cardiac resynchronization therapy with pacemaker; ICD = implantable cardioverter defibrillator; SVT = supraventricular tachycardia; VPC = ventricular premature complex; VT = ventricular tachycardia.

2.7. Myanmar

Myanmar is a developing country, and currently rheumatic valvular heart disease with AF is the most prevalent arrhythmia condition.[29,30] The absence of widespread availability of advanced therapies, antiarrhythmic medication, and anticoagulation therapy is a major healthcare burden.

Currently the Ministry of Labor provides partial reimbursement of healthcare costs for people who are employed.

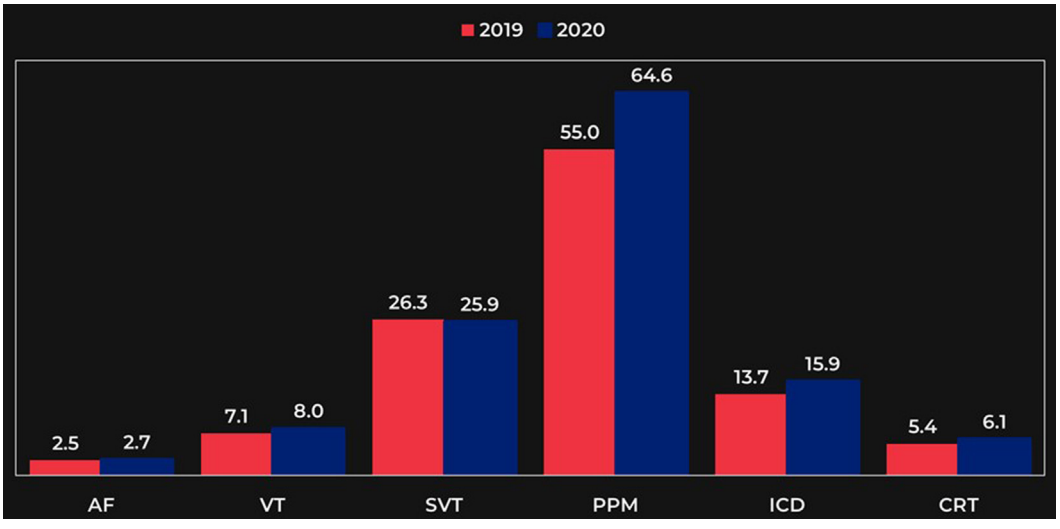

Figure 10 Annual numbers of electrophysiology procedures per 1 million population of Thailand. AF = atrial fibrillation; CRT = cardiac resynchronization therapy; ICD = implantable cardioverter defibrillator; PPM = permanent pacemaker; SVT = supraventricular tachycardia; VT = ventricular tachycardia.

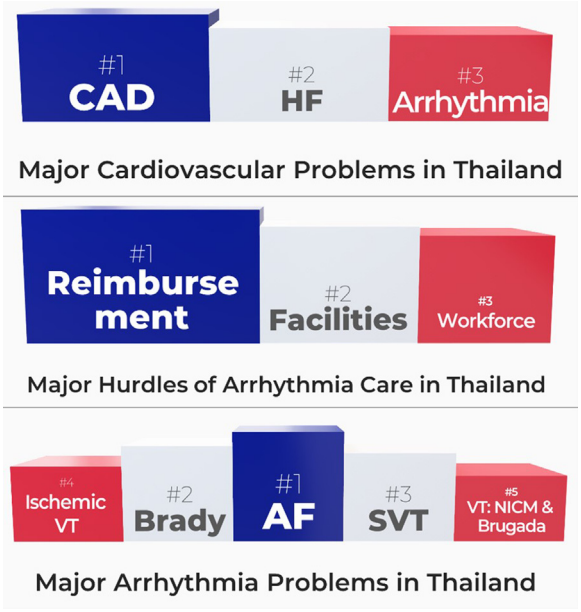

Figure 11 Major issues in healthcare, cardiovascular care, and arrhythmia care in Thailand. AF = atrial fibrillation; Brady = bradycardia; CAD = coronary artery disease; HF = heart failure; NICM = nonischemic cardiomyopathy; SVT = supraventricular tachycardia; VA = ventricular arrhythmia; VT = ventricular tachycardia.

Private insurance is also available but rare. Medications such as antiarrhythmic drugs are available during hospital stays, but continued outpatient treatment is the patient's responsibility. The Myanmar government provides infrastructure for electrophysiology laboratories. Ablation for SVT is the most common procedure, followed by pacing therapy for bradyarrhythmia Table 2. Specialized electrophysiology training of the physician and nonphysician workforce is recognized as an important problem in Myanmar.

2.8. New Zealand

The estimated population of New Zealand (NZ) is 5 million, with a prevalence of arrhythmia comparable with other OECD countries.[31,32] The largest cardiac medical issue in NZ is coronary heart disease, followed by arrhythmia disorders, valvular heart disease, vascular disease, and congenital heart disease. Importantly, a disproportionate burden of rheumatic heart disease exists in NZ. Arrhythmia-specific issues, in order of prevalence and healthcare burden, encompass AF, bradycardia, VA in a structurally normal heart, VA associated with cardiomyopathy, and VA related to ischemia.

Bradycardia is the most prevalent arrhythmia problem requiring intervention faced in NZ, and the workforce is sufficient to meet this demand in a timely fashion. However, workforce issues, particularly too few cardiac physiologists (personnel that can perform ambulatory electrocardiographic monitoring and monitoring in cardiac invasive laboratories), are the major clinical problem, followed by training, technology/equipment facilities, access to antiarrhythmic drugs, nonantiarrhythmic drugs, and CIEDs. Interventional data are derived from a national device registry and activity records from individual operating centers.[33,34] In 2020, there were 2056 ablation procedures, comprising 730 for AF, 921 for SVT, and 120 for VA. In the same year, 2670 pacemakers, 457 ICDs, and 347 CRT devices were implanted.

2.9. Pakistan

Pakistan is the fifth largest country in the world by population, with 242 million people.[35] Unfortunately, there are no national data available, but coronary heart disease and associated risk factors and infectious disease are likely the largest health issues in Pakistan.[36,37] Arrhythmias are likely the third major cardiovascular problem behind coronary artery disease and heart failure. SVT, followed by AF (mainly due to rheumatic heart disease), and bradycardia are the 3 most important arrhythmia issues in Pakistan. Workforce challenges remain the most critical health policy problem in Pakistan, mainly due to lack of training availability. Access to antiarrhythmic drugs is also a critical problem.

2.10. Philippines

Arrhythmia management in the Philippines faces challenges including geographic and economic barriers to equitable healthcare access. CIEDs such as pacemakers and ICDs are available in the country, but most of the facilities in which these devices can be implanted are in the city centers, particularly in the Metropolitan Manila area. Radiofrequency ablation and specialized mapping equipment are available in the larger hospitals, and ablation procedures are slowly increasing. However, many patients are unable to afford these expensive therapies, with approximately 24% of the citizenry living under the poverty line.[38] Evaluation of the national health insurance program's database suggests that pacemaker implantation, radiofrequency ablation, and ICDs are underutilized in the country Table 3.[38-40]

2.11. Singapore

Singapore is a city state located approximately 1 degree north of the equator in Southeast Asia. In the year 2021, the population numbered 5.45 million with a median age of 41.8 years.[41] Approximately 11.7% of the population is aged ≥65 years. The government's healthcare system comprises a government-funded health insurance program, a compulsory national medical savings system, and a safety net for those not able to afford healthcare. The volume of CIEDs and catheter ablation is shown in Table 4.[3,42] It shows a stable trend with a reduction in ablation volume during the COVID-19 pandemic due to a decision to reduce the number of elective procedures in the country. The volume is much lower than countries such as the United Kingdom and United States.

Action is needed to enhance healthcare delivery for heart rhythm management. First, adoption of established guidelines for cardiac arrhythmia management and CIED implantation in patients who will benefit from these therapies must be improved. Second, rising healthcare costs must be contained. To meet these challenges, Singapore is adopting a

Table 5 Availability of medications commonly used for treating arrhythmias in countries in the Asia Pacific region

	Direct oral anticoagulants	Class 1A drugs	Class 1C drugs	Amiodarone	Sotalol	Dofetilide
Brunei Darussalam	Dabigatran (funded); apixaban (available with defined criteria); rivaroxaban (partially funded)	Procainamide	Flecainide; propafenone	Available	Available	Not available
Cambodia	Dabigatran 150 mg, 110 mg, 75 mg; rivaroxaban 20 mg, 15 mg, 10 mg; apixaban 5 mg, 2.5 mg	Not available	Flecainide (tablet)	Available (IV, tablet)	Available (tablet)	Not available
China	Dabigatran; edoxaban; rivaroxaban	Not available	Propafenone	Available (dronedarone)	Available	Ibutilide
Indonesia	All available (none covered by NHS)	Not available	Propafenone (not covered by NHS)	Available	Not available	Not available
Japan	All available	Procainamide; disopyramide; quinidine; cibenzoline; pirmenol	Pilsicainide; flecainide; propafenone	Available	Available	Not available
Mongolia	Xarelto 20 mg, 15 mg	Not available	Propafenone	Available	Not available	Not available
New Zealand	Dabigatran (funded); rivaroxaban (funded); apixaban (not funded)	Disopyramide; quinidine†	Flecainide; propafenone	Available	Available	Not available
Philippines	All available	Not available	Flecainide	Available	Available	Not available
Singapore	All available	Disopyramide; quinidine†		Available (dronedarone)	Yes	No
South Korea	All available	Quinidine; procainamide*; disopyramide*	Flecainide; propafenone; pilsicainide	Available	Available	Not available
Taiwan	All available	Quinidine	Flecainide; propafenone	Available (dronedarone)	Sotalol*	No
Thailand	All available	Not available	Flecainide; propafenone	Available	Not available	Not available

All available: dabigatran, apixaban, rivaroxaban, edoxaban.
NHS = national health service.
*Drugs that are not distributed although may be used.
†Special authority.

value-driven care approach and shifting to a capitation model to fund its healthcare system.

2.12. South Korea

The 10-year trend of out-of-hospital cardiac arrests (OHCAs) from a South Korean nationwide population-based study showed that the incidence of OHCA has rapidly increased during the past decade. One-year mortality rate after OHCA has gradually decreased but is still high.[43] Between 2002 and 2013, coronary artery disease was the most common cause of sudden cardiac arrest cases (59.3%), and sudden unexplained death syndrome accounted for 14.7% of total sudden cardiac arrest.[30] The annual number of new ICDs has been rapidly increasing in South Korea in response to guideline updates and reimbursement policies.[3,44,45] In 2016, a pre-evaluation system for reimbursement of ICDs was adopted to address the issue of value and clinical benefit. Importantly, after implementation, total cases of ICD implantation increased, perhaps due to prior underuse. One of the most important issues in electrophysiology is the process of new medical technology evaluation by the government. The process is too slow to approve the use of cutting-edge technology in patients who need it, even if that technology is already widely used in other Asian countries or around the world. For example, cryoablation was approved in South Korea in 2018, 8 years after its approval in the United States. Another important issue is telemedicine. Telemedicine is

Table 6 Country-specific barriers to providing the best arrhythmia care

Country	Significant obstacle
Brunei Darussalam	None
Cambodia	Lack of centers
	Lack of reimbursement and financial resources
	Lack of trained personnel
	Lack of operators
China	Limited reimbursement and financial resources
	Lack of trained personnel
India	Lack of reimbursement and financial resources
	Lack of trained personnel
	Lack of awareness of guidelines
Indonesia	Lack of reimbursement and financial resources
Japan	None
Malaysia	Lack of reimbursement and financial resources
	Lack of trained personnel
	Lack of referral
	Lack of awareness of guidelines
	Lack of operators
Mongolia	Lack of centers
	Lack of awareness of guidelines
	Lack of trained personnel
	Lack of operators
Myanmar	Lack of reimbursement and financial resources
New Zealand	None
Pakistan (2021)	Lack of centers
Philippines	Lack of reimbursement and financial resources
	Lack of awareness of guidelines
	Lack of trained personnel
	Lack of operators
Singapore	None
South Korea	None
Sri Lanka	Lack of centers
	Lack of reimbursement and financial resources
Taiwan	Lack of reimbursement and financial resources
Thailand	Lack of reimbursement and financial resources
	Lack of referral
	Lack of awareness of guidelines
Vietnam	Lack of reimbursement and final resources
	Lack of referral
	Lack of trained personnel

During the Summit and also throughout the APHRS White Book (2021 and 2022 editions), leaders of the heart rhythm-related organizations were asked about obstacles specifically for arrhythmia care that were important in their country (defined as great or near great).

currently prohibited in South Korea; thus, it is impossible for physicians to use a patient-monitoring system based on CIED. However, medical professional associations, including the Korean Heart Rhythm Society, and the government have exchanged their opinions continuously and kept mutual communication, so many policies and regulations will be gradually adjusted to the generally acceptable level.

2.13. Taiwan

Based on the analysis from National Health Insurance (NHI) Research Database, the projected AF prevalence in Taiwan is between 1.5% and 1.8% (2020–2025).[46] A community survey conducted for the residents of Yi-Lan city showed that AF prevalence was 6.5% in people >65 years old.[47] The SCD registry in central Taiwan reported the incidence of out-of-hospital cardiac death (cardiovascular cause) as approximately 60 per 100,000 person-years with relatively low incidence of VAs.[47]

The NHI of Taiwan plays an important role in not only deciding health policy but also providing comprehensive medical information for research. The NHI program is mandatory for the citizens of Taiwan and has a high coverage rate of approximately 99% of the residents. This system generally offers excellent accessibility to medical care and medications. Access to healthcare has led to improvements in quality of life and clinical outcomes. However, because of budget constraints and requirements for fee-for-service payment, access to interventional arrhythmia therapy and expensive cardiac devices is limited. The annual performance of CIEDs and catheter ablation procedures is shown in Figure 9.

2.14. Thailand

Like much of the world, the most common arrhythmia in Thailand is AF.[3,48] In order to provide optimal care for patients with AF and other arrhythmias, the field of cardiac electrophysiology in Thailand is actively growing. Over the past decade, the numbers of pacemaker implantation, ICD implantation, and overall electrophysiology procedures increased by 80%, 140%, and 100%, respectively.[3,49] The numbers of AF ablation increased by 30% over the past few years. However, the absolute numbers (2.7 procedures per 1 million population) are relatively small Figure 10.

The major determinant of the rising procedural numbers is the reimbursement policy of the government-based health insurance. In 2012, the policy expanded its package to fully cover most of the electrophysiology procedures including ICD for primary prevention, CRT with defibrillator, and catheter ablation using 3-dimensional mapping. However, the number of electrophysiologists who are trained in complex ablation techniques remains small. The Thai Electrophysiology Club (Thai EP Club) established standards for electrophysiology fellowship training and certification in 2018 and has been active in implementing strategies to provide training in complex techniques.

As shown in Figure 11, the top policy issue in Thailand for arrhythmia care is reimbursement. Beyond standard procedures, adoption of newer procedures such leadless pacemaker, subcutaneous ICD, and cryoablation for AF has been slow due to reimbursement policies since patients must pay

70%–100% of the cost. The Thai EP Club, which is the major professional group dedicated to arrhythmia care and is part of the Heart Association of Thailand, has filed a request to the government asking for full coverage of these new procedures, but the process will likely require years before implementation.

2.15. Vietnam

Vietnam has a population of 96 million people.[50] One report has estimated that 12.5% of the GDP is spent on healthcare.[51] Universal health coverage allows 88% of the population to have healthcare coverage.[52] The Ministry of Health manages larger hospitals, and a decentralized approach allows province, city, and community healthcare providers to deliver more local care. In 2019, efforts were started to have a national electronic healthcare system throughout.

3. Future directions and strategies

Arrhythmia care in the Asia Pacific region continues to develop, but there is significant variability due to differences in country-specific clinical issues, available resources, workforce availability, and access to medications and technology. Leaders of professional medical societies focused on arrhythmia care were asked to identify significant obstacles related to the delivery of arrhythmia care at the APHRS/Heart Rhythm Society Summit. As would be expected, fewer or no obstacles to delivery of arrhythmia-specific care were identified in countries that devoted a larger portion of their national GDP to healthcare. Among the remaining countries, the obstacles were diverse, but the most common obstacle was lack of reimbursement or financial resources with related infrastructure to support advanced arrhythmia therapies. Based on this information, there are several immediate and long-term strategies that could be implemented to improve arrhythmia care for patients in the region. First, increasing access to all antiarrhythmic medications throughout the region would be an important step. While most countries have access to older antiarrhythmic medication, access to newer-generation antiarrhythmic drugs is less consistent Table 5. In addition, while an antiarrhythmic drug may be available in a country, adequate supplies may not be present. Second, consistent use among countries of a portion of the GDP directed to healthcare would be helpful. From an arrhythmia perspective, focusing on the treatment of bradycardia and implantation of permanent pacemakers seems to correlate with the GDP percentage directed to healthcare. As noted in Table 6, countries that devoted larger percentages of the GDP to healthcare reported fewer obstacles for the delivery of arrhythmia-related care. Perhaps consistently allocating greater than 5% of a country's GDP to healthcare would improve the health of the population while continuing to address other non–healthcare-related issues in countries that have limited financial resources. Third, workforce issues and training have a significant impact on access to use of important advanced arrhythmia care procedures, such as ablation or implantation of newer types of CIEDs beyond permanent pacemakers. Some training issues can be alleviated in part by developing a system of collaboration among different countries both in the region and worldwide, facilitated by cardiac professional organizations that focus on arrhythmia care such as APHRS and the Heart Rhythm Society. However, longer-term, more permanent solutions to workforce problems will require implementation of health policy measures that incentivize entry into the medical workforce and provide additional training for delivering advanced arrhythmia care.

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Author disclosures

Name	Employment	Honoraria/Speaking/ Consulting	Speakers' bureau	Research*	Fellowship support*	Ownership/ Partnership/ Principal/ Majority stockholder	Stock or stock options	Intellectual property/ Royalties	Other
Minglong Chen, MD, PhD, FHRS	Jiangsu Province Hospital, Nanjing, Jiangsu, China	None	None	None	None	None	None	None	None
Jonathan M. Kalman, MBBS, PhD, FHRS	Royal Melbourne Hospital, Melbourne, Victoria, Australia	1: Biosense Webster 1: Biosense Webster	None	3: Medtronic	3: Abbott 3: Biosense Webster 3: Medtronic	None	None	None	2: Abbott
Martin K. Stiles, MBChB, PhD, FHRS	Waikato Hospital, Hamilton, New Zealand	1: Abbott Medical 1: Biosense Webster 1: Boehringer Ingelheim 1: Boston Scientific 1: Ceryx Medical 1: Medtronic	None	None	None	None	None	None	None
Hsuan-Ming Tsao, MD	National Yang Ming University Hospital, Yi-lan, Taiwan	None	None	None	None	None	None	None	None
Sofian Johar, MA, MBChB, PhD, FHRS	Gleneagles JPMC, Kg Kiarong, Brunei Darussalam	None	None	None	None	None	None	None	None
Pichmanil Khmao, MD	Khmer Soviet Friendship Hospital, Phnom Penh, Cambodia	None	None	None	None	None	None	None	None
Sirin Apiyasawat, MD	Ramathibodi Hospital, Bangkok, Thailand	None	None	None	None	None	None	None	None
Tachapong Ngarmukos, MD	Ramathibodi Hospital, Bangkok, Thailand	1: Biosense Webster 1: Boston Scientific	None	None	None	None	None	None	None
Seil Oh, MD, PhD, FHRS	Seoul National University Hospital, Seoul, Republic of Korea	None	None	None	None	None	None	None	None
Jong-Il Choi, MD, MHS, PhD	Korea University Medical Center, Seoul, Republic of Korea	1: Daiichi Sankyo	None	2: Medtronic 3: Sanofi Genzyme 5: Chong Kun Dang Pharmaceutical Corp	None	None	None	None	None
Van Buu Dan Do, MD, FHRS	Tam Duc Cardiology Hospital Joint Stock Company, Ho Chi Minh City, Vietnam	None	None	None	None	None	None	None	None

Son Thai Binh Nguyen, MD	FV Hospital, Ho Chi Minh City, Vietnam	None	None	None	None	None	None	None	None
Wataru Shimizu, MD, PhD	Nippon Medical School, Tokyo, Japan	None	None	None	None	None	None	None	None
Kyoko Soejima, MD	Kyorin University School of Medicine, Tokyo, Japan	1: Boehringer Ingelheim 2: Abbott Japan 2: Daiichi Sankyo 2: Medtronic Japan	None	None	None	None	None	None	None
Nwe Nwe, MS	Yangon General Hospital, Yangon, Myanmar	None	None	None	None	None	None	None	None
Chi Keong Ching, MBBS, FHRS	National Heart Centre Singapore, Singapore	1: Abbott 1: Biosense Webster 1: Biotronik 1: Boston Scientific 1: Medtronic 1: Pfizer	None	None	None	None	None	None	None
Saruul Tseveendee, MD	National Heart Centre Singapore, Ulaanbaatar, Mongolia	None	None	None	None	None	None	None	None
Dicky A. Hanafy, MD, PhD	PJN Harapan Kita, Jakarta, Indonesia	None	None	None	None	None	None	None	None
Michael-Joseph F. Agbayani, MD	Philippine Heart Center, Quezon City, Philippines	None	None	None	None	None	None	None	None
Aamir Hameed H. Khan, MBBS	Aga Khan University Hospital, Karachi, Pakistan	None	None	None	None	None	None	None	None
Jodie L. Hurwitz, MD, FHRS	North Texas Heart Center, Dallas, Texas, United States	None	None	None	None	None	None	None	None
Andrew D. Krahn, MD, FHRS	Division of Cardiology, University of British Columbia, Vancouver, British Columbia, Canada	1: Medtronic	None	None	None	None	None	None	None
Fred M. Kusumoto, MD, FHRS	Mayo Clinic Jacksonville, EP and Pacing Services, Jacksonville, Florida, United States	None	None	None	None	None	None	None	None

Number value: **0** = $0; **1** = ≤ $10,000; **2** = > $10,000 to ≤ $25,000; **3** = > $25,000 to ≤ $50,000; **4** = > $50,000 to ≤ $100,000; **5** = > $100,000.

*Research and fellowship support are classed as programmatic support. Sources of programmatic support are disclosed but are not regarded as a relevant relationship with industry for writing group members or reviewers.