Preface

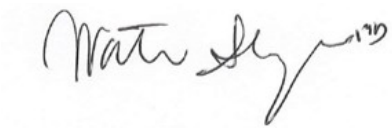
The APHRS was founded in 2008 with the goal to promote the care, education, and research in heart rhythm disorders in Asia-Pacific region. In pursuit of this goal, the APHRS has developed a White Book in 2010 under the leadership of Prof Shu Zhang, China, to collect basic statistical data and other information on the current status of interventional therapies for cardiac arrhythmia in Asia-Pacific countries. Such data have never been available before.

Interventional therapies for cardiac arrhythmias have developed rapidly in the Asia-Pacific region in recent decades, accompanied by the rapid growth of electrophysiological procedures and use of cardiac implantable electronic devices (CIEDs). However, significant inequalities exist in healthcare across Asia-Pacific countries and regions and in treatment of cardiac arrhythmia specifically, which highlight the importance and the necessity for the healthcare community to share, recognize, and communicate within itself the data and information on the current status of cardiac electrophysiology and arrhythmia treatment. My fellow members and I hope that the annually updated White Book will not only promote scientific, technological, and clinical development for better treatment of cardiac arrhythmias, but also improve healthcare and reduce inequalities in care for patients across Asia-Pacific countries and regions.

The APHRS White Book reports the most updated and comprehensive information on the current situation in the field of arrhythmia treatment, encompassing country demographics, epidemiology of cardiac arrhythmia, usage of CIEDs (pacemakers, implantable cardioverter defibrillators, and cardiac resynchronization therapy), and interventional electrophysiology. Prof Zhang first presented such data from 7 countries and regions in the scientific session of APHRS 2012, and the next year the Society published the first edition of the APHRS White Book during the scientific session of APHRS 2013. Since then, the APHRS White Book has been updated each year. With the continuous efforts of the Society in the past 7 years, the APHRS White Book has gained increasing attention from researchers and clinicians across Asia-Pacific countries and regions.

The current Eighth Edition of the APHRS White Book is much extended. This new edition comprises data from 18 countries and regions. As before, data collection is mostly the result of voluntary participation of each county or region's representative Society of Pacing and Electrophysiology or Heart Rhythm Society. In some other Asia-Pacific countries, there are currently no registries and data are limited. As such, the APHRS White Book marks the beginnings of an international registry compiled by collaborative efforts between countries, which may also encourage the adoption of a systematic approach to data collection on arrhythmia therapies in each country and region.

May I take this opportunity to thank and congratulate Prof Zhang and his team for putting this excellent job together. I would also like to thank the country representatives and members of individual national HRS working group who have voluntary contributed important data from their countries and regions.

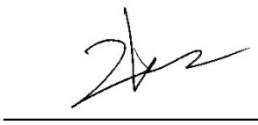


Wataru Shimizu
President of APHRS (2023)

Acknowledgements

As a member of the APHRS and the chief editor of this volume, I am profoundly grateful to all contributors' instrumental in the publication of the Eighth Edition of the APHRS White Book. My sincere thanks go to Professor Wataru Shimizu, our current president, for spearheading this edition's preparation. Additionally, I extend my gratitude to our board members for their steadfast support of this project.

My deep gratitude also goes to all contributors, the national Societies of Pacing and Electrophysiology and the national Heart Rhythm Societies of 18 member countries or regions of APHRS. Without their voluntary collection of data, this book would never have been completed. In particular, I'd like to thank Mr. Jimmy Yap, and the secretary of APHRS, who helped collect data from member countries and regions. Finally, I would like to express my appreciation to the members of my working group, Ms. Na Lin and Dr. Xiaohui Ning, who performed secondary research to verify and establish the quantitative and qualitative information contained in the book.



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Chief Editor of the APHRS White Book 2023

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Table of Contents

Country/Region: PR.China

1. Statistics

	2019	2020	2021	2022
Population(thousand)[1]	1400050	1411780	1412600	1411750
Hospitals	34354	34354	36570	36976
Beds(per 100,000 population) [1]	630	630	669	691
Physicians(per 1,000 population)[1]	2.40	2.4	3.03	3.15
Nurses(per 1,000 population)[1]	2.70	2.7	3.55	3.71
GDP (US$, billions)[3]	143647.03	158800	178200	180600
Total expenditure on health as % GDP[2]	6.6%	7.12%	6.6%	7.0%
Government expenditure on health as %	30.88%	30.4%	27.4%	28.2%
Insured citizens (%)	70%	70%	70%	70%
SCD patients	0.54m	0.54m	0.54m	0.54m
Heart failure patients	4.5m	4.5m	4.5m	4.5m
AF patients	8m	8m	8m	8m

1, www.stats.gov.cn

2, www.who.int

3, www.imf.org

2. Pacemaker

	2019	2020	2021	2022
Total Pacemakers	90524	86181	98306	98619
New implants				
Replacements				
Single-chamber	26959	23731	25415	27455
Dual-chamber	63565	62450	72891	71164
Sick sinus syndrome	45388		52135	52958
AV block	39396		44191	41913
Implanting Centers	946			2488
Implanting Physicians		3000	3000	
National Registry	☑	☑	☑	

3. Cardiac resynchronization therapy

	2019	2020	2021	2022
Total CRTs	4523	3896	5333	5398
CRT-P	1628	1371	1825	1967
CRT-P new implants				
CRT-P replacements/upgrade				
CRT-D	2895	2525	3508	3431
CRT-D new implants				
CRT-D replacements/upgrade				
Ischemic	1492			
Non-ischemic	3031			
Implanting Centers	366	403		
Implanting Physicians	3000	3000	3000	
National Registry	☑	☑	☑	

4. Implantable cardioverter defibrillator

	2019	2020	2021	2022
Total ICDs	5031	4800	6647	6762
ICD new implants				
ICD replacements				
Single-chamber	3119	2392	3771	3477
Dual-chamber	1912	2408	2876	3282
Primary prevention	2264	2540	2618	2732
Secondary prevention	2767	2260	3929	4030
Implanting Centers	408	433		
Implanting Physicians	3000	3000	3000	
National Registry	☑	☑	☑	

5. Interventional electrophysiology

	2019	2020	2021	2022
Ablation procedures	173950	156873	210609	203984
SVT ablation procedures			76971	63535
AVNRT	38975			
AVRT/WPW	30065			
AFL (RA isthmus dependent)				
AT				
VT/VPC		-		
Idiopathic		-		
Structural		-		
AF ablation procedures	57275	56012	87994	82763
Ablation centers	812	863		1834
AF ablation centers	383	420		
Structural VT ablation centers	-	-		
Ablation physicians	-	2000	2000	
AF ablation physicians	-	-		
Structural VT ablationphysicians	-	-		
National Registry	☑	☑	☑	

6. Management

National certification for physicians	☐PM	☐CRT	☐ICD	☐Ablation
National accreditation for centers	☐PM	☐CRT	☐ICD	☐Ablation
Guidelines followed	☐National	☐U.S.	☐Europe	☐AP

Payment (%)	Pacemaker	ICD	CRT	Ablation
Government	-	-	-	-
Insurance	-	-	-	-
Public insurance	-	-	-	-
Private insurance	-	-	-	-
Individual	-	-	-	-

Obstacles to guideline implementation (1=no obstacle, 5=great obstacle)

	1	2	3	4	5
Lack of centers	☑	☐	☐	☐	☐
Lack of reimbursement, limited financial resources	☐	☐	☐	☑	☐
Lack of referral	☐	☐	☑	☐	☐
Lack of trained personnel	☐	☐	☑	☐	☐
Low awareness of guidelines	☐	☐	☑	☐	☐
Lack of operators	☐	☐	☑	☐	☐

7. Source

Chinese Society of Pacing and Electrophysiology (CSPE)

Country/Region: Brunei Darussalam

1. Statistics

	2019	2020	2021	2022
Population (thousand)	459	453		
Hospitals	6	6		
Beds				
Physicians				
Nurses				
GDP (US$, billions)	13.4	12.2		
Total expenditure on health as % GDP	2.1	2.3		
Government expenditure on health (US$)	286,440,000	277,000,000		
Insured citizens (%)				
SCD patients				
Heart failure patients				
AF patients				

2. Pacemaker

	2019	2020	2021	2022
Total Pacemakers	52	81	61	77
New implants	40	63	47	53
Replacements	12	18	14	24
Single-chamber	11	26	19	12
Dual-chamber	41	55	42	63
Leadless				2
Conduction System Pacing				8
Left Bundle Branch Pacing				8
His Bundle Pacing				
Sick sinus syndrome	30	44	41	39
AV block	18	30	14	28
Implanting Centers	2	2	2	2
Implanting Physicians	6	6	5	5

National Registry				

	2019	2020	2021	2022
SSS	30	44	41	39
AVN	18	30	14	28
Bi Nodal	3	3	5	9
Others	1	4	1	1

3. Cardiac resynchronization therapy

	2019	2020	2021	2022
Total CRTs	19	22	18	8
CRT-P	4	8	2	1
CRT-P new implants	4	3	1	1
CRT-P replacements/upgrade	0	5	1	0
CRT-D	15	14	16	7
CRT-D new implants	13	11	8	4
CRT-D replacements/upgrade	2	3	8	3
Ischemic	10	11	7	1
Non-ischemic	9	11	11	7
Conduction System Pacing				1
Left Bundle Branch Pacing				1
His Bundle Pacing				
Implanting Centers	2	2	2	2
Implanting Physicians	1	1	1	1
National Registry				

4. Implantable cardioverter defibrillator

	2019	2020	2021	2022
Total ICDs	44	30	27	29
ICD new implants	37	27	22	21
ICD replacements	7	3	5	8
Single-chamber	1	3	4	7
Dual-chamber	43	27	23	22
Subcutaneous				
Primary prevention	35	25	17	16

Secondary prevention	9	5	10	13
Implanting Centers	2	2	2	2
Implanting Physicians	6	6	6	0
National Registry				

5. Lead Extraction

Lead extractions procedures and number of centers that performed lead extraction

	2019	2020	2021	2022
Total lead extraction procedures	2	2	3	4
Hospitals performed lead extraction	1	1	1	1
Cardiologists performing lead extraction	1	1	1	1
Surgeons performing lead extraction	0	0	0	0
National Registry				

6. Interventional electrophysiology

	2019	2020	2021	2022
Ablation procedures	103	92	102	84
SVT ablation procedures	41	29	37	37
AVNRT	10	14	17	19
AVRT/WPW	11	4	8	5
AFL(RA isthmus dependent)	11	5	7	10
AT	9	6	5	3
VT/VPC	15	30	22	19
Idiopathic	9	17	19	17
Structural	6	13	3	2
AF ablation procedures	47	33	43	28
Ablation centers				
AF ablation centers	1	1	1	1
Structural VT ablation centers	1	1	1	1
Ablation physicians				
AF ablation physicians	1	1	1	1
Structural VT ablation physicians	1	1	1	1
National Registry				

7. Management

National certification for physicians	☐PM	☐CRT	☐ICD	☐Ablation
National accreditation for centers	☐PM	☐CRT	☐ICD	☐Ablation
Guidelines followed	☐National	☑U.S.	☑Europe	☐AP

Payment (%)	Pacemaker	ICD	CRT	Ablation
Government				
Insurance				
Public insurance				
Private insurance				
Individual				

Obstacles to guideline implementation (1=no obstacle, 5=great obstacle)

	1	2	3	4	5
Lack of centers	☐	☑	☐	☐	☐
Lack of reimbursement, limited financial resources	☐	☑	☐	☐	☐
Lack of referral	☐	☑	☐	☐	☐
Lack of trained personnel	☐	☑	☐	☐	☐
Low awareness of guidelines	☐	☑	☐	☐	☐
Lack of operators	☐	☑	☐	☐	☐

8. Source

Cardiac Society, Brunei Darussalam
Ministry of Health, Brunei Darussalam
Department of Economic Planning and Development, Prime Minister's Office, Brunei Darussalam

Country/Region: Cambodia

1. Statistics

	2019	2020	2021	2022
Population (thousand)				16767
Hospitals				148
Beds				13500
Physicians (per 10,000 people)				1.4
Nurses (per 10,000 people)				9.5
GDP (US$, billions)				28.54
Total expenditure on health as % GDP				7.5
Government expenditure on health (US$)				490
Insured citizens (%)				
SCD patients				
Heart failure patients				
AF patients				

2. Pacemaker

	2019	2020	2021	2022
Total Pacemakers	261	105	219	113
New implants	210	78	190	
Replacements	51	17	29	
Single-chamber	49	38	72	
Dual-chamber	169	40	118	
Leadless				
Conduction System Pacing				
Left Bundle Branch Pacing				
His Bundle Pacing				
Sick sinus syndrome	110	35	92	
AV block	100	43	98	
Implanting Centers	5	5	5	6
Implanting Physicians	7	8	9	9
National Registry				

3. Cardiac resynchronization therapy

	2019	2020	2021	2022
Total CRTs	5	3	2	
CRT-P	2	2	2	
CRT-P new implants	2	2	2	
CRT-P replacements/upgrade				
CRT-D	3	1	0	
CRT-D new implants	3	1	0	
CRT-D replacements/upgrade				
Ischemic				
Non-ischemic				
Conduction System Pacing				
Left Bundle Branch Pacing				
His Bundle Pacing				
Implanting Centers				
Implanting Physicians				
National Registry				

4. Implantable cardioverter defibrillator

	2019	2020	2021	2022
Total ICDs	4	2	2	1
ICD new implants	4	2	2	1
ICD replacements				
Single-chamber	1	1	1	1
Dual-chamber	3	1	1	
Subcutaneous				
Primary prevention				
Secondary prevention	4	2	2	1
Implanting Centers	1	2	2	5
Implanting Physicians	1	1	1	7
National Registry				

5. Lead Extraction

Lead extractions procedures and number of centers that performed lead extraction

	2019	2020	2021	2022

Total lead extraction procedures	2	3	2	
Hospitals performed lead extraction	2	3	2	
Cardiologists performing lead extraction	1	1	2	
Surgeons performing lead extraction				
National Registry				

6. Interventional electrophysiology

	2019	2020	2021	2022
Ablation procedures	102	103	125	75
SVT ablation procedures				
AVNRT	25	25	26	
AVRT/WPW	26	21	18	
AFL (RA isthmus dependent)	28	29	43	
AT	10	6	10	
VT/VPC	21	22	28	
Idiopathic	21	22	28	
Structural				
AF ablation procedures				
Ablation centers				3
AF ablation centers				
Structural VT ablation centers				
Ablation physicians				5
AF ablation physicians				
Structural VT ablation physicians				
National Registry				

7. Management

National certification for physicians	☐PM	☐CRT	☐ICD	☐Ablation
National accreditation for centers	☐PM	☐CRT	☐ICD	☐Ablation
Guidelines followed	☐National	☑U.S.	☑Europe	☐AP

Payment (%)	Pacemaker	ICD	CRT	Ablation
Government				

Insurance				
Public insurance				
Private insurance				
Individual				

Obstacles to guideline implementation (1=no obstacle, 5=great obstacle)

	1	2	3	4	5
Lack of centers	☐	☐	☑	☐	☐
Lack of reimbursement, limited financial resources	☐	☐	☐	☐	☑
Lack of referral	☐	☐	☐	☑	☐
Lack of trained personnel	☐	☐	☑	☐	☐
Low awareness of guidelines	☐	☐	☐	☐	☑
Lack of operators	☐	☐	☑	☐	☐

8. Source

Country/Region: Hong Kong, CN

1. Statistics

	2019	2020	2021	2022
Population (thousand)[1]	7,520.80	7,428.30	7,401.50	7,333.20
Hospitals	55	56	56	56
Beds	41,474	42,180	31,887*	32,254
Physicians	15,004	15,298	15,546	15,815
Nurses	44,601	46,168	48,415	50,650
GDP (US$, billions)	367.71	347.53	367.91	361.29
Total expenditure on health as % GDP	2.88%	7.00%	3.38%	4.06%
Government expenditure on health (US$)	10,600mil	24,310mil	12,436mil	14,679mil
Insured citizens (%)				
SCD patients				
Heart failure patients				
AF patients				

*Figures include only hospital beds in Hospital Authority hospitals and private hospitals excluding accident and emergency observation beds, day beds and nursery beds, which follow the definition of the Organisation for Economic Co-operation and Development (OECD). On 1 January 2021, the Hospitals, Nursing Homes and Maternity Homes Registration Ordinance (Cap.165) was repealed when the Private Healthcare Facilities Ordinance (Cap. 633) was commenced. Hence, the number of hospital beds previously compiled under 'Cap. 165 Ordinance definition' is no longer applicable

2. Pacemaker

	2019	2020	2021	2022
Total Pacemakers	1810 (including 302 leadless pacemaker)	1662 (including 414 leadless pacemakers)	2073 (including 527 leadless pacemakers)	2,080 (including 519 leadless pacemakers)
New implants				
Replacements				
Single-chamber				

Dual-chamber				
Sick sinus syndrome				
AV block				
Implanting Centers				
Implanting Physicians				
National Registry				

3. Cardiac resynchronization therapy

	2019	2020	2021	2022
Total CRTs	164	183	184	200
CRT-P	27	41	36	43
CRT-P new implants				
CRT-P replacements/upgrade				
CRT-D	137	142	148	157
CRT-D new implants				
CRT-D replacements/upgrade				
Ischemic				
Non-ischemic				
Implanting Centers				
Implanting Physicians				
National Registry				

4. Implantable cardioverter defibrillator

	2019	2020	2021	2022
Total ICDs	274	234	330	314
ICD new implants				
ICD replacements				
Single-chamber				
Dual-chamber				
Primary prevention				
Secondary prevention				
Implanting Centers				
Implanting Physicians				
National Registry				

5. Lead Extraction

Lead extractions procedures and number of centers that performed lead extraction

	2019	2020	2021	2022
Total lead extraction procedures				
Hospitals performed lead extraction				
Cardiologists performing lead extraction				
Surgeons performing lead extraction				
National Registry				

6. Interventional electrophysiology

	2019	2020	2021	2022
Ablation procedures	768	656	907	873
SVT ablation procedures				
AVNRT				
AVRT/WPW				
AFL (RA isthmus dependent)				
AT				
VT/VPC				
Idiopathic				
Structural				
AF ablation procedures				
Ablation centers				
AF ablation centers				
Structural VT ablation centers				
Ablation physicians				
AF ablation physicians				
Structural VT ablation physicians				
National Registry				

7. Management

National certification for physicians	☐PM	☐CRT	☐ICD	☐Ablation
National accreditation for centers	☐PM	☐CRT	☐ICD	☐Ablation
Guidelines followed	☐National	☐U.S.	☐Europe	☐AP

Payment (%)	Pacemaker	ICD	CRT	Ablation
Government	-	-	-	-
Insurance	-	-	-	-
Public insurance	-	-	-	-
Private insurance	-	-	-	-
Individual	-	-	-	-

Obstacles to guideline implementation (1=no obstacle, 5=great obstacle)

	1	2	3	4	5
Lack of centers	☐	☐	☐	☐	☐
Lack of reimbursement, limited financial resources	☐	☐	☐	☐	☐
Lack of referral	☐	☐	☐	☐	☐
Lack of trained personnel	☐	☐	☐	☐	☐
Low awareness of guidelines	☐	☐	☐	☐	☐
Lack of operators	☐	☐	☐	☐	☐

8. Source

Country/Region: India

1. Statistics

	2016	2017	2018	2019
Population (bn)	1.326	1.342	1.354	1.38
Urban Hospitals (Govt. only)	-	-	8812	4375
Beds (Govt. only)	-	-	1013017	713986
Physicians	-	-	-	1154686
Nurses	-	-	-	ANM =860927; RN &RM = 2048979
GDP (US$ - billion)	2,250	2597	2716	3202
Total expenditure on health as % GDP	2.5%	2.5%	3.66 as per WHO and World Bank 2016 data; 1.5% as per Indian Health Ministry data	4%
Government expenditure on health as %	-	-	1.02	1.6
Insured citizens (in Millions)	-	-	482	472
SCD patients[i1] (in Thousands)	NA	-	202	204
Heart failure patients[ii] (in Millions)	~8–10mn	-	1.145	1.2
AF patients (million)	-	-	4.26	4.5

1, http://www.worldometers.info/world-population/india-population/

2, https://data.gov.in/catalog/number-government-hospitals-and-beds-rural-and-urban-areas

3, http://statisticstimes.com/economy/gdp-of-india.php.

4, https://www.ihs.com/country-industry-forecasting.html?ID=1065985237

5, http://www.japi.org/december_2014/006_ra_sudden_cardiac_death.pdf.

6, http://csiheartfailure2015.org/

2. Pacemaker

	2016	2017	2018	2019
Total Pacemakers	35794	38700	44700	48,860
New implants	75%	70%	70%	70%
Replacements	25%	30%	30%	30%
Single-chamber	19440	22200	25100	26,028
Dual-chamber	16354	16500	19600	22,832
Sick sinus syndrome[iii]	25%	20%	20%	20%
AV block	75%	80%	80%	80%
Implanting Centers	970	1120	1120	1500
Implanting Physicians	1560	1560	1560	2000
National Registry	☐	☐	0	1

3. Cardiac resynchronization therapy

	2016	2017	2018	2019
Total CRTs	2728	2500	3000	3608
CRT-P	944	1000	1200	1372
CRT-P new implants	88%	80%	88%	90%
CRT-P replacements/upgrade	12%	20%	12%	10%
CRT-D	1784	1500	1800	2236
CRT-D new implants	82%	75%	82%	85%
CRT-D replacements/upgrade	18%	25%	18%	15%
Ischemic	-		40%	40%
Non-ischemic	-		60%	60%
Implanting Centers	345	345	345	350
Implanting Physicians	395	395	395	400
National Registry	☐	☐	1	1

4. Implantable cardioverter defibrillator

	2016	2017	2018	2019
Total ICDs	3664	3500	4100	5021
ICD new implants	85%	75%	85%	88%
ICD replacements	15%	25%	15%	12%
Single-chamber	2464	2300	2800	3360
Dual-chamber	1200	1200	1300	1661

Primary prevention	40%	20%	20%	22%
Secondary prevention	60%	80%	80%	78%
Implanting Centers	~380	400	400	400
Implanting Physicians	500	515	515	500
National Registry	☐	☐	1	1

5. Lead Extraction

Lead extractions procedures and number of centers that performed lead extraction

	2016	2017	2018	2019
Total lead extraction procedures	-	-	170	84
Hospitals performed lead extraction	-	-	26	15
Cardiologists performing lead extraction	-	-	84	25
Surgeons performing lead extraction	-	-	8	6
National Registry	☐	☐	0	0

6. Interventional electrophysiology

	2016	2017	2018 (Incomplete data, obtained only from a few centers)	2019 (Data from limited centers)
Ablation procedures	22900		7910	4659
SVT ablation procedures	14400		6642	3328
AVNRT	7500		4066	2342
AVRT/WPW	5000		2152	1482
AFL (RA isthmus dependent)	900		424	239
AT	1000		456	220
VT/VPC	7100		1025	597
Idiopathic	3000		618	262
Structural	4100		407	168
AF ablation procedures	1400		215	146
Ablation centers	176		66	49
AF ablation centers	30		29	19
Structural VT ablation centers	93		21	20
Ablation physicians	135		54	46

AF ablation physicians	41		31	29
Structural VT ablation physicians	83		35	29
National Registry	☐		0	0

7. Management

National certification for physicians	☐PM	☐CRT	☐ICD	☐Ablation
National accreditation for centers	☐PM	☐CRT	☐ICD	☐Ablation
Guidelines followed	☐National	√ U.S.	√ Europe	☐AP

Payment (%)	Pacemaker	ICD	CRT	Ablation
Government	60%	35%	40%	25%
Insurance	10%	10%	10%	50%
Public insurance				25%
Private insurance				25%
Individual	30%	55%	50%	25%

Insurance data – External consultant data, Media source

Obstacles to guideline implementation (1=no obstacle, 5=great obstacle)

	1	2	3	4	5
Lack of centers	☐	☐	☑	☐	☐
Lack of reimbursement, limited financial resources	☐	☐	☐	☑	☐
Lack of referral	☐	☐	☑	☐	☐
Lack of trained personnel	☐	☐	☐	☑	☐
Low awareness of guidelines	☐	☐	☐	☑	☐
Lack of operators	☐	☐	☑	☐	☐

8. Source

Name of national working group or arrhythmia body

INDIAN HEART RHYTHM SOCIETY

Country/Region: Indonesia

1. Statistics

	2019	2020	2021	2022
Population (thousand)[1]	268,074	271,066	273,879	275,77
Hospitals[1]	2,877	2,985	3,042	3072
Beds[1]	321,544	379,548	371,195	389,803
Physicians[1]	228,180	233,064	223,254	206,346
Nurses[2]	345,508	438,234	511,191	524,508
GDP (US$, billions)[2]	1,063.5	1,058.4	1,186	1,319,1
Total expenditure on health as % GDP[1,2]	3.1	3.1	3.1	4,6
Government expenditure on health (US$, billion)[3]	7.83	14.66	11.38	15,43
Insured citizens (%)[1]	83.94	82.05	87	91
SCD patients	-	-	-	
Heart failure patients	-	-	-	
AF patients	-	-	-	

1, Indonesian Health Profile 2022, Ministry of Health

2, World Bank

3, Statista.com

2. Pacemaker

	2019	2020	2021	2022
Total Pacemakers	1637	1840	1342	1473
New implants	1518	1714	1194	1326
Replacements	119	126	148	147
Single-chamber	1075	1268	877	996
Dual-chamber	563	572	465	477
Leadless				10
Conduction System Pacing				192
Left Bundle Branch Pacing				88

His Bundle Pacing				104
Sick sinus syndrome	673	676	551	419
AV block	964	1102	791	1002
Implanting Centers	65	65	67	95
Implanting Physicians	119	119	119	121
National Registry	☐	☐	☐	

3. Cardiac resynchronization therapy

	2019	2020	2021	2022
Total CRTs	63	55	64	60
CRT-P	35	32	36	35
CRT-P new implants	26	26	30	26
CRT-P replacements/upgrade	9	6	6	9
CRT-D	28	23	28	25
CRT-D new implants	22	20	24	19
CRT-D replacements/upgrade	6	3	4	6
Ischemic	32	39	18	30
Non-ischemic	31	16	20	26
Conduction System Pacing				4
Left Bundle Branch Pacing				2
His Bundle Pacing				2
Implanting Centers	12	11	17	17
Implanting Physicians	25	24	24	31
National Registry	☐	☐	☐	

4. Implantable cardioverter defibrillator

	2019	2020	2021	2022
Total ICDs	56	45	66	84
ICD new implants	49	37	59	74
ICD replacements	7	8	7	10
Single-chamber	37	29	47	56
Dual-chamber	19	16	19	28
Subcutaneous				9
Primary prevention	10	20	23	33
Secondary prevention	46	25	40	43

Implanting Centers	14	15	21	23
Implanting Physicians	25	26	29	40
National Registry	☐	☐	☐	

5. Lead Extraction

Lead extractions procedures and number of centers that performed lead extraction

	2019	2020	2021	2022
Total lead extraction procedures	12	13	36	13
Hospitals performed lead extraction	9	8	12	11
Cardiologists performing lead extraction	17	21	19	19
Surgeons performing lead extraction	7	12	10	12
National Registry	☐	☐	☐	

6. Interventional electrophysiology

	2019	2020	2021	2022
Ablation procedures	1193	885	1178	1646
SVT ablation procedures	680	283	612	816
AVNRT	377	165	330	409
AVRT/WPW	228	34	213	294
AFL (RA isthmus dependent)	31	34	34	54
AT	44	17	35	59
VT/VPC	433	252	472	621
Idiopathic	386	30	418	596
Structural	47	30	54	25
AF ablation procedures	68	49	84	141
Ablation centers	17	21	23	28
AF ablation centers	11	11	14	20
Structural VT ablation centers	12	13	17	13
Ablation physicians	26	33	29	41
AF ablation physicians	17	22	38	40
Structural VT ablation physicians	20	23	27	33
National Registry	☐	☐	☐	

7. Management

National certification for physicians ☑PM ☑CRT ☑ICD ☑Ablation

National accreditation for centers	☐PM	☐CRT	☐ICD	☑Ablation
Guidelines followed	☑National	☐U.S.	☐Europe	☐AP

Payment (%)	Pacemaker	ICD	CRT	Ablation
Government				
Insurance				
Public insurance				
Private insurance				
Individual				

Obstacles to guideline implémentation (1=no obstacle, 5= great obstacle)

	1	2	3	4	5
Lack of centers	☐	☑	☐	☐	☐
Lack of reimbursement, limited financial resources	☐	☐	☐	☑	☐
Lack of referral	☐	☐	☑	☐	☐
Lack of trained personnel	☐	☐	☑	☐	☐
Low awareness of guidelines	☐	☑	☐	☐	☐
Lack of operators	☐	☐	☑	☐	☐

8. Source

Indonesian Heart Rhythm Society (InaHRS)

Country/Region: Japan

1. Statistics

	2019	2020	2021	2022
Population (thousand)[1]	126,167	126,226	125,502	125,190
Hospitals (per 100,000 population)				
Beds	1,627,288	1,596,328	1,580,892	1,573,451
Physicians (per 1,000 population) [2]				
Nurses (per 1,000 population) [2]				
GDP (US$, billions) [3]	5,148.78	5,048.69	4,937,42	4,912,15
Total expenditure on health as % GDP [2]				
Government expenditure on health as % [2]				
Insured citizens (%)				
SCD patients				
Heart failure patients				
AF patients				

2. Pacemaker

	2019	2020	2021	2022
Total Pacemakers	63411	64277	68,337	69,221
New implants	44359	43862	45,634	44,582
Replacements	19052	20415	22,703	24,639
Single-chamber	12575	12156	12,276	9,215
Dual-chamber	50836	52121	56,061	60,006
Leadless				
Conduction System Pacing				
Left Bundle Branch Pacing				
His Bundle Pacing				
Sick sinus syndrome				
AV block				
Implanting Centers				
Implanting Physicians				

National Registry				

3. Cardiac resynchronization therapy

	2019	2020	2021	2022
Total CRTs	5149	5475	5543	5,563
CRT-P	1503	1620	1645	1,815
CRT-P new implants	1201	1279	1244	1,343
CRT-P replacements/upgrade	302	341	401	472
CRT-D	3646	3855	3898	3,748
CRT-D new implants	2406	2334	2329	2,189
CRT-D replacements/upgrade	1240	1521	1569	1,559
Ischemic				
Non-ischemic				
Conduction System Pacing				
Left Bundle Branch Pacing				
His Bundle Pacing				
Implanting Centers				
Implanting Physicians				
National Registry				

4. Implantable cardioverter defibrillator

	2019	2020	2021	2022
Total ICDs	6552	5779	6092	6,440
ICD new implants	4341	3902	3911	3,770
ICD replacements	2211	1877	2181	2,670
Single-chamber	2096	1802	1847	1,794
Dual-chamber	4456	3977	4245	4,646
Subcutaneous				
Primary prevention				
Secondary prevention				
Implanting Centers				
Implanting Physicians				
National Registry				

5. Lead Extraction

Lead extractions procedures and number of centers that performed lead extraction

	2019	2020	2021	2022
Total lead extraction procedures	580	785	984	1031
Hospitals performed lead extraction	41	72	98	98
Cardiologists performing lead extraction	103	138	NA	NA
Surgeons performing lead extraction	6	6	NA	NA
National Registry	+(J-LEX)	+(J-LEX)	+(J-LEX)	+(J-LEX)

6. Interventional electrophysiology

	2019	2020	2021	2022
Ablation procedures	96000	100000	102781	109008
SVT ablation procedures	11000	11000	11000	11200
AVNRT	7500	7500	7400	7859
AVRT/WPW	3500	3500	3300	3341
AFL (RA isthmus dependent)	10000	12000	12000	11847
AT	3000	5000	4800	6869
VT/VPC	6000	7000	7200	7633
Idiopathic				6191
Structural				1442
AF ablation procedures	62000	74000	76674	81750
Ablation centers	700	750	750	503
AF ablation centers	500	550	550	490
Structural VT ablation centers				NA
Ablation physicians	2500	2500	2500	NA
AF ablation physicians	2000	2000	2000	NA
Structural VT ablation physicians				NA
National Registry	☑	☑	☑	☑

7. Management

National certification for physicians ☐PM ☑CRT ☑ICD ☐Ablation

National accreditation for centers	☐PM	☑CRT	☑ICD	☐Ablation
Guidelines followed	☑National	☐U.S.	☐Europe	☐AP

Payment (%)	Pacemaker	ICD	CRT	Ablation
Government	-	-	-	-
Insurance	-	-	-	-
Public insurance	-	-	-	-
Private insurance	-	-	-	-
Individual	-	-	-	-

Obstacles to guideline implementation (1=no obstacle, 5=great obstacle)

	1	2	3	4	5
Lack of centers	☑	☐	☐	☐	☐
Lack of reimbursement, limited financial resources	☑	☐	☐	☐	☐
Lack of referral	☑	☐	☐	☐	☐
Lack of trained personnel	☑	☐	☐	☐	☐
Low awareness of guidelines	☐	☑	☐	☐	☐
Lack of operators	☑	☐	☐	☐	☐

8. Source

Japanese Heart Rhythm Society

Country/Region: Malaysia

1. Statistics

	2019	2020	2021	2022
Population (Thousand)	32,733	45,010	33,290	37,701
Hospitals	7	7	7	7
Beds	1768	1,822	1786	2884
Physicians	715	639	650	874
Nurses	3174	2,643	2693	3756
GDP (RM)	1, 353, 380	1,343,353,380	1,353,380	1,787.8 bil
Total expenditure on health as % GDP	4	4	4.5	4
Government expenditure on health as %	7	10	7	10
Insured citizens (%)	32	22	17	30
SCD patients	12%	12%	10%	10
Heart failure patients	1780	1,638	821	888
AF patients	492	927	716	751

***Data source: Portal Rasmi, Kementerian Kesihatan Malaysia (www.moh.gov.my)**

2. Pacemaker

	2019	2020	2021	2022
Total Pacemakers	798	883	534	1411
New implants	626	668	401	993
Replacements	172	215	128	411

Single-chamber	233	246	185	246
Dual-chamber	560	569	284	701
Leadless				160
Conduction System Pacing				120
Left Bundle Branch Pacing				134
His Bundle Pacing				88
Sick sinus syndrome	382	439	165	508
AV block	428	431	284	716
Implanting Centers	7	6	51	51
Implanting Physicians	28	26	24	38
National Registry	☑	-	0	0

3. Cardiac resynchronization therapy

	2019	2020	2021	2022
Total CRTs	160	175	63	253
CRT-P	60	56	16	98
CRT-P new implants	38	34	12	62
CRT-P replacements/upgrade	26	25	4	36
CRT-D	84	110	47	154
CRT-D new implants	73	74	32	98
CRT-D replacements/upgrade	19	42	15	54
Ischemic	51	53	23	119
Non-ischemic	55	76	33	214
Conduction System Pacing				107
Left Bundle Branch Pacing				14

His Bundle Pacing				3
Implanting Centers	5	6	5	7
Implanting Physicians	15	15	12	15
National Registry	☑	–	0	0

4. Implantable cardioverter defibrillator

	2019	2020	2021	2022
Total ICDs	223	207	103	401
ICD new implants	203	204	78	314
ICD replacements	29	46	25	87
Single-chamber	168	184	68	192
Dual-chamber	64	63	22	78
Subcutaneous				9
Primary prevention	78	90	4	152
Secondary prevention	154	157	87	158
Implanting Centers	7	6	5	7
Implanting Physicians	23	19	14	28
National Registry	☑		0	0

5. Lead Extraction

Lead extractions procedures and number of centers that performed lead extraction

	2019	2020	2021	2022
Total lead extraction procedures	19	22	9	24
Hospitals performed lead extraction	4	3	3	5
Cardiologists performing lead extraction	9	8	5	6
Surgeons performing lead extraction	3	3	3	3
National Registry			0	0

6. Interventional electrophysiology

	2019	2020	2021	2022
Ablation procedures	891	1,038	579	1745
SVT ablation procedures	576	524	311	966
AVNRT	251	253	169	398
AVRT/WPW	156	137	89	193
AFL (RA isthmus dependent)	101	129	37	139
AT	70	51	37	85
VT/VPC	238	268	94	347
Idiopathic	100	226	103	330
Structural	59	42	17	66
AF ablation procedures	122	191	85	324
Ablation centers	5	5	47	7
AF ablation centers	4	4	3	6
Structural VT ablation centers	3	5	3	6
Ablation physicians	8	10	9	11
AF ablation physicians	8	9	6	14
Structural VT ablation physicians	7	10	6	14
National Registry			0	0

7. Management

National certification for physicians	☑PM	☑CRT	☑ICD	☑Ablation
National accreditation for centers	☑PM	☑CRT	☑ICD	☑Ablation
Guidelines followed	☑National	☑U.S.	☑Europe	☑AP

Payment (%)	Pacemaker	ICD	CRT	Ablation
Government	69.5	80.6	69.0	46.7
Insurance	3.1	1.4	14.3	34.7
Public insurance	0.7			0.8
Private insurance	2.7	1.4	14.3	34.9
Individual	27.7	18.1	16.7	18.6

Obstacles to guideline implementation (1=no obstacle, 5=great obstacle)

	1	2	3	4	5
Lack of centers	☐	☐	☑	☐	☐
Lack of reimbursement, limited financial resources	☐	☐	☐	☑	☐
Lack of referral	☐	☑	☐	☑	☐
Lack of trained personnel	☐	☑	☐	☑	☐
Low awareness of guidelines	☐	☑	☐	☑	☐
Lack of operators	☐	☑	☐	☐	☑

8. Source

QEH2, HRPZII, HPP, UMMC, PJHUS, Hospital Serdang, CVSKL

Country/Region: Mongolia

1. Statistics

	2019	2020	2021	2022
Population (thousand)[1]	3,296,9	3,402,7	3.409.9	3.457,5
Hospitals	58	60	57	57
Beds	25661	27083	35310	35310
Physicians	11788	12431	12970	12970
Nurses	12773	13112	13473	13473
GDP (US$, billions)	13.85	-	15.10	16.81
Total expenditure on health as % GDP	4%	5,6%	3,6%	4%
Government expenditure on health (US$)	458000.0	-	543600.0	-
Insured citizens (%)	-	-	-	-
SCD patients	-	-	-	-
Heart failure patients	-	-	-	-
AF patients	-	-	-	-

1, www.census.gov

2. Pacemaker

	2019	2020	2021	2022
Total Pacemakers	180	237	276	365
New implants	-	225	258	-
Replacements	-	5	18	-
Single-chamber	-	-	-	-
Dual-chamber	180	237		-
Leadless				-
Conduction System Pacing				12
Left Bundle Branch Pacing				
His Bundle Pacing				
Sick sinus syndrome	-	60%	-	-
AV block	-	40%	-	-

Implanting Centers	3	3	3	-
Implanting Physicians	6	6	7	8
National Registry	☒	☒	–	–

3. Cardiac resynchronization therapy

	2019	2020	2021	2022
Total CRTs	3	7	6	12
CRT-P	3	7	6	12
CRT-P new implants	3	5	6	12
CRT-P replacements/upgrade	-	-	-	-
CRT-D	-	2	-	-
CRT-D new implants	-	2	-	-
CRT-D replacements/upgrade	-	2	-	-
Ischemic	-	2	-	-
Non-ischemic	3	1	6	12
Conduction System Pacing				
Left Bundle Branch Pacing				
His Bundle Pacing				
Implanting Centers	1	1	1	1
Implanting Physicians	1	1	3	4
National Registry	☒	☒	–	–

4. Implantable cardioverter defibrillat

	2019	2020	2021	2022
Total ICDs	1	4	4	none
ICD new implants	1	4	4	
ICD replacements	-		-	
Single-chamber	-	1	-	
Dual-chamber	1	3	4	
Subcutaneous				
Primary prevention	-	-	-	
Secondary prevention	-	4	4	
Implanting Centers	1	1	1	
Implanting Physicians	2	2	3	
National Registry		☒	–	

5. Lead Extraction

Lead extractions procedures and number of centers that performed lead extraction

	2019	2020	2021	2022
Total lead extraction procedures	1	1	1	none
Hospitals performed lead extraction	1	1	1	
Cardiologists performing lead extraction	2	2	3	
Surgeons performing lead extraction	-	-	-	
National Registry	☒	☒	–	

6. Interventional electrophysiology

	2019	2020	2021	2022
Ablation procedures	156	90	113	180
SVT ablation procedures	140	86	111	165
AVNRT	98	46	75	
AVRT/WPW	32	40	33	
AFL (RA isthmus dependent)	6	1	4	
AT	4	-	-	
VT/VPC	10	3	2	10
Idiopathic	10	3	2	10
Structural	-	-	-	
AF ablation procedures	6	-	-	5
Ablation centers	1	1	1	2
AF ablation centers	1	1	1	2
Structural VT ablation centers	1	1	1	1
Ablation physicians	2	3	3	3
AF ablation physicians	1	1	1	1
Structural VT ablation physicians	1	1	1	1
National Registry	☒	☒	–	–

7. Management

National certification for physicians	☐PM	☐CRT	☐ICD	☐Ablation
National accreditation for centers	☐PM	☐CRT	☐ICD	☐Ablation
Guidelines followed	☐National	☐U.S.	☑Europe	☐AP

Payment (%)	Pacemaker	ICD	CRT	Ablation
Government	90%-100%	90%-100%	90%-100%	90%-100%
Insurance				
Public insurance	90%-100%	90%-100%	90%-100%	90%-100%
Private insurance				
Individual	Up to 10%	Up to 10%	Up to 10%	Up to 10%

Obstacles to guideline implementation (1=no obstacle, 5=great obstacle)

	1	2	3	4	5
Lack of centers	☐	☐	☐	☐	☑
Lack of reimbursement, limited financial resources	☐	☐	☑	☐	☐
Lack of referral	☐	☐	☑	☐	☐
Lack of trained personnel	☐	☐	☐	☐	☑
Low awareness of guidelines	☐	☐	☐	☑	☐
Lack of operators	☐	☐	☐	☐	☑

8. Source

State Third Central Hospital, National Cardiac Center
Mongolian Heart Rhythm Society

Country/Region: Myanmar

1. Statistics

	2019	2020	2021	2022
Population (thousand)	54425	54000	54000	54000
Hospitals (implanting)	11	12	12	12
Beds				
Physicians				
Nurses				
GDP (US$, billions)				
Total expenditure on health as % GDP				
Government expenditure on health as %				
Insured citizens (%)				
SCD patients				
Heart failure patients				
AF patients				

2. Pacemaker

	2019	2020	2021	2022
Total pacemakers	641	509	483	927
New implants	610	479	431	848
Replacements	31	30	52	79
Single-chamber	572	475	422	815
Dual-chamber	69	34	61	112
Leadless				-
Conduction System Pacing				-
Left Bundle Branch Pacing				-
His Bundle Pacing				-
Sick sinus syndrome	296	259	264	525
AV block	345	250	219	402
Implanting Centers	11	12	12	12
Implanting Physicians	21	21	21	21
National Registry	–	–		–

3. Cardiac resynchronization therapy

	2019	2020	2021	2022
Total CRTs	11	1	1	3
CRT-P	1			1
CRT-P new implants	1			
CRT-P replacements/ upgrade				1
CRT-D	10	1	1	2
CRT-D new implants	10			
CRT-D replacements/upgrade		1	1	2
Ischaemic	6	1		2
Non-ischaemic	5		1	1
Conduction System Pacing				
Left Bundle Branch Pacing				
His Bundle Pacing				
Implanting Centers	4	4	4	4
Implanting physicians	15	15	15	15
National Registry	–	–	–	

4. Implantable cardioverter defibrillator

	2019	2020	2021	2022
Total ICDs	37	22	15	30
ICD new implants	37	21	12	25
ICD replacements	-	1	3	5
Single-chamber	32	19	15	27
Dual-chamber	5	3	-	3
Subcutaneous				
Primary prevention	21	12	9	21
Secondary prevention	16	10	6	9
Implanting Centers	5	6	6	6
Implanting physicians	15	15	15	15
National Registry	–	–	–	–

5. Lead extraction

	2019	2020	2021	2022
Total lead extraction procedure	-	1	–	1

Hospitals performed lead extraction	-	1		1
Cardiologists performing lead extraction	-	2		2
Surgeons performing lead extraction	-	-		
National Registry	-	-		

6. Interventional Electrophysiology

	2019	2020	2021	2022
Ablation procedures	1034	601	296	823
SVT ablation procedures	945	555	257	747
AVNRT	519	303	149	400
AVRT/WPW	408	237	100	327
AFL (RA isthmus dependent)	10	5	-	15
AT	15	8	8	5
VT/PVC	58	76	39	76
Idiopathic	56	69	37	74
Structural	2	7	2	2
AF ablation procedures	11	13	-	-
Ablation centers	5	6	6	6
AF ablation centers	1	1	1	1
Structural VT ablation centers	1	1	1	1
Ablation physicians	13	13	13	13
AF ablation physicians	1	1	1	1
Structural VT ablation physicians	1	1	1	1
National Registry	☐		–	–

7. Management

National certification for physicians	☐PM	☐CRT	☐ICD	☐Ablation
National accreditation for centers	☐PM	☐CRT	☐ICD	☐Ablation
Guidelines followed	☐National	☑U.S.	☑Europe	☑AP

Payment (%)	Pacemaker	ICD	CRT	Ablation
Government	80 %	-	-	100 %

Insurance	-	-	-	-
Public insurance	-	-	-	-
Private insurance	-	-	-	-
Individual	20 %	100 %	100 %	-

Obstacles to guideline implementation (1=no obstacle, 5=great obstacle)

	1	2	3	4	5
Lack of centers	☑	☐	☐	☐	☐
Lack of reimbursement, limited financial resources	☐	☐	☐	☑	☐
Lack of referral	☐	☑	☐	☐	☐
Lack of trained personnel	☐	☑	☐	☐	☐
Low awareness of guidelines	☐	☑	☐	☐	☐
Lack of operators	☐	☑	☐	☐	☐

8. Source

Yangon General Hospital, North Okkalapa General Hospital, Mandalay General Hospital, No (1) Defense Services General Hospital, No (2) Defense Services General Hospital, Naypyitaw 1000 bedded Hospital, Private Hospitals in Yangon

Country/Region: New Zealand

1. Statistics

	2019	2020	2021	2022
Population (thousand)[1]	5000	4822	5000	5000
Hospitals *(includes every small hosp.)*				
Beds *(includes every small hosp.)*				
Physicians				
Nurses				
GDP(US$, billions)[2]				
Total expenditure on health as % GDP[2]				
Government expenditure on health as %[2]				
Insured citizens (%)				
SCD patients				
Heart failure patients				
AF patients				

1, www.census.gov

2, www.imf.org

2. Pacemaker

	2019	2020	2021	2022
Total Pacemakers	2644	2670	2505	1624
New implants	2142	2062	1710	1318
Replacements	502	603	423	284
Single-chamber	773	647	495	237
Dual-chamber	1763	1848	1471	769
Leadless				10
Conduction System Pacing				40
Left Bundle Branch Pacing				35
His Bundle Pacing				2
Sick sinus syndrome			83	167
AV block			84	336
Implanting Centers	14	14	14	6

Implanting Physicians	39	39	48	32
National Registry	☑	☑		

3. Cardiac resynchronization therapy

	2019	2020	2021	2022
Total CRTs	318	347	339	167
CRT-P	168	210	171	127
CRT-P new implants	106	121	81	93
CRT-P replacements/upgrade	62	37	52	34
CRT-D	150	137	139	65
CRT-D new implants	108	74	48	49
CRT-D replacements/upgrade	42	23	47	41
Ischemic		6	31	26
Non-ischemic		45	33	89
Conduction System Pacing				1
Left Bundle Branch Pacing				1
His Bundle Pacing				0
Implanting Centers	9	9	9	9
Implanting Physicians	23	35	27	25
National Registry				

4. Implantable cardioverter defibrillator

	2019	2020	2021	2022
Total ICDs	602	457	585	358
ICD new implants	416	319	421	281
ICD replacements	186	138	164	67
Single-chamber		120		64
Dual-chamber		70		54
Subcutaneous				17
Primary prevention		5		95
Secondary prevention		18		54
Implanting Centers	9	9	9	1
Implanting Physicians	23	24	27	11
National Registry	☑	☑		

5. Lead Extraction

Lead extractions procedures and number of centers that performed lead extraction

	2019	2020	2021	2022
Total lead extraction procedures	42	52	40	53
Hospitals performed lead extraction	1	1	1	1
Cardiologists performing lead extraction	2	2	2	2
Surgeons performing lead extraction	Support			Support
National Registry				

6. Interventional electrophysiology

	2019	2020	2021	2022
Ablation procedures	1788	2056	1383	1327
SVT ablation procedures	1029	921	722	704
AVNRT	300	252	208	166
AVRT/WPW	146	125	117	115
AFL (RA isthmus dependent)	391	420	318	336
AT	80	111	44	50
VT/VPC	153	120	64	93
Idiopathic		36	22	30
Structural		22	44	32
AF ablation procedures	644	730	429	544
Ablation centers				5
AF ablation centers	8	8	8	5
Structural VT ablation centers	7	7	7	5
Ablation physicians				
AF ablation physicians	16	21	21	15
Structural VT ablation physicians	16	21	21	15
National Registry	☒	☒	x	incomp

7. Management

National certification for physicians	☐PM	☐CRT	☐ICD	☐Ablation
National accreditation for centers	☐PM	☐CRT	☐ICD	☐Ablation
Guidelines followed	☑National	☐U.S.	☐Europe	☐AP

Payment (%)	Pacemaker	ICD	CRT	Ablation
Government				
Insurance				
Public insurance				
Private insurance				
Individual				

Obstacles to guideline implementation (1=no obstacle, 5=great obstacle)

	1	2	3	4	5
Lack of centers	☐	☐	☑	☐	☐
Lack of reimbursement, limited financial resources	☐	☑	☐	☐	☐
Lack of referral	☐	☐	☑	☐	☐
Lack of trained personnel	☐	☑	☐	☐	☐
Low awareness of guidelines	☐	☐	☑	☐	☐
Lack of operators	☐	☑	☐	☐	☐

8. Source

"Heart Rhythm New Zealand" ---- a branch of the Cardiac Society of Australia and New Zealand

Country/Region: Pakistan

1. Statistics

	2016	2017	2018	2019
Population (million)[1]	182.5	182.7	190	194
Hospitals	–	–		
Beds(per thousand)	0.6	0.6	0.6	0.7
Physicians	05/1000	0.5/1000	0.5/1000	0.5/1000
Nurses	–	–		
GDP (US$, billions)	247	247	246	248
Total expenditure on health as % GDP	3.5	3.8	4.5	5
Government expenditure on health (US$)	4%	4.5%	4.9	5
Insured citizens (%)	0.1%	1	3%	3.1%
SCD patients	–	–		
Heart failure patients	–	–		
AF patients	0.5%	0.5%	0.5%	0.7%

1, www.census.gov

2. Pacemaker

	2016	2017	2018	2019
Total Pacemakers	3450	4030	4300	4600
New implants	3000	4000	4000	4050
Replacements	450	500	520	550
Single-chamber	80%	80%	70%	70%
Dual-chamber	20%	20%	30%	30%
Sick sinus syndrome	20%	26%	25%	23%
AV block	80%	74%	75%	77%
Implanting Centers	29	31	32	34
Implanting Physicians	70	100	102	110
National Registry	☐	☐	no	

3. Cardiac resynchronization therapy

	2016	2017	2018	2019
Total CRTs	137	416	360	390
CRT-P	102	290	300	290
CRT-P new implants	97	290	280	270
CRT-P replacements/upgrade	5	16	20	20
CRT-D	35			
CRT-D new implants	35	110	100	100
CRT-D replacements/upgrade	–	–		
Ischemic	90%	80%	80%	70%
Non-ischemic	10%	20%	20%	30%
Implanting Centers	6	8	8	10
Implanting Physicians	7	8	8	12
National Registry	☐	☐	no	

4. Implantable cardioverter defibrillator

	2016	2017	2018	2019
Total ICDs	–	–		
ICD new implants	150	350	360	390
ICD replacements				
Single-chamber	92%	85	80%	70%
Dual-chamber			20%	30%
Primary prevention	18%	32%	27%	23%
Secondary prevention	82%	68%	73%	77%
Implanting Centers	8	9	9	10
Implanting Physicians	8	8	12	15
National Registry	☐	☐	no	

5. Lead Extraction

Lead extractions procedures and number of centers that performed lead extraction

	2016	2017	2018	2019
Total lead extraction procedures	–	–		7
Hospitals performed lead extraction	–	–	1	2

Cardiologists performing lead extraction	–	–	1	2
Surgeons performing lead extraction	–	–		
National Registry	☐	☐	no	

6. Interventional electrophysiology

	2016	2017	2018	2019
Ablation procedures	–	–	1350	1500
SVT ablation procedures	870	1200	1300	1450
AVNRT	63%	65%	67%	65%
AVRT/WPW	25%	25%	20%	35%
AFL (RA isthmus dependent)	5%	6%	8%	7%
AT	7%	5%	6%	5%
VT/VPC	8%	11%	82%	15%
Idiopathic	7%	10%	18%	10%
Structural				
AF ablation procedures	10	20	16	10
Ablation centers	1		2	
AF ablation centers	2	2	2	2
Structural VT ablation centers	1	2	2	2
Ablation physicians				
AF ablation physicians	2	1	3	3
Structural VT ablation physicians	1		3	3
National Registry	☐	☐		

7. Management

National certification for physicians	☐YPM	☐CRT	☐ICD	☐Ablation
National accreditation for centers	☐PM	☐CRT	☐ICD	☐Ablation
Guidelines followed	☐National	☐U.S.	☐Europe	☐AP

Payment (%)	Pacemaker	ICD	CRT	Ablation
Government	40%	5%	20%	50%
Insurance	–	–	–	–

Public insurance	–	–	–	–
Private insurance	–	–	–	–
Individual	60%	95%	80%	50%

Obstacles to guideline implementation (1=no obstacle, 5=great obstacle)

	1	2	3	4	5
Lack of centers	☐	☐	☐	☑	Y
Lack of reimbursement, limited financial resources	☐	☐	☐	☑	Y
Lack of referral	☐	☐	☑	☐	☐
Lack of trained personnel	☐	☐	☑	☐	Y
Low awareness of guidelines	☐	☐	☑	☐	☐
Lack of operators	☐	☑	☐	☐	Y

8. Source

Pakistan Heart Rhythm Society

Country/Region: Philippines

1. Statistics

	2019	2020	2021	2022
Population (thousand) *	109,938,244	110,818	112321	115,559,009 (a)
Hospitals	1800	1800	1800	1792 (b)
Beds (per 100,000 population)**	135	150	150	53.1 (c)
Physicians (per 1,000 population) ***	1.16	1.16	1.16	--
Nurses (per 1,000 population) ****	24	24	24	0.8 (d)
GDP (US$, billions) *****	376.79	377.205	394.09	404.28 (e)
Total expenditure on health as % GDP	7.1%	4.4%	4.60%	6% (f)
Government expenditure on health as %	33%	33%	33%	17.3% (g)
Insured citizens (%)	93%	93%	93%	69.7% (h)
SCD patients	–	–	–	N/A
Heart failure patients	-	-	-	N/A
AF patients	0.2%	0.40%	0.40%	N/A

*http://www.worldometers.info/world-population/philippines-population/

** http://statista.com

*** http://data.worldbank.org/indicator/SH.MED.BEDS.ZS

**** http://www.who.int/whosis/whostat/EN_WHS2011_Full.pdf

***** http://www.tradingeconomics.com/philippines/gdp-growth-annual

(a) https://www.worldometers.info/world-population/philippines-population/

(b) https://www.bworldonline.com/features/2019/12/18/270194/working-together-for-a-healthy-country/#:~:text=According%20to%20DoH%2C%20there%20are,units%20and%20other%20national%20government.

(c) https://www.statista.com/statistics/1122326/philippines-number-of-hospital-beds-by-region/#:~:text=As%20of%20April%202020%2C%20there,MIMAROPA%20region%20or%20Region%204B.

(d) https://www.statista.com/statistics/1281390/philippines-number-of-nurses-per-ten-thousand-population/

(e) https://tradingeconomics.com/philippines/gdp#:~:text=GDP%20in%20Philippines%20averaged%20105.76,statistics%2C%20economic%20calendar%20and%20news.

(f) https://www.pids.gov.ph/details/news/in-the-news/health-expenses-remain-a-big-burden-for-pinoys-despite-uhc#:~:text=The%20Total%20Health%20Expenditure%20(THE,01%20trillion%20recorded%20in%202020.

(g) https://www.dbm.gov.ph/index.php/secretary-s-corner/press-releases/list-of-press-releases/2627-pangandaman-elated-over-decline-in-nat-l-government-s-budget-deficit#:~:text=0%20billion%20improvement%20from%20the,7%20trillion%20a%20year%20ago.

(h) https://rssocar.psa.gov.ph/article/2022-national-demographic-and-health-survey-ndhs-key-indicators-health-insurance-coverage

(i)

2. Pacemaker

	2019	2020	2021	2022
Total Pacemakers	1335	898	520	1281
New implants	1168	768	410	1092
Replacements	167	130	119	189
Single-chamber	526	352	120	211
Dual-chamber	778	546	281	734
Leadless				24
Conduction system pacing				
Left bundle branch pacing				30
His bundle pacing				
Sick sinus syndrome	197	211	212	

AV block	84	140	189	
Implanting Centers	42	45	69	
Implanting Physicians	55	58	65	
National Registry	□		N/A	

3. Cardiac resynchronization therapy

	2019	2020	2021	2022
Total CRTs	27	26	14	33
CRT-P	3	4	2	
CRT-P new implants	1	3	1	7
CRT-P replacements/upgrade	2	1	1	3
CRT-D	24	22	12	
CRT-D new implants	18	20	6	27
CRT-D replacements/upgrade	6	2	6	10
Ischemic	5	5	8	
Non-ischemic	2	3	4	
Conduction system pacing				
Left bundle branch pacing				
His bundle pacing				
Implanting Centers	4	11	11	
Implanting Physicians	6	20	20	
National Registry	□	N/A	N/A	-

4. Implantable cardioverter defibrillator

	2019	2020	2021	2022
Total ICDs	109	85	42	78
ICD new implants	98	73	36	60
ICD replacements	11	12	6	18
Single-chamber	61	45	26	50
Dual-chamber	48	40	16	28
Subcutaneous				
Primary prevention	26	25	24	--
Secondary prevention	11	17	18	--
Implanting Centers	10	11	15	
Implanting Physicians	9	20	23	
National Registry	□	N/A	N/A	

5. Lead Extraction

Lead extractions procedures and number of centers that performed lead extraction

	2019	2020	2021	2022
Total lead extraction procedures	-	-	–	–
Hospitals performed lead extraction	-	-	–	–
Cardiologists performing lead extraction	-	-	–	–
Surgeons performing lead extraction	-	-	–	–
National Registry	□	□	N/A	–

6. Interventional electrophysiology

	2019	2020	2021	2022
Ablation procedures	153	69	114	141
SVT ablation procedures		60	93	91
AVNRT	60	26	36	82
AVRT/WPW	55	30	45	48
AFL (RA isthmus dependent)	1	2	2	6
AT	1	2	10	5
VT/VPC	19	5	11	22
Idiopathic	-	5	11	20
Structural	-	0	0	2
AF ablation procedures	17	4	10	28
Ablation centers	4	4	4	
AF ablation centers	4	3	4	4
Structural VT ablation centers	4	3	4	3
Ablation physicians	-	20	6	
AF ablation physicians	-	-	6	12
Structural VT ablation physicians	-	-	6	6
National Registry	□	N/A	N/A	N/A

7. Management

National certification for physicians	☐PM	☐CRT	☐ICD	☐Ablation
National accreditation for centers	☐PM	☐CRT	☐ICD	☐Ablation
Guidelines followed	☐National	☑U.S.	☐Europe	☐AP

Payment (%)	Pacemaker	ICD	CRT	Ablation
Government	7.13%	3.27%	3.27%	10.74%
Insurance				
Public insurance	7.13%	3.27%	3.27%	10.74%
Private insurance	0	0	0	0
Individual	92.87%	96.73%	96.73%	89.26%

Obstacles to guideline implementation (1=no obstacle, 5=great obstacle)

	1	2	3	4	5
Lack of centers	☐	☐	☑	☐	☐
Lack of reimbursement, limited financial resources	☐	☐	☐	☐	☑
Lack of referral	☐	☐	☑	☐	☐
Lack of trained personnel	☐	☐	☐	☑	☐
Low awareness of guidelines	☐	☐	☐	☑	☐
Lack of operators	☐	☐	☐	☑	☐

8. Source

a. Philippine Heart Rhythm Society, Inc.

b. Different ablation centers

c. Other Sources:

Medtronic Phils.

Abbott Phils.

Boston Phils.

Transmedic Phils.

Country/Region: Singapore

1. Statistics

	2018	2019	2020	2021	2022
Population ('000)[1]	**5,638.7**	**5,703.6**	**5,685.8**	**5,453.6**	**5,637.0**
Hospitals [2]	**28**	**29**	**28**	**29**	**29**
a. Public Sector	*15*	*16*	*16*	*16*	*16*
- Acute Hospitals	*10*	*10*	*10*	*10*	*10*
- Psychiatric Hospitals	*1*	*1*	*1*	*1*	*1*
- Community Hospitals	*4*	*5*	*5*	*5*	*5*
b. Not-for-Profit	*5*	*5*	*5*	*5*	*5*
- Acute Hospitals	*1*	*1*	*1*	*1*	*1*
- Psychiatric Hospitals	*-*	*-*	*-*	*-*	*-*
- Community Hospitals	*4*	*4*	*4*	*4*	*4*
c. Private Sector	*8*	*8*	*7*	*8*	*8*
- Acute Hospitals	*8*	*8*	*7*	*8*	*8*
- Psychiatric Hospitals	*-*	*-*	*-*	*-*	*-*
- Community Hospitals	*-*	*-*	*-*	*-*	*-*
Beds[3]	**29,938**	**31,495**	**32,038**	**32,928**	**34,395**
a. Public Sector	*17,425*	*18,590*	*19,141*	*19,927*	*21,147*
- Acute Hospitals	*9,071*	*9,404*	*9,610*	*9,762*	*9,820*
- Psychiatric Hospitals	*1,950*	*1,950*	*1,950*	*1,950*	*1,950*
- Community Hospitals	*799*	*974*	*1,130*	*1,180*	*1,226*
- Nursing Homes	*5,581*	*6,238*	*6,391*	*6,971*	*8,087*
- Inpatient Hospices	*24*	*24*	*-*	*-*	*-*
*- IHPCS**	*-*	*-*	*60*	*64*	*64*
b. Not-for-Profit					
- Acute Hospitals	*7,360*	*7,418*	*7,380*	*7,424*	*7,579*
- Psychiatric Hospitals	*273*	*288*	*285*	*270*	*273*
- Community Hospitals	*-*	*-*	*-*	*-*	*-*
- Nursing Homes	*979*	*1,012*	*939*	*899*	*968*
- Inpatient Hospices	*5,953*	*5,963*	*5,963*	*6,060*	*6,138*

*- IHPCS**	*155*	*155*	*-*	*-*	*-*
	-	*-*	*193*	*195*	*200*
b. Private Sector					
- Acute Hospitals					
- Psychiatric Hospitals	*5,153*	*5,487*	*5,517*	*5,577*	*5,669*
- Community Hospitals	*1,482*	*1,629*	*1,650*	*1,672*	*1,737*
- Nursing Homes	*-*	*-*	*-*	*-*	*-*
- Inpatient Hospices	*-*	*-*	*-*	*-*	*-*
*- IHPCS**	*3,671*	*3,858*	*3,867*	*3,905*	*3,932*
	-	*-*	*-*	*-*	*-*
	-	*-*	*-*	*-*	*-*
Physicians[4]	**13,766**	**14,279**	**14,823**	**15,423**	**16,009**
a. Public Sector	*8,819*	*9,030*	*9,532*	*9,844*	*10,146*
b. Private Sector	*4,225*	*4,439*	*4,489*	*4,601*	*4,682*
c. Not in active Practice	*722*	*810*	*802*	*978*	*1,181*
Nurses/Midwives[4]	**42,125**	**42,777**	**42,173**	**43,005**	**43,772**
- Registered Nurses	*33,614*	*34,609*	*34,654*	*35,948*	*36,995*
- Enrolled Nurses	*8,394*	*8,059*	*7,442*	*6,989*	*6,715*
- Registered Midwives	*117*	*109*	*77*	*68*	*62*
Advanced Practice Nurses[4]	**238**	**267**	**264**	**330**	**383**
GDP (US$, billions)					
Government Health Expenditure (as % of GDP)[5]	**2.1**	**2.2**	**3.6**	**3.7#**	**4.1#**
Government Health Expenditure (as % of Total Government Expenditure)[5]	**13.4**	**15.0**	**17.7**	**18.4#**	**18.8#**
Insured citizens (%)	-	-	-	-	-
SCD patients	-	-	-	-	-
Heart failure patients	-	-	-	-	-
AF patients	-	-	-	-	-

Source: Singapore Health Facts, Singapore Department of Statistics, Ministry of Health, Singapore and data.gov.sg retrieved as of 30 September 2023[1,2,3,4,5] (www.moh.gov.sg).

* The new Inpatient Palliative Care Services (IHPCS) started on Apr 2020, replacing Inpatient Hospice and Community Hospital Palliative Care Services, and are tracked separately from 2020 onwards.

Estimated figures

2. Pacemaker

	2018	2019	2020	2021	2022
Total Pacemakers[4]	**875**	**928**	**910**	**957**	**1071**
- New implants	589	620	613	616	657
Replacements/Upgrades	139	135	143	169	223
Others	147	173	154	172	191
- Single-chamber	143	131	97	147	132
Dual-chamber	591	621	673	641	759
Not applicable	141	176	140	169	180
- Sick sinus syndrome	377	338	360	361	430
AV block*	230	259	282	287	293
Implanting Centers[4]	6	6	6	6	6
Implanting Physicians[4]	~25	~27	~22	~25	~26
National Registry[4]	☑	☑	☑	☑	☑

Source: CGH, KTPH, NHCS, NTFGH, NUHCS, TTSH, SCDB as of 30 September 2023[4]

** refer to Complete AV Block only.*

CGH: Changi General Hospital, KTPH: Khoo Teck Puat Hospital, NHCS: National Heart Centre Singapore, NTFGH: Ng Teng Fong General Hospital, NUHCS: National University Heart Centre Singapore, TTSH: Tan Tock Seng Hospital, SCDB: Singapore Cardiac Data Bank

3. Cardiac resynchronization therapy

	2018	2019	2020	2021	2022
Total CRTs[4]	**184**	**205**	**177**	**172**	**191**
- CRT-P	38	52	48	39	34
CRT-P new implants	16	30	31	9	10
CRT-P replacements/upgrade	22	20	15	28	22
Others	-	2	2	2	2
- CRT-D	146	153	129	133	157
CRT-D new implants	100	101	76	65	78
CRT-D replacements/upgrade	42	41	48	59	69
Others	4	11	5	9	10
- Ischemic	92	94	79	63	98
Non-ischemic	26	49	51	70	56
Implanting Centers[4]	6	6	6	6	6

Implanting Physicians[4]	~22	~25	~21	~22	~24
National Registry[4]	☑	☑	☑	☑	☑

Source: CGH, KTPH, NHCS, NTFGH, NUHCS, TTSH, SCDB as of 30 September 2023[4]

4. Implantable cardioverter defibrillator

	2018	***2019***	***2020***	***2021***	***2022***
Total ICDs[4]	**394**	**345**	**410**	**363**	**365**
- ICD new implants	288	222	238	225	210
ICD replacements/upgrade	64	77	130	*100*	105
Others	42	46	42	38	50
- Single-chamber	311	246	296	276	261
Dual-chamber	54	70	78	63	71
Others	29	29	36	24	33
- Primary prevention	266	225	248	229	224
Secondary prevention	128	119	162	132	141
Others	-	1	-	2	-
Implanting Centers[4]	6	6	6	*6*	*6*
Implanting Physicians[4]	~21	~26	~23	~24	~22
National Registry[4]	☑	☑	☑	☑	☑

Source: CGH, KTPH, NHCS, NTFGH, NUHCS, TTSH, SCDB as of 30 September 2023[4]

5. Lead Extraction

Lead extractions procedures and number of centers that performed lead extraction

	2018	***2019***	***2020***	***2021***	***2022***
Total lead extraction procedures	47	49	53	49	67
Hospitals performed lead extraction	~6	~5	~4	~5	~4
Cardiologists performing lead extraction	~16	~16	~14	~17	~15

Surgeons performing lead extraction	-	~2	~2	~2	~2
National Registry	☑	☑	☑	☑	☑

Inclusive of Explantation / Replacement of PPM / ICD.

6. Interventional electrophysiology

	2018	***2019***	***2020***	***2021***	***2022***
Ablation procedures[4]	**951**	**963**	**720**	**877**	**874**
SVT ablation procedures	-	-	-	-	-
AVNRT	193	206	162	205	209
AVRT/WPW	116	116	97	129	100
AFL (RA isthmus dependent)	205	198	156	183	192
AT	42	67	52	47	51
VT/VPC	128	152	90	108	95
Idiopathic	-	-	-	-	---
Structural	-	-	-	-	---
AF ablation procedures	244	193	143	182	201
Others	23	31	20	23	26
Ablation centers[4]	3	3	3	3	3
AF ablation centers	2	2	2	2	2
Structural VT ablation centers	2	2	2	2	2
Ablation physicians[4]	~20	~21	~19	~20	~19
AF ablation physicians	–	–	–	-	-
Structural VT ablation physicians	–	–	–	-	-
National Registry[4]	☑	☑	☑	☑	☑

Source: CGH, KTPH, NHCS, NTFGH, NUHCS, TTSH, SCDB as of 30 September 2023[4]

7. Management

National certification for physicians	☐PM	☐CRT	☐ICD	☐ Ablation
National accreditation for centers	☑PM	☑CRT	☑ICD	☑ Ablation
Guidelines followed	☐National	☑U.S.	☑Europe	☐AP

Payment (%)	Pacemaker	ICD	CRT	Ablation
Government	-	-	-	-
Insurance	–	–	–	–
Public insurance	-	-	-	-
Private insurance	-	-	-	-
Individual	-	-	-	-

Obstacles to guideline implementation (1=no obstacle, 5=great obstacle)

	1	2	3	4	5
Lack of centers	☑	☐	☐	☐	☐
Lack of reimbursement, limited financial resources	☐	☐	☑	☐	☐
Lack of referral	☐	☐	☑	☐	☐
Lack of trained personnel	☐	☑	☐	☐	☐
Low awareness of guidelines	☐	☐	☑	☐	☐
Lack of operators	☐	☑	☐	☐	☐

8. Source

The source of information is contributed by the public hospitals i.e. Changi General Hospital, Khoo Teck Puat Hospital, National Heart Centre Singapore, Ng Teng Fong General Hospital, National University Hospital and Tan Tock Seng Hospital.

Country/Region: South Korea (Republic of Korea)

1. Statistics

	2019	2020	2021	2022
Population (thousand)[1]	51269	51780	51680	51565
Hospitals[2]	-	40049	40862	41906
Beds (per 100,000 population)[2]	-	1321	1398	1400
Physicians (per 1,000 population)[2]	-	2.1	2.1	2.1
Nurses (per 1,000 population)[2]	-	4.3	4.7	5.0
GDP (US$, billions)[3]	1913.9	1933.1	2071.6	2161.7
Total expenditure on health as % GDP[3]	8.0%	8.4%	8.8%	
Government expenditure on health as %[3]	4.9%	5.2%	5.9%	6.1%
Insured citizens (%)	100	100	100	100
SCD patients				
Heart failure patients				
AF patients				

1. www.census.gov
2. www.who.int / http://apps.who.int/nha/database/country_profile/Index/en
3. www.imf.org

2. Pacemaker

	2019	2020	2021	2022
Total Pacemakers	4368	4285	5153	8165
New implants		3497	3805	6367
Replacements			951	1798
Single-chamber		620	834	1012
Dual-chamber		3006	3500	5355
Leadless				
Conduction System Pacing				
Left Bundle Branch Pacing				
His Bundle Pacing				
Sick sinus syndrome		1682	2040	3415

AV block		2089	2519	4510
Implanting Centers		56	60	
Implanting Physicians		109	114	
National Registry		☒	☒	☒

3. Cardiac resynchronization therapy

	2019	2020	2021	2022
Total CRTs	352	346	409	502
CRT-P		58	61	74
CRT-P new implants		31	31	37
CRT-P replacements/upgrade		22	31	37
CRT-D		284	290	428
CRT-D new implants		176	211	291
CRT-D replacements/upgrade		67	81	137
Ischemic		58	76	130
Non-ischemic		229	261	372
Conduction System Pacing				
Left Bundle Branch Pacing				
His Bundle Pacing				
Implanting Centers		50	51	
Implanting Physicians		89	90	
National Registry		☒	☒	☒

4. Implantable cardioverter defibrillator

	2019	2020	2021	2022
Total ICDs	1248	1146	1135	1685
ICD new implants		896	868	1422
ICD replacements		116	122	263
Single-chamber		564	426	821
Dual-chamber		456	450	601
Subcutaneous				
Primary prevention		491	475	705
Secondary prevention		576	499	932
Implanting Centers		56	59	
Implanting Physicians		103	110	

National Registry		☒	☒	☒

5. Lead Extraction

Lead extractions procedures and number of centers that performed lead extraction

	2019	2020	2021	2022
Total lead extraction procedures	113	125	135	150
Hospitals performed lead extraction		19	24	
Cardiologists performing lead extraction		71	74	
Surgeons performing lead extraction		21	32	
National Registry		☒		

6. Interventional electrophysiology

	2019	2020	2021	2022
Ablation procedures	9631	10348	11554	10453
SVT ablation procedures	4936	4636	5124	4162
AVNRT		1992	1915	1909
AVRT/WPW		1379	1171	1124
AFL (RA isthmus dependent)		1030	1233	882
AT		359	386	259
VT/VPC	671	975	615	533
Idiopathic		447	420	400
Structural		106	115	133
AF ablation procedures	4024	4977	5796	6991
Ablation centers				
AF ablation centers	45	49	53	45
Structural VT ablation centers	19	16	18	15
Ablation physicians				
AF ablation physicians		88	98	87
Structural VT ablation physicians		80	85	78
National Registry		☒	☒	☒

7. Management

National certification for physicians	☐PM	☐CRT	☐ICD	☐Ablation
National accreditation for centers	☐PM	☐CRT	☐ICD	☐Ablation

Guidelines followed ☑National ☐U.S. ☐Europe ☐AP

Payment (%)	Pacemaker	ICD	CRT	Ablation
Government				
Insurance				
Public insurance				
Private insurance				
Individual				

Obstacles to guideline implementation (1=no obstacle, 5=great obstacle)

	1	2	3	4	5
Lack of centers	☑	☐	☐	☐	☐
Lack of reimbursement, limited financial resources	☐	☐	☑	☐	☐
Lack of referral	☐	☐	☑	☐	☐
Lack of trained personnel	☐	☑	☐	☐	☐
Low awareness of guidelines	☐	☐	☑	☐	☐
Lack of operators	☐	☑	☐	☐	☐

8. Source

KHRS (Korean Heart Rhythm Society)

Country/Region: Sri Lanka

1. Statistics

	2019	2020	2021	2022
Population (thousand)[1]		21803	21967	21919
Hospitals		696	696	696
Beds				87280
Physicians (MO s)		19900	19900	21100
Nurses		-		45300
GDP (US$, billions)			285	USD 75.3 billion
Total expenditure on health as % GDP				5.63
Government expenditure on health (US$)				
Insured citizens (%)				
SCD patients				
Heart failure patients				
AF patients				

1, www.census.gov

2. Pacemaker

	2019	2020	2021	2022
Total Pacemakers		1700	1954	1501
New implants		1563	1657	1205
Replacements		137	297	296
Single-chamber		1207	996	872
Dual-chamber		493	561	840
Leadless				0
Conduction System Pacing				0
Left Bundle Branch Pacing				0
His Bundle Pacing				0
Sick sinus syndrome		812	980	541
AV block		888	974	960
Implanting Centers		14	14	15
Implanting Physicians		13	11	10
National Registry		–	–	–

3. Cardiac resynchronization therapy

	2019	2020	2021	2022
Total CRTs		43	35	71
CRT-P		35	25	57
CRT-P new implants		28	22	50
CRT-P replacements/upgrade		7	03	7
CRT-D		8	10	14
CRT-D new implants		7	09	10
CRT-D replacements/upgrade		1	01	4
Conduction System Pacing				-
Left Bundle Branch Pacing				
His Bundle Pacing				
Ischemic		11	13	
Non-ischemic		32	22	
Implanting Centers		9	07	9
Implanting Physicians		9	09	9
National Registry		–	–	

4. Implantable cardioverter defibrillator

	2019	2020	2021	2022
Total ICDs		202	285	169
ICD new implants		185	260	146
ICD replacements		17	25	23
Single-chamber		165	270	93
Dual-chamber		37	15	53
Subcutaneous				0
Primary prevention		123	143	
Secondary prevention		79	142	
Implanting Centers		13	09	9
Implanting Physicians		10	09	9
National Registry		–		–

5. Lead Extraction

Lead extractions procedures and number of centers that performed lead extraction

	2019	2020	2021	2022

Total lead extraction procedures		5	06	5
Hospitals performed lead extraction		3	03	3
Cardiologists performing lead extraction		-		
Surgeons performing lead extraction		2	06	8
National Registry	☐	–		–

6. Interventional electrophysiology

	2019	2020	2021	2022
Ablation procedures		658	478	681
SVT ablation procedures		361	349	360
AVNRT		267	226	251
AVRT/WPW		69	123	109
AFL(RA isthmus dependent)		10		2
AT		15	03	3
VT/VPC		297		315
Idiopathic		289	129	315
Structural		8	-	-
AF ablation procedures		-	-	-
Ablation centers		5	5	5
AF ablation centers		-		0
Structural VT ablation centers		-		0
Ablation physicians		9	9	8
AF ablation physicians		-	-	-
Structural VT ablation physicians		-	-	-
National Registry			–	–

7. Management

National certification for physicians	☐PM	☐CRT	☐ICD	☐Ablation
National accreditation for centers	☑PM	☑CRT	☑ICD	☑Ablation
Guidelines followed	☐National	☑U.S.	☑Europe	☑AP

Payment (%)	Pacemaker	ICD	CRT	Ablation
Government				
Insurance				

Public insurance				
Private insurance				
Individual				

Obstacles to guideline implementation (1=no obstacle, 5=great obstacle)

	1	2	3	4	5
Lack of centers	☐	☒	☐	☐	☐
Lack of reimbursement, limited financial resources	☐	☐	☐	☒	☐
Lack of referral	☐	☒	☐	☐	☐
Lack of trained personnel	☐	☒	☐	☐	☐
Low awareness of guidelines	☐	☒	☐	☐	☐
Lack of operators	☐	☒	☐	☐	☐

8. Source

Individual Device Implantation and EP centers

Country/Region: Taiwan, CN

1. Statistics

	2019	2020	2021	2022
Population (thousand)[1]	23574	23561	23195	23265
Hospitals[2]	476	472	473	475
Beds[2]	168,266	151,862	138,442	139,441
Physicians[3]	49,542	51,045	52,175	53,063
Nurses[3]	154,747	160,795	183,253	185,778
GDP (US$, billions)[4]	611,255	669,321	668,321	653,836
Total expenditure on health as % GDP[5]				
Government expenditure on health as %[6]	6.54	6.69		
Insured citizens (%)	99%	99%	99%	99%
SCD patients				
Heart failure patients				
AF patients				

[1]https://www.moi.gov.tw/cl.aspx?n=4412
[2]https://dep.mohw.gov.tw/DOS/cp-1735-3246-113.html
[3]https://dep.mohw.gov.tw/DOS/cp-1735-3245-113.html
[4]https://www.stat.gov.tw/cl.aspx?n=2672
[5]https://iiqsw.mohw.gov.tw/InteractiveIntro.aspx?TID=9FBD55607C91A331
[6]https://dep.mohw.gov.tw/DOS/lp-2156-113.html

2. Pacemaker

	2019	2020	2021	2022
Total Pacemakers	6904	6990	7038	7283
New implants	82%	81%	5711	5785
Replacements	18%	19%	1327	1498
Single-chamber (Leadless included)	22%	18%	1401	1272
Leadless	1.3%	1.3%	147	202
Dual-chamber	78%	82%	5637	6011

Leadless				
Conduction System Pacing				495
Left Bundle Branch Pacing				493
His Bundle Pacing				2
Sick sinus syndrome	63%	55%	3518	4378
AV block	37%	45%	2980	2905
Implanting Centers	110	116	292	228
Implanting Physicians	550	349	946	643
National Registry	☑	☑	☑	☑

3. Cardiac resynchronization therapy

	2019	2020	2021	2022
Total CRTs	354	315	321	335
CRT-P	216	223	240	240
CRT-P new implants	60%	67%	122	112
CRT-P replacements/upgrade	40%	33%	118	128
CRT-D	138	92	81	95
CRT-D new implants	43%	53%	34	44
CRT-D replacements/upgrade	57%	47%	47	51
Ischemic	40%	32%	140	109
Non-ischemic	60%	68%	181	201
Conduction System Pacing				2
Left Bundle Branch Pacing				2
His Bundle Pacing				
Implanting Centers	35	54	98	84
Implanting Physicians	120	123	178	200
National Registry	☑	☑	☑	☑

4. Implantable cardioverter defibrillator

	2019	2020	2021	2022
Total ICDs	891	864	812	861
ICD new implants	77%	76%	592	682
ICD replacements	23%	24%	220	179

Single-chamber	39%	36%	277	327
Dual-chamber	61%	64%	535	534
Subcutaneous				
Primary prevention	1.5%	0.6%	13	7
Secondary prevention	98.5%	99.4%	799	854
Implanting Centers	58	71	190	121
Implanting Physicians	175	178	294	262
National Registry	☑	☑	☑	☑

5. Lead Extraction

Lead extractions procedures and number of centers that performed lead extraction

	2019	2020	2021	2022
Total lead extraction procedures	14	26	35	33
Hospitals performed lead extraction	8	2	12	9
Cardiologists performing lead extraction	12	12	26	19
Surgeons performing lead extraction	2	12	9	9
National Registry	☑	☑	☑	☑

6. Interventional electrophysiology

	2019	2020	2021	2022
Ablation procedures	5020	5501	5254	6274
SVT ablation procedures	2507	2923	2473	3263
AVNRT	1804	1530	1401	1558
AVRT/WPW	722	624	593	679
AFL (RA isthmus dependent)	632	666	691	758
AT	171	246	226	224
VT/VPC	1115	1021	1013	1048
Idiopathic	810	889	755	532
Structural	125	212	119	90
AF ablation procedures	1142	1185	1282	1659
Ablation centers	38	73	18	38
AF ablation centers	15	22	16	31
Structural VT ablation centers	15	22	7	15
Ablation physicians	98	78	60	109
AF ablation physicians	70	65	69	100
Structural VT ablation physicians	69	57	60	54

National Registry				

7. Management

National certification for physicians	☐ PM	☐CRT	☑ ICD	☑ Ablation
National accreditation for centers	☐ PM	☐CRT	☐ICD	☐ Ablation
Guidelines followed	☑ National	☑ U.S.	☑ Europe	☑ AP

Payment (%)	Pacemaker	ICD	CRT	Ablation
Government				
Insurance				
Public insurance				
Private insurance				
Individual				

Obstacles to guideline implementation (1=no obstacle, 5=great obstacle)

	1	2	3	4	5
Lack of centers	☑	☐	☐	☐	☐
Lack of reimbursement, limited financial resources	☐	☐	☐	☑	☐
Lack of referral	☑	☐	☐	☐	☐
Lack of trained personnel	☑	☐	☐	☐	☐
Low awareness of guidelines	☑	☐	☐	☐	☐
Lack of operators	☑	☐	☐	☐	☐

8. Source

Taiwan Heart Rhythm Society

Country/Region: Thailand

1. Statistics*

	2019	2020	2021	2022
Population#	65,557,054	65,421,139	65,212,951	66,090,475
Hospitals		1356	1344	1367
Beds(per 100,000 population)		245 beds/100,000 Or Bed: Population = 1:415	229 beds/100,000 or 1:389	229 beds/100,000 or 1:389
Physicians		Physician: Population =1:1674	1:1680	1:1680
Nurses		Nurse: Population =1:379	1:353	1:353
GDP (US$)	$543.65 billion	$512 billion	$505 billion 16200 billion baht	$495 billion 17400 billion baht
Total expenditure on health as % GDP				
Government expenditure on health as %		1.7% (Gov Expenditure on Health 343,906 mil Baht; GDP 16,898,086 mil Baht)		
Insured citizens (%)	87.9	99.3%	99.3%	99.87%
SCD patients				
Heart failure patients		Inpatient with heart failure Dx: 216,131 Or 3/1000 pop		
AF patients				

*Source: Strategy and Planning Division, Ministry of Public Health, Thailand
#Data on numbers of population in 2019-2021 was corrected according to national data.

2. Pacemakers

	2019	2020	2021	2022
Total Pacemakers	3827	4509	3954	5192
New implants	2802	3498	2923	3963
Replacements	1025	1011	1031	1216
Single-chamber	1138	1133	1637	1137
Dual-chamber	2711	3351 (74.3%)	2139	3886
Leadless		25 Micra	21 MICRA	30
Conduction system pacing				561
Left bundle branch pacing				
His bundle pacing				
Sick sinus syndrome				
AV block				
Implanting Centers	25 (government)		26 (government)	27 (government)
Implanting Physicians				
National Registry				

3.Cardiac resynchronization therapy

	2019	2020	2021	2022
Total CRTs	373	429	399	539
CRT-P				
CRT-P new implants	62	43	50	50
CRT-P replacements/upgrade	33	39	36	52
CRT-D				
CRT-D new implants	177	255	233	321
CRT-D replacements/upgrade	101	92	80	110
Ischemic				
Non-ischemic				
Conduction system pacing				6
Left bundle branch pacing				
His bundle pacing				

Implanting Centers	25 (government)		26 (government)	27 (government)
Implanting Physicians				
National Registry				

4. Implantable cardioverter defibrillator

	2019	2020	2021	2022
Total ICDs	952	1110	890	1313
ICD new implants	750	930	752	1120
ICD replacements	202	180	138	193
Single-chamber	805	880	669	405
Dual-chamber	225	216	205	151
Subcutaneous		20	7	9
Primary prevention				
Secondary prevention				
Implanting Centers	25 (government)		26 (government)	27 (government)
Implanting Physicians				
National Registry				

5. Lead Extraction

Lead extractions procedures and number of centers that performed lead extraction

	2019	2020	2021	2022
Total lead extraction procedures	23	43	68	62
Hospitals performed lead extraction	7	7	13	13
Cardiologists performing lead extraction			68	62
Surgeons performing lead extraction			0	
National Registry				

6. Interventional electrophysiology

	2019	2020	2021	2022
Ablation procedures				
SVT ablation procedures				
AVNRT	1135	1060	897	1173
AVRT/WPW	372	347	476	554
AFL (RA isthmus dependent)	184	279	188	256

AT	138	125	148	125
VT/VPC				
Idiopathic	479	526	435	591
Structural	16	31	26	53
AF ablation procedures	177	188	187RF + 16Cryo	264 RF 31 Cryo
Ablation centers	25 (government)			27 (government)
AF ablation centers	25 (government)	12	12	15
Structural VT ablation centers		12	12	12
Ablation physicians				
AF ablation physicians				
Structural VT ablation physicians				
National Registry				

7. Management

National certification for physicians	☑PM	☑CRT	☑ICD	☑Ablation
National accreditation for centers	☐PM	☐CRT	☑ICD	☐Ablation
Guidelines followed	☑National	☑U.S.	☑Europe	☑AP

Payment (%)	Pacemaker	ICD	CRT	Ablation
Government	100% except MICRA (20%)	100% Except sICD (20%)	100%	100% except Cryo (30%)
Insurance				
Public insurance				
Private insurance				
Individual				

Obstacles to guideline implementation (1=no obstacle, 5=great obstacle)

	1	2	3	4	5
Lack of centers	☐	☐	☑	☐	☐
Lack of reimbursement, limited financial resources	☐	☐	☐	☑	☐

Lack of referral	☐	☐	☐	☑	☐
Lack of trained personnel	☐	☑	☐	☐	☐
Low awareness of guidelines	☐	☐	☐	☑	☐
Lack of operators	☐	☑	☐	☐	☐

8. Source

Country/Region: Vietnam

1. Statistics

	2019	2020	2021	2022
Population (thousand)[1]		97,338	98,510	99.46
Hospitals				
Beds				
Physicians				
Nurses				
GDP (US$, billions)		271	362.64	406.45
Total expenditure on health as % GDP				
Government expenditure on health (US$)				
Insured citizens (%)				92.04
SCD patients				
Heart failure patients				
AF patients				

1, www.census.gov

2. Pacemaker

	2019	2020	2021	2022
Total Pacemakers	4891	2042	3351	4137
New implants				
Replacements				
Single-chamber	1876		1118	1120
Dual-chamber	2641		2233	2927
Leadless				
Conduction system pacing				90
Left bundle branch pacing				
His bundle pacing				
Sick sinus syndrome				
AV block				
Implanting Centers	46	46	46	50
Implanting Physicians	126	130	135	140
National Registry				

3. Cardiac resynchronization therapy

	2019	2020	2021	2022
Total CRTs	111	104	85	95
CRT-P	49	73	61	61
CRT-P new implants				
CRT-P replacements/upgrade			24	
CRT-D	62	32		34
CRT-D new implants				
CRT-D replacements/upgrade				
Ischemic				
Non-ischemic				
Conduction system pacing				
Left bundle branch pacing				
His bundle pacing				
Implanting Centers	14	14	14	20
Implanting Physicians	30	30	30	40
National Registry				

4. Implantable cardioverter defibrillator

	2019	2020	2021	2022
Total ICDs	263	263	216	254
ICD new implants				
ICD replacements				
Single-chamber		219	198	238
Dual-chamber		44	8	16
Subcutaneous				
Primary prevention				
Secondary prevention				
Implanting Centers	18	18	18	20
Implanting Physicians	40	40	40	45
National Registry				

5. Lead Extraction

Lead extractions procedures and number of centers that performed lead extraction

	2019	2020	2021	2022

Total lead extraction procedures		1	1	1
Hospitals performed lead extraction		1	1	1
Cardiologists performing lead extraction		1	1	1
Surgeons performing lead extraction				
National Registry				

6. Interventional electrophysiology

	2019	2020	2021	2022
Ablation procedures	4042	2947		5126
SVT ablation procedures				
AVNRT	1656	785		1451
AVRT/WPW	902	835		1170
AFL (RA isthmus dependent)	40	29		214
AT	100	57		213
VT/VPC	1289	1064		1838
Idiopathic		1064		1784
Structural				54
AF ablation procedures	55	106		240
Ablation centers	22	22		24
AF ablation centers	7	7		9
Structural VT ablation centers	4	4		5
Ablation physicians		45		50
AF ablation physicians	16	16		20
Structural VT ablation physicians		9		11
National Registry				

7. Management

National certification for physicians	☑PM	☑CRT	☑ICD	☑Ablation
National accreditation for centers	☑PM	☑CRT	☑ICD	☑Ablation
Guidelines followed	☑National	☑U.S.	☑Europe	☐AP

Payment (%)	Pacemaker	ICD	CRT	Ablation
Government				
Insurance				

Public insurance				
Private insurance				
Individual				

Obstacles to guideline implementation (1=no obstacle, 5=great obstacle)

	1	2	3	4	5
Lack of centers	☐	☑	☐	☐	☐
Lack of reimbursement, limited financial resources	☑	☐	☐	☐	☐
Lack of referral	☑	☐	☐	☐	☐
Lack of trained personnel	☐	☑	☐	☐	☐
Low awareness of guidelines	☑	☐	☐	☐	☐
Lack of operators	☐	☐	☑	☐	☐

8. Source

Vietnam Heart Rhythm Society: Ton That Minh, MD., Pham Tran Linh, MD. Vien Hoang Long, MD., et al

The APHRS White Book: Eleventh edition

-The current status of cardiac electrophysiology in APHRS member countries
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President of APHRS

1. Foreword

The White Book of Asia Pacific Heart Rhythm Society (APHRS) is an annual compilation of the cardiac electrophysiology data from APHRS member countries and regions from 2013. As in previous years, the APHRS white book provided valuable update information about current status of activity in the field of arrhythmia treatment encompassing country demographics, epidemiology of cardiac arrhythmia, implantation of CIEDs (pacemaker, cardiac resynchronization therapy, and implantable cardioverter defibrillator), procedures of interventional electrophysiology, and obstacles to guideline implementation etc. Under the joint effort of our board members, the Eleventh edition of APHRS White Book was finally released with data from 17 countries and regions, including China mainland, Hong Kong CN, India, Indonesia, Japan, Korea, Malaysia, Myanmar, New Zealand, Philippines, Singapore, Taiwan CN, Thailand, Vietnam, Brunei Darussalam, Cambodia, Mongolia, and Sri Lanka. The Data collection is mostly the result of voluntary participation of each national Society of Pacing and Electrophysiology or national Heart Rhythm Society. We hope the APHRS White Book will become a key reference for those seeking information about electrophysiological procedures and CIEDs in Asia-Pacific countries.

2. Methodology

A primary research was conducted within national Heart Rhythm Societies or working groups of cardiac pacing and electrophysiology of each country. Each chairman of the societies and/or working groups was asked to compile information about their country for the year 2019, 2020, 2021 and 2022 based on a questionnaire. Secondary research has been conducted with the help of reliable official online databases to cross verify the information reported here. Three major source of information have been used: healthcare data were extracted from the World Health Organization (WHO) (http://www.who.int), whereas demographic information were taken by the

United States Census Bureau International Database (http://www.census.gov), and finally, the source of economic information has been the International Monetary Fund (IMF) World Economic Outlook Databases (http://www.imf.org). A total of 17 APHRS member countries and regions provided their data in this edition. The analysis was performed on the trend of device implantation and catheter ablation from 2019 to 2022, and the device implantation rates or catheter ablation rates and centers in 2022.

3. Permanent Pacemaker Implantation

3.1 Increase in pacemaker implantation

As shown in Figure 1, the increasing trend in the implantation of permanent pacemaker was seen in all the 17 countries or regions in 2022 as compared with 2021. For Malaysia and Philippines, the implantation of pacemaker demonstrated a significant increasing rate over 100%. The pacemaker implantation in Myanmar,South Korea,Mongolia,Thailand,Brunei Darussalam, Vietnam and Singapore show an increasing rate over 10%. Reported data showed decreased pacemaker implantation in PR. China,Sri Lanka,New Zealand and Cambodia.. In Indonesia,Taiwan CN, Japan and Hong Kong CN the increasing rate was 9.76%,3.48%,1.29% and 0.34%, respectively.

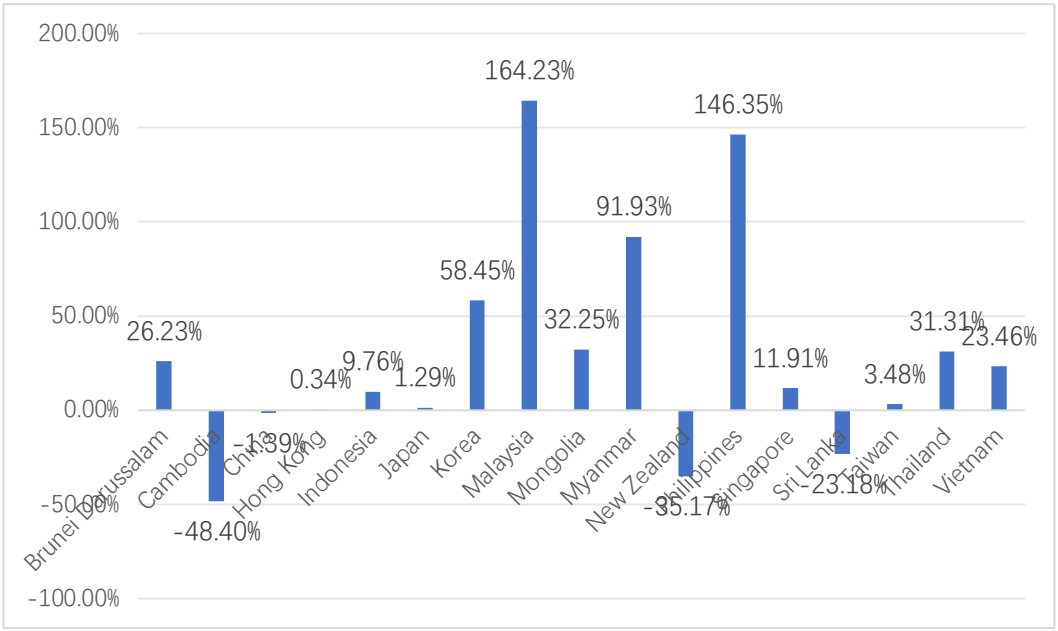

Figure 1: Increasing rate of pacemaker implantation in 2022 as compared with 2021

3.2 Pacemaker implantation rate

As shown in Table 1, data in 2022 were analyzed by evaluating pacemaker implantation rates. Across the 17 countries or regions, the pacemaker implantation rate per million inhabitants

showed similar trend to that in last year with the highest reported implantation rate in Japan (552.93) and New Zealand (325.8) and the lowest in Cambodia(6.7). The pacemaker implantation rates per million inhabitants were also low in Mongolia(10.56),Philippines (11.14) and Myanmar (17.17). The large gap in the number of pacemaker implanting center per million inhabitants still remained among the 17 countries and regions.

In 2022, Taiwan CN remianed as the top region where had the same highest implanting centers per million inhabitants (9.80), while the second with high pacemaker implanting centers per million inhabitants were Brunei(4.4) and Indonesia(3.44). Other countries remained similar level to that in 2021. Although the reported data in 2022 did not differ significantly from that in 2021, our analysis still found a significant change as compared with several years before. One major difference from last year is that pacemaker implantation rate was shown an increased trend in most of Asia-Pacific countries and regions. Other data provided similar information. For example, China and Japan are still the countries that had the highest total number of pacemaker implantations in 2022.

3. ICD and Cardiac Resynchronization Therapy devices (CRT)

3.1 The implantation of ICD in 2022

Similar to data last year, the increasing trend of implantation of ICD was observed in 17 APHRS countries and regions in 2022 as compared with 2021 (Figure 2). Most Asia-Pacific countries and region kept an increasing trend in ICD implantation. Japan, China and South Korea are the three countries that had the highest total number of pacemaker implantations in 2022. The countries with the increase rates of ICD implant more than 50% in 2022 were Malaysia(289.32%) ,Myanmar (100.00%) and Philippines(85.71%).China had an increasing trend of 2.41% in ICD implantation. The ICD implantation was still rare in some Asia-Pacific countries like Mongolia (none) and Cambodia (1 case).

We also analyzed the data on ICD primary or secondary prevention from 8 countries and regions: Brunei Darussalam,Cambodia,China PR,Indonesia,Malaysia,New Zealand,Singapore and Taiwan.The use of ICD for primary prevention in Singapore and Brunei Darussalam were higher than 50% (61.4% and 55.2%, respectively). China PR,Indonesia and Malaysia had a primary prevention ratio of ICD more than 30% (40.4%, 39.3% and 37.9%,respectively). Singapore was the country having the highest ratio of primary prevention in Asia-Pacific countries and regions (61.4%).

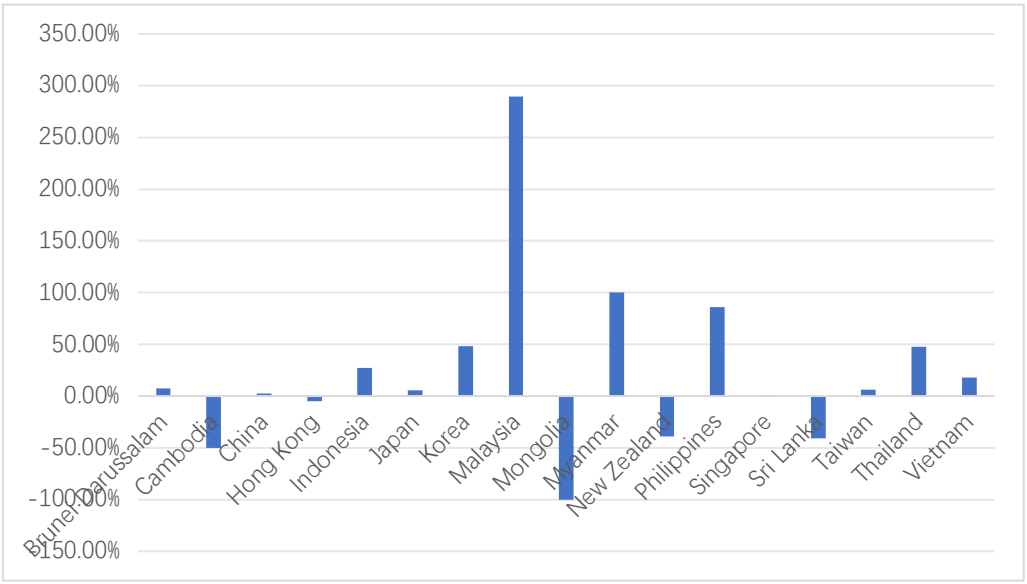

Figure 2: Increasing rate of ICD implantation in 2022 as compared with 2021

3.2 ICD implantation rate

As shown in table 1, New Zealand was still the country with highest reported ICD implantation rate per million inhabitants (71.6),Singapore (64.75), Brunei(64.0) and Japan (51.44) were the other countries with high ICD implants/million. Some countries kept increasing ICD implants/million, including Hong Kong (42.82),Taiwan (37.01), South Korea(32.68), and Thailand(19.89). Countries with low ICD implants/million were Mongolia(0),Cambodia(0.06)
Myanmar (0.56) and Philippines 0.67). The available data also showed a large gap among the 17 countries and regions in the number of ICD implanting center per million inhabitants. In 2022data, the countries with more than 1 ICD implanting centers per million inhabitants were Brunei (4.46), Taiwan (3.1), New Zealand (1.8), and Singapore (1.06). The other countries and regions with less than 1 implanting centers per million inhabitants included Sri Lank(0.41), Thailand(0.41),Vietnam(0.20),Malaysia(0.19),Myanmar(0.07),Indonesia(0.06),Mongolia(0.03)and Cambodia(0)..

3.3 CRT utilization in Asia-Pacific area

In 2022,we had data on CRT implantation from 17 Asia-Pacific countries and regions (Figure 3). The rising trend in CRT implantation remains in 13 among the data from 17 countries and regions, there were 4 countries and regions which showed decreased CRT implantation.

In 2022, the countries with total number of CRTs implantation more than 1000 were Japan (6160) and Mainland China (5563) and those with CRT implantation between 100 and 1000 were Thailand(539),Korea(502),Taiwan(335),Malaysia(253),Hong Kong(200),Singapore(191) and New Zealand(167).. The countries with the increase rates of CRT implant more than 10% in 2022 were

Malaysia(301.59%),Myanmar(200.00%),Philippines(135.71%),Sri Lanka (102.86%) ,Mongolia (100.00%),Thailand(35.09%),Korea(22.74%),Vietnam(11.76%) and Singapore(11.05%)., And the countries and regions with an increase below 10% included Hong Kong(8.70%), Taiwan(4.36%), China(3.43%) and Japan(0.36%).In contrast, 5 countries and region presented as decrease in CRT implantation, including Indonesia(-6.25%),New Zealand (-50.74%), Brunei Darussalam(-55.56%) and Cambodia(-100.00%).. The total number of CRT implant was also relatively low in 3 countries and regions, including Brunei Darussalam(8),Myanmar(3)and Cambodia(0),, although some of them had been demonstrated as an increasing trend.

The CRT implantation rate per million inhabitants in 2022 seemed to be increased as compared to last year. However, still a great heterogeneity was seen similar to last year, from as low as 0.06-0.96/million (Myanmar,Philippines,Mongolia and Vietnam) to as high as 44.44 in Japan, and 33.88 in Singapore,33.4/million in New Zealand, 27.27 in Hong Kong. The increasing trend continued was seen in the CRT implantation rate per million inhabitants in most Asia-Pacific countries and regions, including Japan (from 37.8 in 2021 to 40.7 in 2022), Singapore (from 32.6 in 2021 to 36.3 in 2022), South Korea (from 5.3 in 2021 to 6.9 in 2022), and there was a slightly decreasing trend in Hong Kong (from 23.9 in 2021 to 21.9 in 2022), Malaysia (from 5.5 in 2021 to 4.9 in 2022).

There was also significant variability in the ratio of CRT-D/CRT-P implants. The number of “CRT implant centers” in 16 countries and regions were analyzed. 10 out of 16 Asia-Pacific countries and regions were with more than 50% CRT-D implantation rate, in which Brunei Darussalam were shown with the highest CRT-D/total CRT ratio (87.50%).CRT-D implantation rate above 50% were shown in other 10 countries and regions, including Korea()84.66%, Singapore(82.20%)Philippines(81.82%),Thailand(79.96%),China(79.76%),Hong Kong(78.50%),Japan(67.37%),Myanmar(66.67%) and Malaysia(60.87%). However, CRT-D implant rate was less than 30% in Taiwan(28.36%),Sri Lanka(19.72%) and Mongolia(0).

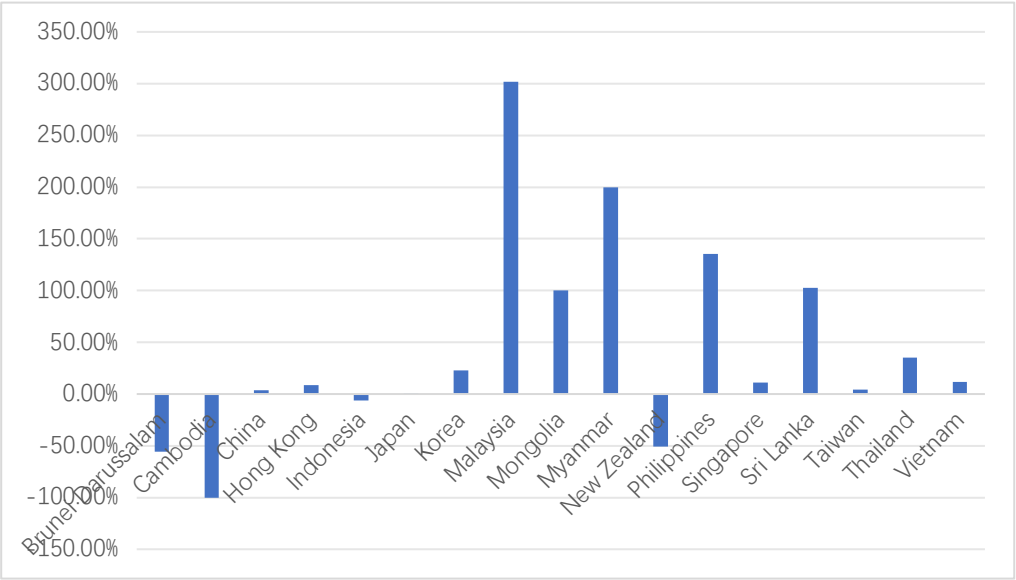

Figure 3: Increasing rate of CRT implantation in 2021 as compared with 2021

4 Catheter Ablation

4.1 General information of Catheter Ablation

We received data about catheter ablation from 17 countries and regions in 2022. China mainland was still the country having the highest cases receiving catheter ablations (203984). Japan was the other countries with high cases of 109008. And South Korea was the third country with cases more than 10000(10453).The ablation procedures in other 12 countries and regions were less than 10000. An increasing trend was observed in ablation procedures across 9 countries. Malaysia and Myanmar were the countries with the highest ablation increasing rate (201.38%, and 178.04% respectively). Mongolia, Sri Lanka, Indonesia, Thailand, the Philippines and Taiwan Province showed an increasing trend, with growth rates of 59.29%, 42.47%, 39.73%, 28.40%, 23.68% and 19.41% respectively.The scale of radiofrequency ablation in Japan, Singapore, hina, Hong Kong, New Zealand and Korea tends to be stable, with the change rates of 6.06%, -0.34%, -3.15%, -3.75%, -4.05% and -9.53% respectively.In contrast, Brunei Darussalam and Cambodia showed a significant decreasing trend, with the decreasing rates of -17.65% and -40.00% respectively.

4.2 Ablation procedure rates

Table 2 is shown the ablation procedures per million inhabitants in 17 countries and regions. Japan was the country which continued having increasing ablation procedures per million inhabitants, from 819.0 in 2021, and then to 870.67 in 2022. Countries having more than one hundred ablation procedures per million inhabitants included PR. China(144.46),Brunei(186.67)

Hong Kong(119.59),South Korea(202.72),New Zealand(265.4),Singapore(155.05) and Taiwan CN (269.68).Philippines(1.22),Cambodia(4.47) and Indonesia 5.97had the lowest ablation procedures per million inhabitants. Regarding ablation centers per million inhabitants in 2022, the highest density was remained in Japan (3.91) and the lowest in Myanmar (0.019) and Philippines (0.03).

4.3 Atrial fibrillation (AF) catheter ablation

We had the data of AF ablation from 15 countries and regions this year. In 2019, AF ablation procedures increased almost in all countries. Japan was still the country with the highest number of AF ablation procedures (81750 cases). As shown in Table 2, the AF ablation rate per million inhabitants was increased from 466.4 to 870.67 in Japan, which was the highest among APHRS member countries and regions. Philippines (0.24) ,Indonesia(0.51) and Thailand (0.57) were the countries with the lowest AF ablation rate. Regarding the ratio of AF ablation/total ablation, there was also a large gap among 17 countries and regions, with highest ratio of AF ablation/total ablation in Japan (74.99%), and lowest AF ablation ratio in Mongolia (2.78%). And the AF ablation ratio was 40.57% in China,43.75% inBrunei,8.57% in Indonesia, 18.57% in Malaysia, 2.78% in Mongolia, 40.99%in New Zealand, 19.86% in Philippines, 23.0% in Singapore, 66.88% in South Korea, 26.44% in Taiwan, 9.68% in Thailand, and 4.68% in Vietnam.

5 Conclusion and future work

After collecting data from 17 APHRS countries and regions, the new APHRS white paper has made important achievements. However, there is still a problem that some data cannot be obtained. According to the preliminary analysis of the existing data, we found that interventional therapy for arrhythmia showed an obvious growth trend in most Asia-Pacific countries and regions. However, it must be admitted that there is a clear gap between Asian countries and western countries in terms of treatment level. At the same time, it is not difficult to see from the data that there are significant inequalities in interventional therapy of arrhythmia in countries in the Asia-Pacific region. In order to promote the development of interventional therapy for arrhythmia, we urgently need to strengthen supervision, carry out cardiac education and training, and formulate and implement relevant guidelines. To this end, the White Paper of the Asia-Pacific Forum for Human Rights calls on all member countries in the Asia-Pacific region to actively participate and provide necessary support. We expect that the APHRS white paper will encourage countries to adopt a systematic approach to collect and process the key data of arrhythmia treatment in the future.

Table 1. The CIEDs implantation rates and implanting centers per million inhabitants for the year 2022 in 17 Asia-Pacific countries and regions

Countries and regions	Pacemaker implantation rate/ million inhabitants	Pacemaker implanting centers / million	ICD implantation rate/ million inhabitants	CRT implantation rate/ million inhabitants	ICD/CRT implanting centers / million
PR. China	79.09	1.76	5.79	4.22	0.3
Brunei	170.0	4.4	64.0	17.7	4.4
Cambodia	6.7	0.4	0.06	No data	No data
Hong Kong CN	283.6	No data	42.82	27.27	No data
India	待定				
Indonesia	53.4	3.44	3.05	2.18	1.45
Japan	552.93	No data	51.44	44.44	No data
South Korea	158.34	No data	32.68	9.74	No data
Malaysia	37.43	1.35	10.64	6.71	0.73
Mongolia	10.56	No data	0	0.35	0.03
Myanmar	17.17	0.22	0.56	0.06	0.19
New Zealand	325.8	1.2	71.6	33.4	2.0
Pakistan	24.2	0.2	2.05	2.05	No data
Philippines	11.14	No data	0.67	0.29	No data
Singapore	189.99	1.06	64.75	33.88	2.13
Sri Lanka	68.48	0.68	7.71	3.24	0.82
Taiwan CN	313.05	9.80	37.01	14.40	8.81
Thailand	76.67	0.41	19.89	8.17	0.82
Vietnam	41.79	0.51	2.57	0.96	0.41

Table 2 The ablation procedure rate and centers per million inhabitants for the year 2022 in 17 Asia-Pacific countries and regions

Countries and regions	Ablation procedure rate/ million inhabitants	Ablation centers/ million inhabitants	AF ablation rate/ million inhabitants	AF ablation centers/ million inhabitants	AF ablation/ ablation procedure
PR. China	144.46	1.30	58.61	0.31	40.57%
Brunei	186.67	2.22	62.22	2.22	43.75%
Cambodia	4.47	0.18	No data	No data	No data
Hong Kong	119.59	No data	No data	No data	No data
India	4.5	0.06	0.26	0.03	7.7%
Indonesia	5.97	0.10	0.51	0.07	8.57%
Japan	870.67	4.02	652.96	3.91	74.99%
South Korea	202.72	1.16	135.58	0.87	66.88%
Malaysia	46.29	0.19	8.59	0.16	18.57%
Mongolia	52.02	0.58	1.45	0.58	2.78%
Myanmar	15.24	0.11	No data	0.019	No data
New Zealand	265.4	1	108.8	1	40.99%
Pakistan	170.7	0.53	34.2	0.35	20.3%
Philippines	1.22	0.06	0.24	0.03	19.86%
Singapore	155.05	0.53	35.66	0.35	23.0%
Sri Lanka	31.07	0.23	No data	No data	No data
Taiwan CN	269.68	1.63	71.71	1.33	26.44%
Thailand	46.17	0.41	0.57	0.23	9.68%
Vietnam	51.54	24.13	2.41	9.05	4.68%