

## **Preface**

The APHRS was founded in 2008 with the goal to promote the care, education, and research in heart rhythm disorders in Asia-Pacific countries. 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 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 Seventh Edition of the APHRS White Book is much extended. This new edition comprises data from 19 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 voluntarily contributed important data from their countries.



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Chu-Pak LAU  
President of APHRS (2019)

## **Acknowledgements**

As a member of APHRS and the chief editor of this book, I would like to express my great appreciation for all who made possible the publication of the Seventh edition of the APHRS White Book. I owe particular thanks to the current president of APHRS, Professor Chu-Pak LAU, who led the preparation of this edition of the APHRS White Book. I would like to thank our board members for their great support of this work.

My deep gratitude also goes to all contributors, the national Societies of Pacing and Electrophysiology and the national Heart Rhythm Societies of 19 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 Clarinda Lim, and the secretary of APHRS, who helped collect data from member countries and regions. Finally, I would like to express my appreciation for the members of my working group, Dr. Xiaohan Fan and 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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Shu Zhang, MD, PhD, FHRS, FESC  
Chief Editor of the APHRS White Book 2019

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## **List of Contributors and Authors**

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Brunei Darussalam	Sofian Johar
Cambodia	Chandara Mam
Hong Kong	Ngai-Yin Chan
India	Ajay Naik, Anil Saxena
Islamic Republic of Pakistan	Zahid Aslam Awan
Japan	Akihiko Nogami, Yoshinori Kobayashi
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New Zealand	Dean Boddington
People's Republic of China	Shu Zhang, Xiaohan Fan, Na Lin
Republic of Indonesia	Yoga Yuniadi, Dicky A. Hanafy
Republic of Korea	Yong Seog Oh, Hui-Nam Pak, Young-Hoon Kim
Republic of Philippines	Giselle Gervacio, Jhobeleen de Leon
Republic of Singapore	Ching Chi Keong
Sri Lanka	Rohan Gunawardhane
Taiwan	Hsuan-Ming Tsao, Yung-Kuo Lin, Chun-Chieh Wang
Vietnam	Pham Tran Linh

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## Country/Region: **PR.China**

### 1. Statistics

	2015	2016	2017	2018
Population(thousand) <sup>1</sup>	1367820	1382710	1390080	1395380
Hospitals	25906	27587	31056	33009
Beds(per 100,000 population) <sup>1</sup>	511.00	536.80	572.20	572.20
Physicians(per 1,000 population) <sup>1</sup>	1.74	2.21	2.21	2.40
Nurses(per 1,000 population) <sup>1</sup>	2.20	2.36	2.36	2.70
GDP (US\$, billions) <sup>3</sup>	10,982.829	11,218.281	13173.585	134572.67
Total expenditure on health as % GDP <sup>2</sup>	5.55%	6.0%	6.2%	6.2%
Government expenditure on health as %	30.0%	30.88%	30.88%	30.88%
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

<sup>1</sup> [www.stats.gov.cn](http://www.stats.gov.cn)

<sup>2</sup> [www.who.int](http://www.who.int)

<sup>3</sup> [www.imf.org](http://www.imf.org)

### 2. Pacemaker

	2015	2016	2017	2018
Total Pacemakers	65785	73080	76717	82779
New implants	57683	62508	63312	68660
Replacements	8102	10572	13405	14119
Single-chamber	20393	21066	20762	20853
Dual-chamber	45392	51588	55955	61926
Sick sinus syndrome	26253	37202	38791	40008
AV block	21177	29107	31122	34938
Implanting Centers	955	995	1055	1066
Implanting Physicians	3000	3000	3000	3000
National Registry	☑	☑	☑	☑



### 3. Cardiac resynchronization therapy

	2015	2016	2017	2018
Total CRTs	3092	3560	4138	4432
CRT-P	1330	1426	1633	1724
CRT-P new implants	1052	1095	1135	
CRT-P replacements/upgrade	278	331	498	
CRT-D	1762	2078	2505	2708
CRT-D new implants	1456	1609	1993	
CRT-D replacements/upgrade	306	469	512	
Ischemic	866	1188	1319	1460
Non-ischemic	2226	2372	2819	2972
Implanting Centers	374	396	403	410
Implanting Physicians	3000	3000	3000	3000
National Registry	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

### 4. Implantable cardioverter defibrillator

	2015	2016	2017	2018
Total ICDs	2851	3317	4092	4471
ICD new implants	2601	2986	3541	3897
ICD replacements	250	331	551	574
Single-chamber	1939	2183	2550	2739
Dual-chamber	912	1134	1542	1732
Primary prevention	1197	1693	1821	2129
Secondary prevention	1654	1624	2271	2342
Implanting Centers	363	408	433	459
Implanting Physicians	3000	3000	3000	3000
National Registry	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

## 5. Interventional electrophysiology

	2015	2016	2017	2018
Ablation procedures	117021	132504	133897	151595
SVT ablation procedures	53176	73702	80809	76971
AVNRT	26916	36708	40874	38754
AVRT/WPW	20383	28318	28885	26447
AFL (RA isthmus dependent)	3074	4734	5903	6428
AT	2803	3942	5147	5342
VT/VPC	-	-	-	
Idiopathic	-	-	-	
Structural	-	-	-	
AF ablation procedures	24545	30574	36615	48317
Ablation centers	759	805	863	886
AF ablation centers	341	383	420	429
Structural VT ablation centers	-	-	-	
Ablation physicians	-	-	2000	2000
AF ablation physicians	-	-	-	
Structural VT ablation physicians	-	-	-	
National Registry	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

## 6. Management

National certification for physicians	<input type="checkbox"/> PM	<input type="checkbox"/> CRT	<input type="checkbox"/> ICD	<input type="checkbox"/> Ablation
National accreditation for centers	<input type="checkbox"/> PM	<input type="checkbox"/> CRT	<input type="checkbox"/> ICD	<input type="checkbox"/> Ablation
Guidelines followed	<input type="checkbox"/> National	<input type="checkbox"/> U.S.	<input type="checkbox"/> Europe	<input type="checkbox"/> 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	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Lack of reimbursement, limited financial resources	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Lack of referral	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Lack of trained personnel	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Low awareness of guidelines	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Lack of operators	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

## 7. Source

**Chinese Society of Pacing and Electrophysiology (CSPE)**

## Country/Region: Brunei Darussalam

### 1. Statistics

	2015	2016	2017	2018
Population (thousand) <sup>1</sup>	417	420	421	442
Hospitals	6	6	6	6
Beds	1143*	1165*	1224*	
Physicians	739	739	683	
Nurses	2756	2742	2713	
GDP (US\$, billions)	12.8	11.4	12.1	13.5
Total expenditure on health as % GDP	2.17	2.22		
Government expenditure on health (US\$)	278,000,000	259,000,000	234,000,000	
Insured citizens (%)	-	-		
SCD patients	-	-		
Heart failure patients	-	-		
AF patients	-	-		

\* includes beds in Ministry of Health facilities only

### 2. Pacemaker

	2015	2016	2017	2018
Total Pacemakers	69	65	52	75
New implants	55	52	41	67
Replacements	14	13	11	8
Single-chamber	11	17	12	27
Dual-chamber	58	48	40	48
Sick sinus syndrome	-	-	-	
AV block	-	-	-	
Implanting Centers	2	2	2	2
Implanting Physicians	5	5	5	5
National Registry	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

	2015	2016	2017	2018
SSS	41	43	24	45
AVN	24	20	26	21
Bi Nodal	4	2	2	7
Others				2

### 3. Cardiac resynchronization therapy

	2015	2016	2017	2018
Total CRTs	16	14	16	13
CRT-P	2	0	6	4
CRT-P new implants	2	0	2	0
CRT-P replacements/upgrade	0	0	4	4
CRT-D	14	14	10	9
CRT-D new implants	6	5	5	5
CRT-D replacements/upgrade	8	9	5	4
Ischemic	2	7	3	7
Non-ischemic	12	7	7	2
Implanting Centers	2	2	2	2
Implanting Physicians	2	2	5	2
National Registry	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

\*exclude CRT-P for ischemic & non ischemic.

### 4. Implantable cardioverter defibrillator

	2015	2016	2017	2018
Total ICDs	26	14	18	31
ICD new implants	23	13	14	30
ICD replacements	3	1	4	1
Single-chamber	2	0	3	2
Dual-chamber	24	14	15	29
Primary prevention	12	10	16	23
Secondary prevention	14	4	2	7
Implanting Centers	2	2	2	2
Implanting Physicians	5	5	5	5
National Registry	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

## 5. Lead Extraction

### Lead extractions procedures and number of centers that performed lead extraction

	2015	2016	2017	2018
Total lead extraction procedures	4	0	3	6
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	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

## 6. Interventional electrophysiology

	2015	2016	2017	2018
Ablation procedures	103	109	103	149
SVT ablation procedures	24	26	32	29
AVNRT	13	14	19	21
AVRT/WPW	3	6	4	8
AFL(RA isthmus dependent)	4	5	1	9
AT	-	5	8	3
VT/VPC	-	4	15	7
Idiopathic	-		9	3
Structural	-		6	4
AF ablation procedures	79	52	56	59
Ablation centers	-	-	-	-
AF ablation centers	1	1	1	1
Structural VT ablation centers	1	1	1	1
Ablation physicians	-	-	-	-
AF ablation physicians	2	2	2	2
Structural VT ablation physicians	1	1	1	1
National Registry	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

## 7. Management

National certification for physicians	<input type="checkbox"/> PM	<input type="checkbox"/> CRT	<input type="checkbox"/> ICD	<input type="checkbox"/>
National accreditation for centers	<input type="checkbox"/> PM	<input type="checkbox"/> CRT	<input type="checkbox"/> ICD	<input type="checkbox"/>
				Ablation
				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	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Lack of reimbursement, limited financial resources	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Lack of referral	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Lack of trained personnel	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Low awareness of guidelines	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Lack of operators	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

**8. Source**

**Name of national working group or arrhythmia body**

**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

	2015	2016	2017	2018
Population(thousand) <sup>1</sup>	15,577.899	15,827.241	16245.729	
Hospitals	-	-		
Beds	-	-		
Physicians	-	-		
Nurses	-	-		
GDP (US\$, billions)	-	-	1307	
Total expenditure on health as % GDP	-	-		
Government expenditure on health (US\$)	-	-		
Insured citizens (%)	-	-		
SCD patients	-	-		
Heart failure patients	-	-		
AF patients	-	-		

1. [www.census.gov](http://www.census.gov)

### 2. Pacemaker

	2015	2016	2017	2018
Total Pacemakers	161	211	212	218
New implants	155	202	200	198
Replacements	6	9	12	14
Single-chamber	81	95	93	98
Dual-chamber	74	107	119	106
Sick sinus syndrome	69	95	93	100
AV block	86	107	119	118
Implanting Centers	1	2	3	4
Implanting Physicians	1	1	3	7
National Registry	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	



### 3. Cardiac resynchronization therapy

	2015	2016	2017	2018
Total CRTs	2	3	4	
CRT-P	2	2	1	
CRT-P new implants	-	-	1	
CRT-P replacements/upgrade	-	1	0	
CRT-D	-	1	3	
CRT-D new implants	-	1	3	
CRT-D replacements/upgrade	-	-	0	
Ischemic	-	-	0	
Non-ischemic	-	-	3	
Implanting Centers	1	2	3	
Implanting Physicians	1	1	3	
National Registry	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

### 4. Implantable cardioverter defibrillator

	2015	2016	2017	2018
Total ICDs	4	4	5	2
ICD new implants	4	4	5	2
ICD replacements	-	-	0	
Single-chamber	2	2	1	
Dual-chamber	2	2	4	2
Primary prevention	-	-	-	
Secondary prevention	4	4	5	2
Implanting Centers	1	1	3	1
Implanting Physicians	1	1	3	1
National Registry	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

### 5. Lead Extraction

**Lead extractions procedures and number of centers that performed lead extraction**

	2015	2016	2017	2018
Total lead extraction procedures			1	1

Hospitals performed lead extraction			1	1
Cardiologists performing lead extraction			1	1
Surgeons performing lead extraction			0	
National Registry	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

## 6. Interventional electrophysiology

	2015	2016	2017	2018
Ablation procedures	152	185	192	201
SVT ablation procedures				
AVNRT	32	42	43	55
AVRT/WPW	0	0	7	45
AFL(RA isthmus dependent)	35	60	58	42
AT	59	59	54	28
VT/VPC	0	0	30	31
Idiopathic	26	24	30	20
Structural	0	0	0	
AF ablation procedures	0	1	0	
Ablation centers	-	-	0	1
AF ablation centers	1	1	0	
Structural VT ablation centers	-	-	0	
Ablation physicians	1	1	1	2
AF ablation physicians	-	-	0	
Structural VT ablation physicians	-	-	0	
National Registry	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

## 7. Management

National certification for physicians	<input type="checkbox"/> PM	<input type="checkbox"/> CRT	<input type="checkbox"/> ICD	<input type="checkbox"/> Ablation
National accreditation for centers	<input type="checkbox"/> PM	<input type="checkbox"/> CRT	<input type="checkbox"/> ICD	<input type="checkbox"/> Ablation
Guidelines followed	<input type="checkbox"/> National	<input type="checkbox"/> U.S.	<input type="checkbox"/> Europe	<input type="checkbox"/> AP

Payment (%)	Pacemaker	ICD	CRT	Ablation
Government	Some			Some

Insurance				
Public insurance				
Private insurance	some	some		
Individual	ok	ok	ok	Ok

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

	1	2	3	4	5
Lack of centers	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	✓	<input type="checkbox"/>
Lack of reimbursement, limited financial resources	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	✓	<input type="checkbox"/>
Lack of referral	<input type="checkbox"/>	<input type="checkbox"/>	✓	<input type="checkbox"/>	<input type="checkbox"/>
Lack of trained personnel	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	✓	<input type="checkbox"/>
Low awareness of guidelines	<input type="checkbox"/>	<input type="checkbox"/>	✓	<input type="checkbox"/>	<input type="checkbox"/>
Lack of operators	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	✓	<input type="checkbox"/>

**8. Source**

**Name of national working group or arrhythmia bod**

## Country/Region: Hong Kong SAR

### 1. Statistics

	2015	2016	2017	2018
Population (thousand) <sup>1</sup>	7,324	7,375	7392	7,482.5
Hospitals	53	53	54	55
Beds	38,287	39,090	39683	40,434
Physicians	13,726	14,013	14290	14,651
Nurses	37,670	39,178	40505	42,485
GDP (US\$, billions)	307.3	308.28	341.15	364.82
Total expenditure on health as % GDP	2.95%	3.23%	2.33%	2.99%
Government expenditure on health (US\$)	9,051 mil	9,949 mil	7936mil	10,924mil
Insured citizens (%)	-	-		
SCD patients	-	-		
Heart failure patients	-	-		
AF patients	-	-		

<sup>2</sup>, [www.census.gov](http://www.census.gov)

### 2. Pacemaker

	2015	2016	2017	2018
Total Pacemakers	695	752	1513	1958
New implants	594	625	1191	
Replacements	101	127	322	
Single-chamber	-	-	-	
Dual-chamber	-	-	-	
Sick sinus syndrome	-	-	-	
AV block	-	-	-	
Implanting Centers	-	-	-	
Implanting Physicians	-	-	-	
National Registry	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

### 3. Cardiac resynchronization therapy

	2015	2016	2017	2018
Total CRTs	-	-	-	179
CRT-P	-	-	-	71
CRT-P new implants	-	-	-	
CRT-P replacements/upgrade	-	-	-	
CRT-D	-	-	-	108
CRT-D new implants	-	-	-	
CRT-D replacements/upgrade	-	-	-	
Ischemic	-	-	-	
Non-ischemic	-	-	-	
Implanting Centers	-	-	-	
Implanting Physicians	-	-	-	
National Registry	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

### 4. Implantable cardioverter defibrillator

	2015	2016	2017	2018
Total ICDs	102	174	142	268
ICD new implants	60	99	83	
ICD replacements	42	75	59	
Single-chamber	-	-	-	
Dual-chamber	-	-	-	
Primary prevention	-	-	-	
Secondary prevention	-	-	-	
Implanting Centers	-	-	-	
Implanting Physicians	-	-	-	
National Registry	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

### 5. Lead Extraction

#### Lead extractions procedures and number of centers that performed lead extraction

	2015	2016	2017	2018
Total lead extraction procedures	-	-	-	
Hospitals performed lead extraction	-	-	-	

Cardiologists performing lead extraction	-	-	-	
Surgeons performing lead extraction	-	-	-	
National Registry	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

## 6. Interventional electrophysiology

	2015	2016	2017	2018
Ablation procedures	-	-	-	
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	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

## 7. Management

National certification for physicians	<input type="checkbox"/> PM	<input type="checkbox"/> CRT	<input type="checkbox"/> ICD	<input type="checkbox"/> Ablation
National accreditation for centers	<input type="checkbox"/> PM	<input type="checkbox"/> CRT	<input type="checkbox"/> ICD	<input type="checkbox"/> Ablation
Guidelines followed	<input type="checkbox"/> National	<input type="checkbox"/> U.S.	<input type="checkbox"/> Europe	<input type="checkbox"/> 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	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Lack of reimbursement, limited financial resources	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Lack of referral	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Lack of trained personnel	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Low awareness of guidelines	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Lack of operators	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

## 8. Source

**Name of national working group or arrhythmia body**

## Country/Region: India

### 1. Statistics

	2015	2016	2017	2018
Population (bn)	1.311	1.326	1.342	1.354
Urban Hospitals (Govt. only)	-	-	-	8812
Beds (Govt. only)	-	-	-	1013017
Physicians	-	-	-	-
Nurses	-	-	-	-
GDP (US\$ - billion)	-	2,250	2597	2716
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
Government expenditure on health as %	-	-	-	1.02
Insured citizens (in Millions)	-	-	-	482
SCD patients <sup>i1</sup> (in Thousands)	-	NA	-	202
Heart failure patients <sup>ii</sup> (in Millions)	-	~8–10mn	-	1.145
AF patients (million)	-	-	-	4.26

### 2. Pacemaker

1<sup>•</sup> <http://www.worldometers.info/world-population/india-population/>

2<sup>•</sup> <https://data.gov.in/catalog/number-government-hospitals-and-beds-rural-and-urban-areas>

3<sup>•</sup> <http://statisticstimes.com/economy/gdp-of-india.php>.

4<sup>•</sup> <https://www.ihs.com/country-industry-forecasting.html?ID=1065985237>

5<sup>•</sup> [http://www.japi.org/december\\_2014/006\\_ra\\_sudden\\_cardiac\\_death.pdf](http://www.japi.org/december_2014/006_ra_sudden_cardiac_death.pdf).

6<sup>•</sup> <http://csiheartfailure2015.org/>



	2015	2016	2017	2018
Total Pacemakers	31230	35794	38700	44700
New implants	70%	75%	70%	70%
Replacements	30%	25%	30%	30%
Single-chamber	17066	19440	22200	25100
Dual-chamber	14161	16354	16500	19600
Sick sinus syndrome <sup>iii</sup>	20%	25%	20%	20%
AV block	80%	75%	80%	80%
Implanting Centers	945	970	1120	1120
Implanting Physicians	1540	1560	1560	1560
National Registry	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	0

### 3. Cardiac resynchronization therapy

	2015	2016	2017	2018
Total CRTs	2147	2728	2500	3000
CRT-P	784	944	1000	1200
CRT-P new implants	88%	88%	80%	88%
CRT-P replacements/upgrade	12%	12%	20%	12%
CRT-D	1363	1784	1500	1800
CRT-D new implants	85%	82%	75%	82%
CRT-D replacements/upgrade	15%	18%	25%	18%
Ischemic	-	-		40%
Non-ischemic	-	-		60%
Implanting Centers	315	345	345	345
Implanting Physicians	380	395	395	395
National Registry	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	1

### 4. Implantable cardioverter defibrillator

	2015	2016	2017	2018
Total ICDs	3061	3664	3500	4100
ICD new implants	-	85%	75%	85%
ICD replacements	-	15%	25%	15%
Single-chamber	1907	2464	2300	2800

Dual-chamber	1154	1200	1200	1300
Primary prevention	30%	40%	20%	20%
Secondary prevention	70%	60%	80%	80%
Implanting Centers	355	~380	400	400
Implanting Physicians	484	500	515	515
National Registry	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	1

## 5. Lead Extraction

### Lead extractions procedures and number of centers that performed lead extraction

	2015	2016	2017	2018
Total lead extraction procedures	-	-	-	170
Hospitals performed lead extraction	-	-	-	26
Cardiologists performing lead extraction	-	-	-	84
Surgeons performing lead extraction	-	-	-	8
National Registry	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	0

## 6. Interventional electrophysiology

	2015	2016	2017	2018 (Incomplete data, obtained only from a few centers)
Ablation procedures	19370	22900		7910
SVT ablation procedures	12033	14400		6642
AVNRT	5846	7500		4066
AVRT/WPW	4125	5000		2152
AFL (RA isthmus dependent)	813	900		424
AT	1249	1000		456
VT/VPC	6035	7100		1025
Idiopathic	1998	3000		618
Structural	4037	4100		407
AF ablation procedures	1303	1400		215
Ablation centers	160	176		66
AF ablation centers	28	30		29

Structural VT ablation centers	89	93		21
Ablation physicians	109	135		54
AF ablation physicians	40	41		31
Structural VT ablation physicians	72	83		35
National Registry	<input type="checkbox"/>	<input type="checkbox"/>		0

## 7. Management

National certification for physicians	<input type="checkbox"/> PM	<input type="checkbox"/> CRT	<input type="checkbox"/> ICD	<input type="checkbox"/> Ablation
National accreditation for centers	<input type="checkbox"/> PM	<input type="checkbox"/> CRT	<input type="checkbox"/> ICD	<input type="checkbox"/> Ablation
Guidelines followed	<input type="checkbox"/> National	√ U.S.	√ Europe	<input type="checkbox"/> AP

Payment (%)	Pacemaker	ICD	CRT	Ablation
Government	25	25	30	15
Insurance	15	15	10	10
Public insurance	10	10	7	7
Private insurance	5	5	3	3
Individual	60	65	60	75%

## 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	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Lack of reimbursement, limited financial resources	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Lack of referral	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Lack of trained personnel	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Low awareness of guidelines	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Lack of operators	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

## 8. Source

Name of national working group or arrhythmia body

**INDIAN HEART RHYTHM SOCIETY**

## Country/Region: Indonesia

### 1. Statistics

	2015	2016	2017	2018
Population (thousand) <sup>1</sup>	255,461	260,580	261,890	265,050
Hospitals <sup>2</sup>	2,406	2,147	2,773	2,813
Beds <sup>2</sup>	269,791	-	353,136	310,710
Physicians <sup>2</sup>	157,393	186,091	192,879	205,597
Nurses <sup>2</sup>	281,111	-	345,276	354,218
GDP (US\$, billions)	861.93	861.9	1,015.53	1,042.17
Total expenditure on health as % GDP	2.8	2.9	3.4	3.3
Government expenditure on health (US\$)	94.49	299	124	124
Insured citizens (%)	78.0	65	72.9	78
SCD patients	-	-	-	-
Heart failure patients	-	-	-	-
AF patients	-	-	-	-

<sup>3</sup> [www.census.gov](http://www.census.gov)

<sup>4</sup> [Ministry of Health Data, 2018](#)

### 2. Pacemaker

	2015	2016	2017	2018
Total Pacemakers	707	1017	1049	1609
New implants	657	972	969	1522
Replacements	50	45	80	87
Single-chamber	405	541	693	1109
Dual-chamber	302	476	356	500
Sick sinus syndrome	393	350	381	555
AV block	314	667	668	1054
Implanting Centers	16	40	65	65
Implanting Physicians	76	86	111	111

National Registry	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
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### 3. Cardiac resynchronization therapy

	2015	2016	2017	2018
Total CRTs	67	81	63	62
CRT-P	32	34	29	31
CRT-P new implants	27	30	21	26
CRT-P replacements/upgrade	4	4	8	5
CRT-D	35	47	34	31
CRT-D new implants	28	41	28	28
CRT-D replacements/upgrade	7	6	6	3
Ischemic	25	38	24	34
Non-ischemic	12	43	39	28
Implanting Centers	16	10	8	12
Implanting Physicians	23	16	15	25
National Registry	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

### 4. Implantable cardioverter defibrillator

	2015	2016	2017	2018
Total ICDs	24	38	45	49
ICD new implants	21	28	38	44
ICD replacements	3	10	7	5
Single-chamber	16	28	40	35
Dual-chamber	8	10	5	14
Primary prevention	2	8	15	9
Secondary prevention	43	30	30	40
Implanting Centers	15	10	11	14
Implanting Physicians	23	20	19	25
National Registry	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

## 5. Lead Extraction

### Lead extractions procedures and number of centers that performed lead extraction

	2015	2016	2017	2018
Total lead extraction procedures	7	7	13	6
Hospitals performed lead extraction	2	5	9	8
Cardiologists performing lead extraction	2	8	17	17
Surgeons performing lead extraction	0	0	2	2
National Registry	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

## 6. Interventional electrophysiology

	2015	2016	2017	2018
Ablation procedures	491	740	760	880
SVT ablation procedures	268	395	343	404
AVNRT	115	190	210	239
AVRT/WPW	107	138	133	165
AFL (RA isthmus dependent)	31	48	18	32
AT	15	19	41	32
VT/VPC	147	268	296	346
Idiopathic	47	247	249	312
Structural	8	21	47	34
AF ablation procedures	65	77	55	67
Ablation centers	9	11	19	16
AF ablation centers	5	6	7	9
Structural VT ablation centers	2	6	7	10
Ablation physicians	22	18	23	24
AF ablation physicians	7	14	18	17
Structural VT ablation physicians	5	10	17	18
National Registry	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

## 7. Management

National certification for physicians	<input checked="" type="checkbox"/> PM	<input checked="" type="checkbox"/> CRT	<input checked="" type="checkbox"/> ICD	<input checked="" type="checkbox"/> Ablation
National accreditation for centers	<input type="checkbox"/> PM	<input type="checkbox"/> CRT	<input type="checkbox"/> ICD	<input checked="" type="checkbox"/> Ablation
Guidelines followed	<input checked="" type="checkbox"/> National	<input type="checkbox"/> U.S.	<input type="checkbox"/> Europe	<input type="checkbox"/> AP

Payment (%)	Pacemaker	ICD	CRT	Ablation
Government	85	90	80	90
Insurance	13	10	15	7
Public insurance	-	-	-	-
Private insurance	-	-	-	-
Individual	2	0	5	3

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

	1	2	3	4	5
Lack of centers	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Lack of reimbursement, limited financial resources	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Lack of referral	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Lack of trained personnel	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Low awareness of guidelines	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Lack of operators	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

## 8. Source

Indonesian Heart Rhythm Society (InaHRS)

## Country/Region: Japan

### 1. Statistics

	2015	2016	2017	2018
Population (thousand) <sup>1</sup>	126990	126933	126706	126496
Hospitals (per 100,000 population)	6.69	6.68	6.62	
Beds	1611026	1559901	1652102	1662567
Physicians (per 1,000 population) <sup>2</sup>	2.39	2.45		
Nurses (per 1,000 population) <sup>2</sup>	8.41	8.56		
GDP (US\$, billions) <sup>3</sup>	4990.57	4758.75.	4884.49	4938,64
Total expenditure on health as % GDP <sup>2</sup>	10.9	10.9	10.9	
Government expenditure on health as % <sup>2</sup>	-	-		
Insured citizens (%)	-	-		
SCD patients	-	-		
Heart failure patients	1254300	1254300		
AF patients	1000000	1000000		

1. <http://www.stat.go.jp/data/jinsui/2.htm#monthly>

2.3. <http://www.mhlw.go.jp/toukei/saikin/hw/iryosd/m15/is1501.html> 8492/1270=

4. <http://www.mhlw.go.jp/toukei/saikin/hw/ishi/12/dl/gaikyo.pdf#search='%E6%97%A5%E6%9C%AC%E3%81%AE%E5%8C%BB%E5%B8%AB%E6%95%B0'> 303268/126990=

5 [http://www.mhlw.go.jp/file/05-Shingikai-10801000-Iseikyoku-](http://www.mhlw.go.jp/file/05-Shingikai-10801000-Iseikyoku-Soumuka/0000072895.pdf#search='%E6%97%A5%E6%9C%AC%E3%81%AE%E7%9C%8B%E8%AD%B7%E5%B8%AB%E6%95%B0')

[Soumuka/0000072895.pdf#search='%E6%97%A5%E6%9C%AC%E3%81%AE%E7%9C%8B%E8%AD%B7%E5%B8%AB%E6%95%B0'](http://www.mhlw.go.jp/file/05-Shingikai-10801000-Iseikyoku-Soumuka/0000072895.pdf#search='%E6%97%A5%E6%9C%AC%E3%81%AE%E7%9C%8B%E8%AD%B7%E5%B8%AB%E6%95%B0') 1067760/126990=

6. <http://www.nikkei.com/biz/report/gdp/5290000000000000/106>

7 <http://www.mhlw.go.jp/toukei/saikin/hw/k-iryohi/13/dl/kekka.pdf>

8 <http://www.chugaiigaku.jp/upfile/browse/browse492.pdf#search='%E5%BF%83%E4%B8%8D%E5%85%A8%E6%82%A3%E8%80%85%E6%95%B0'>

### 2. Pacemaker

	2015	2016	2017	2018
Total Pacemakers	57337	58693	60137	61238
New implants	39292	40318	41895	43495
Replacements	17935	18375	18242	17743
Single-chamber	11109	10928	11734	13209



Dual-chamber	46118	47765	48403	48029
Sick sinus syndrome	-	-		
AV block	-	-		
Implanting Centers	-	-		
Implanting Physicians	-	-		
National Registry	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

### 3. Cardiac resynchronization therapy

	2015	2016	2017	2018
Total CRTs	4575	4722	4782	4778
CRT-P	1167	1188	1213	1330
CRT-P new implants	729	817	922	1041
CRT-P replacements/upgrade	438	371	291	289
CRT-D	3408	3534	3569	3448
CRT-D new implants	2147	2179	2399	2367
CRT-D replacements/upgrade	1261	1355	1170	1081
Ischemic	-	-	-	
Non-ischemic	-	-	-	
Implanting Centers	-	-	-	
Implanting Physicians	-	-	-	
National Registry	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

### 4. Implantable cardioverter defibrillator

	2015	2016	2017	2018
Total ICDs	5780	6367	6691	6772
ICD new implants	3822	4208	4288	4405
ICD replacements	1958	2159	2403	2367
Single-chamber	1345	1627	1931	2039
Dual-chamber	4435	4740	4760	4733
Primary prevention	-	-	-	
Secondary prevention	-	-	-	
Implanting Centers	-	-	-	
Implanting Physicians	-	-	-	
National Registry	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

## 5. Lead Extraction

### Lead extractions procedures and number of centers that performed lead extraction

	2016	2017	2018	
Total lead extraction procedures	524	588	648	
Hospitals performed lead extraction	66	96	106	
Cardiologists performing lead extraction	59	87	100	
Surgeons performing lead extraction	7	9	6	
National Registry	<input type="checkbox"/>	<input type="checkbox"/>	+ (J-LEX)	

## 6. Interventional electrophysiology

	2015	2016	2017	2018
Ablation procedures	63000	65000	75000	80000
SVT ablation procedures	14500	15000	15000	15000
AVNRT	-	-	-	
AVRT/WPW	-	-	-	
AFL (RA isthmus dependent)	-	-	-	
AT	-	-	-	
VT/VPC	5500	6000	6000	6000
Idiopathic	-	-	-	
Structural	-	-	-	
AF ablation procedures	43000	45000	54000	59000
Ablation centers	480	690	700	700
AF ablation centers	400	450	500	500
Structural VT ablation centers	-	-	-	
Ablation physicians	1800	2000	2200	2200
AF ablation physicians	1300	1500	1700	1700
Structural VT ablation physicians	-	-	-	
National Registry	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

## 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	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Lack of reimbursement, limited financial resources	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Lack of referral	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Lack of trained personnel	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Low awareness of guidelines	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Lack of operators	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

## 8. Source

**Name of national working group or arrhythmia body**  
**Japanese Heart Rhythm Society**

## Country/Region: Malaysia

### 1. Statistics

	2015	2016	2017	2018
Population (Thousand)	30, 331.0	31, 700.00	32042.00	32,400.00
Hospitals	145	146	147	148
Beds	42,056	42,100	42200	42400
Physicians	53,132	53,225	53300	53450
Nurses	103,465	104,500	104900	105,000
GDP (RM)	46,812	48, 918	49890	49, 999
Total expenditure on health as % GDP	4.51	4.5	4.5	4.5
Government expenditure on health as %	50.12	50.2	50.2	50.2
Insured citizens (%)	-	-	-	-
SCD patients	-	-	-	-
Heart failure patients	-	-	-	-
AF patients	-	-	-	-

\*Data source: Portal Rasmi, Kementerian Kesihatan Malaysia ([www.moh.gov.my](http://www.moh.gov.my))

### 2. Pacemaker

	2015	2016	2017	2018
Total Pacemakers	755	460	640	755 (PPM), 87 (leadless)

New implants	569	345	516	597
Replacements	186	115	124	166
Single-chamber	299	155	159	252
Dual-chamber	456	305	481	503
Sick sinus syndrome	218	218	290	296
AV block	356	235	350	370
Implanting Centers	38	38	38	38
Implanting Physicians	122	122	122	127
National Registry	☑	☑	☑	☑

### 3. Cardiac resynchronization therapy

	2015	2016	2017	2018
Total CRTs	203	163	171	177
CRT-P	102	53	40	55
CRT-P new implants	68	23	26	33
CRT-P replacements/upgrade	34	30	14	22
CRT-D	101	110	128	122
CRT-D new implants	77	63	93	92
CRT-D replacements/upgrade	24	47	35	30
Ischemic	131	77	72	65
Non-ischemic	72	86	97	106
Implanting Centers	16	16	16	16
Implanting Physicians	31	31	31	31

National Registry	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
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#### 4. Implantable cardioverter defibrillator

	2015	2016	2017	2018
Total ICDs	201	158	213	256
ICD new implants	167	88	183	216
ICD replacements	34	90	30	40
Single-chamber	135	117	154	179
Dual-chamber	66	41	59	76
Primary prevention	65	69	80	91
Secondary prevention	136	89	133	140
Implanting Centers	21	21	21	21
Implanting Physicians	28	28	28	28
National Registry	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

#### 5. Lead Extraction

##### Lead extractions procedures and number of centers that performed lead extraction

	2015	2016	2017	2018
Total lead extraction procedures	16	12	10	12
Hospitals performed lead extraction	3	2	5	7
Cardiologists performing lead extraction	6	6	9	4
Surgeons performing lead extraction	3	5	2	1
National Registry	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

## 6. Interventional electrophysiology

	2015	2016	2017	2018
Ablation procedures	793	664	979	822
SVT ablation procedures	362	443	647	611
AVNRT	226	193	283	233
AVRT/WPW	136	49/63	182	96
AFL (RA isthmus dependent)	86	92	124	90
AT	51	46	49	40
VT/VPC	181	127	232	164
Idiopathic	121	92	86	45
Structural	60	35	137	39
AF ablation procedures	113	94	94	101
Ablation centers	5	5	5	5
AF ablation centers	4	5	5	5
Structural VT ablation centers	2	2	2	2
Ablation physicians	9	5	12	13
AF ablation physicians	6	5	12	13
Structural VT ablation physicians	4	5	12	13
National Registry	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

## 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	80	80	80
Insurance	10	10	10	10
Public insurance				
Private insurance				
Individual	10	10	10	10

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

	1	2	3	4	5
Lack of centers	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Lack of reimbursement, limited financial resources	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Lack of referral	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Lack of trained personnel	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Low awareness of guidelines	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Lack of operators	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>

**6 Data source: UMMC, PPUKM, SGH, QEH2, HRPZII, IJN**



## Country/Region: Mongolia

### 1. Statistics

	2015	2016	2017	2018
Population (thousand) <sup>1</sup>	3,057.8	3027.4	3177.9	3,238.5
Hospitals	13	13	13	13
Beds	21,720	22960	23897	24884
Physicians	9,563	10000	10576	11169
Nurses	11,357	11486	11939	12267
GDP (US\$, billions)	1.18	1.118	1.149	1.301
Total expenditure on health as % GDP	-	-	-	-
Government expenditure on health (US\$)	3,622,815	3808000.0	3592390.4	-
Insured citizens (%)	-	-	-	-
SCD patients	-	-	-	-
Heart failure patients	-	-	-	-
AF patients	-	-	-	-

<sup>5</sup>, [www.census.gov](http://www.census.gov)

### 2. Pacemaker

	2015	2016	2017	2018
Total Pacemakers	113	123	115	166
New implants	93	118	112	153
Replacements	20	5	3	13
Single-chamber	-	-	-	-
Dual-chamber	-	-	-	-
Sick sinus syndrome	-	-	-	-
AV block	-	-	-	-
Implanting Centers	1	1	1	2
Implanting Physicians	1	3	3	5
National Registry	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	none

### 3. Cardiac resynchronization therapy

	2015	2016	2017	2018
Total CRTs	1	3	2	3
CRT-P	1	3	2	3
CRT-P new implants	1	3	2	3
CRT-P replacements/upgrade	-	-	-	-
CRT-D	-	-	-	-
CRT-D new implants	-	-	-	-
CRT-D replacements/upgrade	-	-	-	-
Ischemic	-	-	-	-
Non-ischemic	1	3	2	3
Implanting Centers	1	1	1	1
Implanting Physicians	1	1	1	1
National Registry	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

### 4. Implantable cardioverter defibrillator

	2015	2016	2017	2018
Total ICDs	-	-	2	5
ICD new implants	-	-	2	5
ICD replacements	-	-	-	-
Single-chamber	-	-	2	-
Dual-chamber	-	-	-	5
Primary prevention	-	-	-	-
Secondary prevention	-	-	2	5
Implanting Centers	-	-	1	1
Implanting Physicians	-	-	2	2
National Registry	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

### 5. Lead Extraction

**Lead extractions procedures and number of centers that performed lead extraction**

	2015	2016	2017	2018
Total lead extraction procedures	-	-	-	-

Hospitals performed lead extraction	-	-	-	-
Cardiologists performing lead extraction	-	-	-	-
Surgeons performing lead extraction	-	-	-	-
National Registry	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

## 6. Interventional electrophysiology

	2015	2016	2017	2018
Ablation procedures	-	38	49	74
SVT ablation procedures	-	38	44	70
AVNRT	-	18	20	32
AVRT/WPW	-	20	21	26
AFL(RA isthmus dependent)	-	-	2	5
AT	-	-	3	4
VT/VPC	-	-	3	2
Idiopathic	-	-	3	2
Structural	-	-	-	
AF ablation procedures	-	-	2	4
Ablation centers	-	1	1	1
AF ablation centers	-	1	1	1
Structural VT ablation centers	-	1	1	1
Ablation physicians	-	1	1	2
AF ablation physicians	-	1	1	1
Structural VT ablation physicians	-	1	1	1
National Registry	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

## 7. Management

National certification for physicians	<input type="checkbox"/> PM	<input type="checkbox"/> CRT	<input type="checkbox"/> ICD	<input type="checkbox"/> Ablation
National accreditation for centers	<input type="checkbox"/> PM	<input type="checkbox"/> CRT	<input type="checkbox"/> ICD	<input type="checkbox"/> Ablation
Guidelines followed	<input type="checkbox"/> National	<input type="checkbox"/> U.S.	<input checked="" type="checkbox"/> Europe	<input type="checkbox"/> AP

Payment (%)	Pacemaker	ICD	CRT	Ablation
Government	75%	75%	75%	75%
Insurance				
Public insurance				
Private insurance				
Individual	25%	25%	25%	25%

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

	1	2	3	4	5
Lack of centers	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Lack of reimbursement, limited financial resources	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Lack of referral	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Lack of trained personnel	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Low awareness of guidelines	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Lack of operators	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

## 8. Source

**Name of national working group or arrhythmia body**

*State Third Central Hospital, National Cardiac Center*

*Mongolian Heart Rhythm Society*

## Country/Region: Myanmar

### 1、Statistics

	2016	2017	2018
Population (thousand)	51480	55000	53850
Hospitals (implanting)	8	8	10
Beds	-		
Physicians	-		
Nurses	-		
GDP (US\$, billions)	-	64.33	74
Total expenditure on health as % GDP	-	1.0	
Government expenditure on health as %	-	45.9	
Insured citizens (%)	-		
SCD patients	-		
Heart failure patients	-		
AF patients	-		

### 1. Pacemaker

	2016	2017	2018
Total pacemakers	515	554	648
New implants	495	529	624
Replacements	20	25	24
Single-chamber	474	513	589
Dual-chamber	41	41	59
Sick sinus syndrome	249	273	317
AV block	266	281	331
Implanting Centers	8	8	10
Implanting Physicians	15	18	21
National Registry	<input type="checkbox"/>	<input type="checkbox"/>	

## 2. Cardiac resynchronization therapy

	2016	2017	2018
Total CRTs	4	10	13
CRT-P	2	5	2
CRT-P new implants	2	5	2
CRT-P replacements/ upgrade			-
CRT-D	2	5	11
CRT-D new implants	2		11
CRT-D replacements/upgrade			
Ischaemic	4	9	5
Non-ischaemic		1	8
Implanting Centers	3	4	4
Implanting physicians	3	15	15
National Registry	<input type="checkbox"/>	<input type="checkbox"/>	

## 3. Implantable cardioverter defibrillator

	2016	2017	2018
Total ICDs	21	33	24
ICD new implants	19	32	20
ICD replacements	2	1	4
Single-chamber	17	31	21
Dual-chamber	4	2	3
Primary prevention	5	8	9
Secondary prevention	16	25	15
Implanting Centers	4	4	4
Implanting physicians	4	15	15
National Registry	<input type="checkbox"/>	<input type="checkbox"/>	

## 4. Lead extraction

	2016	2017	2018
Total lead extraction procedure	-	-	-
Hospitals performed lead	-	-	-

extraction			
Cardiologists performing lead extraction	-	-	-
Surgeons performing lead extraction	-	-	-
National Registry	-	-	-

## 5. Interventional Electrophysiology

	2016	2017	2018
Ablation procedures	618	751	960
SVT ablation procedures	561	672	891
AVNRT	318	362	461
AVRT/WPW	223	282	398
AFL (RA isthmus dependent)	17	15	17
AT	3	13	15
VT/PVC	44	66	58
Idiopathic	44	62	56
Structural	-	4	2
AF ablation procedures	13	13	11
Ablation centers		4	5
AF ablation centers	1	1	1
Structural VT ablation centers	-	1	1
Ablation physicians		10	13
AF ablation physicians	1	1	1
Structural VT ablation physicians	-	1	1
National Registry	<input type="checkbox"/>	<input type="checkbox"/>	

## 6. Management

National certification for physicians ☐PM ☐CRT ☐ICD ☐Ablation  
 National accreditation for centers ☐PM ☐CRT ☐ICD ☐Ablation  
 Guidelines followed ☐ National ☒ **US** ☒ **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	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Lack of reimbursement, limited financial resources	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Lack of referral	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Lack of trained personnel	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Low awareness of guidelines	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Lack of operators	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

## 7. Source

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



## Country/Region: New Zealand

### 1. Statistics

	2015	2016	2017	2018
Population (thousand) <sup>1</sup>	4600	4693	4844	4929
Hospitals ( <i>includes every small hosp.</i> )	184	184		220
Beds ( <i>includes every small hosp.</i> )	12880	10793		13010
Physicians	14678	14700		15819
Nurses	52729	53000		58206
GDP(US\$, billions) <sup>2</sup>	173.75	185		206
Total expenditure on health as % GDP <sup>2</sup>	10%	10%		9%
Government expenditure on health as % <sup>2</sup>	80%	80%		80%
Insured citizens (%)	30%	30%		
SCD patients	3500	3700		
Heart failure patients	26000	30000		
AF patients	-	-		

<sup>6</sup> [www.census.gov](http://www.census.gov)

<sup>7</sup> [www.imf.org](http://www.imf.org)

### 2. Pacemaker

	2015	2016	2017	2018
Total Pacemakers	2470	2492	2582	2635
New implants	2010	1933	2140	2133
Replacements	460	526	441	502
Single-chamber	960	730	703	829
Dual-chamber	1510	1598	1783	1806
Sick sinus syndrome	-	-		
AV block	-	-		
Implanting Centers	12	12	14	14
Implanting Physicians	36	38	38	38
National Registry	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	

### 3. Cardiac resynchronization therapy

	2015	2016	2017	2018
Total CRTs	210	309	326	329
CRT-P	90	150	166	168
CRT-P new implants	70	89		107
CRT-P replacements/upgrade	20	61		61
CRT-D	120	159	160	161
CRT-D new implants	100	107		121
CRT-D replacements/upgrade	20	52		40
Ischemic				
Non-ischemic				
Implanting Centers	6	6	6	8
Implanting Physicians	20	22	22	22
National Registry	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	

### 4. Implantable cardioverter defibrillator

	2015	2016	2017	2018
Total ICDs	625	638	654	649
ICD new implants	500	448	459	479
ICD replacements	125	100	161	170
Single-chamber	–	–		
Dual-chamber	–	–		
Primary prevention	–	–		
Secondary prevention	–	–		
Implanting Centers	7	7	9	
Implanting Physicians	18	22	22	
National Registry	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	

### 5. Lead Extraction

**Lead extractions procedures and number of centers that performed lead extraction**

	2015	2016	2017	2018
Total lead extraction procedures	32	33		40
Hospitals performed lead extraction	2	2	2	1

Cardiologists performing lead extraction	3	3	3	2
Surgeons performing lead extraction	0 (support)	support		
National Registry	<input type="checkbox"/>	<input type="checkbox"/>		

## 6. Interventional electrophysiology

	2015	2016	2017	2018
Ablation procedures	1290	1482	1640	1725
SVT ablation procedures	813	881	901	882
AVNRT	293	322	315	274
AVRT/WPW	182	151	133	178
AFL (RA isthmus dependent)	252	331	336	335
AT	86	77	97	80
VT/VPC	76	135	158	152
Idiopathic	40	94		
Structural	36	41		
AF ablation procedures	363	405	510	563
Ablation centers				
AF ablation centers	8	8	8	8
Structural VT ablation centers	4	4	4	4
Ablation physicians				
AF ablation physicians	9	12	14	15
Structural VT ablation physicians	9	12	14	15
National Registry	<input type="checkbox"/>	<input type="checkbox"/>		

## 7. Management

National certification for physicians	<input type="checkbox"/> PM	<input type="checkbox"/> CRT	<input type="checkbox"/> ICD	<input type="checkbox"/> Ablation
National accreditation for centers	<input type="checkbox"/> PM	<input type="checkbox"/> CRT	<input type="checkbox"/> ICD	<input type="checkbox"/> Ablation
Guidelines followed	<input checked="" type="checkbox"/> National	<input type="checkbox"/> U.S.	<input type="checkbox"/> Europe	<input type="checkbox"/> AP

Payment (%)	Pacemaker	ICD	CRT	Ablation
Government	98%	99.7%	99.7%	77%
Insurance	–	–	–	–
Public insurance	–	–	–	–
Private insurance	–	–	–	23%
Individual	2%	0.3%	0.3%	

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

	1	2	3	4	5
Lack of centers	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Lack of reimbursement, limited financial resources	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Lack of referral	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Lack of trained personnel	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Low awareness of guidelines	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Lack of operators	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

## 8. Source

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

## Country/Region: Pakistan

### 1. Statistics

	2015	2016	2017	2018
Population (million) <sup>1</sup>	182	182.5	182.7	190
Hospitals	–	–	–	
Beds(per thousand)	0.6	0.6	0.6	0.6
Physicians	05/1000	05/1000	0.5/1000	0.5/1000
Nurses	–	–	–	
GDP (US\$, billions)	246	247	247	246
Total expenditure on health as % GDP	3.5	3.5	3.8	4.5
Government expenditure on health (US\$)	–	4%	4.5%	4.9
Insured citizens (%)	0.1%	0.1%	1	3%
SCD patients	–	–	–	
Heart failure patients	–	–	–	
AF patients	1%	0.5%	0.5%	0.5%

<sup>8</sup> [www.census.gov](http://www.census.gov)

### 2. Pacemaker

	2015	2016	2017	2018
Total Pacemakers	2700	3450	4030	4300
New implants	2400	3000	4000	4000
Replacements	300	450	500	520
Single-chamber	70%	80%	80%	70%
Dual-chamber	30%	20%	20%	30%
Sick sinus syndrome	20%	20%	26%	25%
AV block	80%	80%	74%	75%
Implanting Centers	27	29	31	32
Implanting Physicians	62	70	100	102
National Registry	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	no

### 3. Cardiac resynchronization therapy

	2015	2016	2017	2018
Total CRTs	76	137	416	360
CRT-P	56	102	290	300
CRT-P new implants	–	97	290	280
CRT-P replacements/upgrade	3	5	16	20
CRT-D		35		
CRT-D new implants	20	35	110	100
CRT-D replacements/upgrade	–	–	–	
Ischemic	90%	90%	80%	80%
Non-ischemic	10%	10%	20%	20%
Implanting Centers	5	6	8	8
Implanting Physicians	–	7	8	8
National Registry	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	no

### 4. Implantable cardioverter defibrillator

	2015	2016	2017	2018
Total ICDs	–	–	–	
ICD new implants	112	150	350	360
ICD replacements				
Single-chamber	90%	92%	85	80%
Dual-chamber				20%
Primary prevention	20%	18%	32%	27%
Secondary prevention	80%	82%	68%	73%
Implanting Centers	6	8	9	9
Implanting Physicians	8	8	8	12
National Registry	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	no

## 5. Lead Extraction

### Lead extractions procedures and number of centers that performed lead extraction

	2015	2016	2017	2018
Total lead extraction procedures	–	–	–	
Hospitals performed lead extraction	–	–	–	1
Cardiologists performing lead extraction	–	–	–	1
Surgeons performing lead extraction	–	–	–	
National Registry	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	no

## 6. Interventional electrophysiology

	2015	2016	2017	2018
Ablation procedures	–	–	–	1350
SVT ablation procedures	765	870	1200	1300
AVNRT	61%	63%	65%	67%
AVRT/WPW	24%	25%	25%	20%
AFL (RA isthmus dependent)	5%	5%	6%	8%
AT	2%	7%	5%	6%
VT/VPC	6%	8%	11%	82%
Idiopathic	3%	7%	10%	18%
Structural				
AF ablation procedures	5	10	20	16
Ablation centers	1	1		2
AF ablation centers	1	2	2	2
Structural VT ablation centers	1	1	2	2
Ablation physicians	1			
AF ablation physicians	1	2	1	3
Structural VT ablation physicians	1	1		3
National Registry	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

## 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	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Y
Lack of reimbursement, limited financial resources	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Y
Lack of referral	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Lack of trained personnel	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Y
Low awareness of guidelines	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Lack of operators	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Y

## 8. Source

**Pakistan Heart Rhythm Society**



## Country/Region: Philippines

### 1. Statistics

	2015	2016	2017	2018
Population (thousand) *	102,435	103,796	104918	106,512
Hospitals	1974	1823	1436	1800
Beds (per 100,000 population)	100	102	100	100
Physicians (per 1,000 population) **	1.15	1.16	1.16	1.16
Nurses (per 1,000 population) ***	6	6	24	24
GDP (US\$, billions) ****	291.97	304.9	313.6	354.31
Total expenditure on health as % GDP	4.7%	4.71	4.5%	4.5%
Government expenditure on health as %	34.3%	10.1	10.5%	33%
Insured citizens (%)	80%	33%	92%	93%
SCD patients	43	–	–	–
Heart failure patients			1.6%	-
AF patients	0.2%	0.2%	0.2%	0.2%

• <http://www.worldometers.info/world-population/philippines-population/>

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

\*\*\* [http://www.who.int/whosis/whostat/EN\\_WHS2011\\_Full.pdf](http://www.who.int/whosis/whostat/EN_WHS2011_Full.pdf)

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

### 2. Pacemaker

	2015	2016	2017	2018
Total Pacemakers	1049	1225	649	1037
New implants	913	973	609	974

Replacements	136	252	40	63
Single-chamber	523	584	308	414
Dual-chamber	526	637	336	617
Sick sinus syndrome	–	353	355	346
AV block	–	64	78	691
Implanting Centers	42	98	46	72
Implanting Physicians	95	160	51	76
National Registry	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

### 3. Cardiac resynchronization therapy

	2015	2016	2017	2018
Total CRTs	28	34	17	15
CRT-P	2	7	3	1
CRT-P new implants	2	2	6	0
CRT-P replacements/upgrade	0	0	2	1
CRT-D	26	26	12	14
CRT-D new implants	21	22	12	13
CRT-D replacements/upgrade	5	4		1
Ischemic	-	4	5	4
Non-ischemic	-	2	4	11
Implanting Centers	21	16	6	6

Implanting Physicians	18	5	6	6
National Registry	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

#### 4. Implantable cardioverter defibrillator

	2015	2016	2017	2018
Total ICDs	53	104	60	72
ICD new implants	44	84	58	70
ICD replacements	9	20	2	2
Single-chamber	38	55	38	53
Dual-chamber	15	49	22	19
Primary prevention	-	15	18	45
Secondary prevention	-	89	-	27
Implanting Centers	21	7	9	12
Implanting Physicians	18	6	11	11
National Registry	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

#### 5. Lead Extraction

##### Lead extractions procedures and number of centers that performed lead extraction

	2015	2016	2017	2018
Total lead extraction procedures	-	-	4	-
Hospitals performed lead extraction	-	-	3	-
Cardiologists performing lead extraction	-	-	3	-
Surgeons performing lead extraction	-	-		-
National Registry	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

## 6. Interventional electrophysiology

	2015	2016	2017	2018
Ablation procedures	97	151	142	137
SVT ablation procedures	68	29	-	
AVNRT	38	62	53	46
AVRT/WPW	28	25	46	47
AFL (RA isthmus dependent)	1	1	8	6
AT	1	0	5	4
VT/VPC	22	17	15	16
Idiopathic	19	8	-	-
Structural	3	2	-	-
AF ablation procedures	7	13	15	18
Ablation centers	3	4	4	4
AF ablation centers	1	1	1	4
Structural VT ablation centers	1	1	4	4
Ablation physicians	10	-	-	-
AF ablation physicians		-	-	-
Structural VT ablation physicians	6	-	-	-
National Registry	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

## 7. Management

National certification for physicians  
 National accreditation for centers

☐ PM

☐ CRT

☐ ICD

☐

Ablation

☐ PM

☐ CRT

☐ ICD

☐

Ablation

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

Payment (%)	Pacemaker	ICD	CRT	Ablation
Government	50%	10%	5%	20%
Insurance				
Public insurance	10%	0	0	0%
Private insurance	0	0	0	0%
Individual	40%	90%	95%	80%

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

	1	2	3	4	5
Lack of centers	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Lack of reimbursement, limited financial resources	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Lack of referral	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Lack of trained personnel	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Low awareness of guidelines	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Lack of operators	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>

## 8. Source

**Philippine Heart Rhythm Society, Inc.**

**Other Source: Medtronic, Phils.**

## Country/Region: Singapore

### 1. Statistics

	2015	2016	2017	2018
<b>Population ('000)<sup>1</sup></b>	<b>5,535.0</b>	<b>5,607.3</b>	<b>5,612.3</b>	<b>5,638.7</b>
<b>Hospitals <sup>2</sup></b>	<b>27</b>	<b>28</b>	<b>27</b>	<b>28</b>
<i>a. Public Sector</i>	13	13	13	15
- Acute Hospitals	9	9	9	10
- Psychiatric Hospitals	1	1	1	1
- Community Hospitals	3	3	3	4
<i>b. Not-for-Profit</i>	5	5	5	5
- Acute Hospitals	1	1	1	1
- Psychiatric Hospitals	-	-	-	-
- Community Hospitals	4	4	4	4
<i>c. Private Sector</i>	9	10	9	9
- Acute Hospitals	9	9	8	8
- Psychiatric Hospitals	-	-	-	-
- Community Hospitals	-	1	1	-
<b>Beds<sup>3</sup></b>	<b>25,584</b>	<b>27,126</b>	<b>29,050</b>	<b>29,050</b>
<i>a. Public Sector</i>	13,109	14,335	16,568	17,425
- Acute Hospitals	8,128	8,561	8,623	9,071
- Psychiatric Hospitals	1,950	1,950	1,950	1,950
- Community Hospitals	503	690	690	799
- Nursing Homes	2,488	3,110	5,281	5,581
- Inpatient Hospices	40	24	24	24
<i>b. Not-for-Profit</i>	7,180	7,484	7,267	7,360
- Acute Hospitals	316	316	271	273
- Psychiatric Hospitals	-	-	-	-
- Community Hospitals	961	961	969	979
- Nursing Homes	5,802	6,058	5,872	5,953
- Inpatient Hospices	101	149	155	155

<i>b. Private Sector</i>	5,295	5,307	5,215	5,153
- Acute Hospitals	1,400	1,441	1,446	1,482
- Psychiatric Hospitals	-	-	-	-
- Community Hospitals	-	12	4	-
- Nursing Homes	3,895	3,854	3,765	3,671
- Inpatient Hospices	-	-	-	-
<b>Physicians<sup>4</sup></b>	<b>12,459</b>	<b>12,967</b>	<b>13,386</b>	<b>13,766</b>
a. Public Sector	7,909	8,358	8,573	8,819
b. Private Sector	3,914	3,979	4,107	4,225
c. Not in active Practice	636	630	706	722
<b>Nurses/Midwives<sup>4</sup></b>	<b>39,005</b>	<b>40,561</b>	<b>41,440</b>	<b>42,125</b>
- Registered Nurses	29,894	31,615	32,672	33,614
- Enrolled Nurses	8,931	8,781	8,631	8,394
- Registered Midwives	180	165	137	117
<b>Advanced Practice Nurses<sup>4</sup></b>	<b>172</b>	<b>197</b>	<b>218</b>	<b>218</b>
GDP (US\$, billions)				
Government Health Expenditure (as % of GDP) <sup>5</sup>	<b>2.1</b>	<b>2.2</b>	<b>2.2</b>	<b>N/A</b>
Government Health Expenditure (as % of Total Government Expenditure) <sup>5</sup>	<b>12.9</b>	<b>13.8</b>	<b>13.9</b>	<b>N/A</b>
Insured citizens (%)	-	-	-	
SCD patients	-	-	-	
Heart failure patients	-	-	-	
AF patients	-	-	-	

Source: Singapore Health Facts, Ministry of Health, Singapore and data.gov.sg retrieved as of 28 May 2019<sup>1,2,3,4,5</sup> ([www.moh.gov.sg](http://www.moh.gov.sg)).

## 2. Pacemaker

	<b>2015</b>	<b>2016</b>	<b>2017</b>	<b>2018</b>
Total Pacemakers <sup>4</sup>	<b>698</b>	<b>827</b>	<b>801</b>	<b>875</b>
- New implants	530	580	574	589
Replacements/Upgrades	98	126	121	139
Others	70	121	106	147
- Single-chamber	141	145	141	143
Dual-chamber	488	588	562	591
Not applicable	60	94	98	141
- Sick sinus syndrome	344	391	387	377
AV block*	182	219	195	230
Implanting Centers <sup>4</sup>	5	5	6	6
Implanting Physicians <sup>4</sup>	~19	~18	~24	~25
National Registry <sup>4</sup>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

Source: CGH, KTPH, NHCS, NTFGH, NUH, TTSH, SCDB as of 30 April 2019<sup>4</sup>

\* 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, NUH: National University Hospital, TTSH: Tan Tock Seng Hospital, SCDB:

Singapore Cardiac Data Bank

## 3. Cardiac resynchronization therapy

	<b>2015</b>	<b>2016</b>	<b>2017</b>	<b>2018</b>
Total CRTs <sup>4</sup>	<b>154</b>	<b>166</b>	<b>178</b>	<b>184</b>
- CRT-P	24	26	20	38
CRT-P new implants	12	10	11	16
CRT-P replacements/upgrade	12	15	9	22
Others	-	1	-	-
- CRT-D	129	140	158	146
CRT-D new implants	98	94	91	100
CRT-D replacements/upgrade	25	39	58	42
Others	6	7	9	4
- Ischemic	82	87	91	92



Non-ischemic	11	46	48	26
Implanting Centers <sup>4</sup>	5	5	6	6
Implanting Physicians <sup>4</sup>	~17	~16	~20	~22
National Registry <sup>4</sup>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

Source: CGH, KTPH, NHCS, NTFGH, NUH, TTSH, SCDB as of 30 April 2019<sup>4</sup>

#### 4. Implantable cardioverter defibrillator

	2015	2016	2017	2018
Total ICDs <sup>4</sup>	332	339	378	394
- ICD new implants	274	239	277	288
ICD replacements/upgrade	40	57	64	64
Others	18	43	37	42
- Single-chamber	273	272	295	311
Dual-chamber	50	45	59	54
Others	9	22	24	29
- Primary prevention	211	225	248	266
Secondary prevention	121	114	130	128
Others	-	-	-	-
Implanting Centers <sup>4</sup>	5	5	6	6
Implanting Physicians <sup>4</sup>	~17	~17	~23	~21
National Registry <sup>4</sup>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

Source: CGH, KTPH, NHCS, NTFGH, NUH, TTSH, SCDB as of 30 April 2019<sup>4</sup>

#### 5. Lead Extraction

##### Lead extractions procedures and number of centers that performed lead extraction

	2015	2016	2017	2018
Total lead extraction procedures	27	48	45	47
Hospitals performed lead extraction	~5	~4	~5	~6
Cardiologists performing lead extraction	~11	~14	~18	~16
Surgeons performing lead extraction	-	~2	~2	-
National Registry	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

Inclusive of Explantation of PPM / ICD

## 6. Interventional electrophysiology

	<b>2015</b>	<b>2016</b>	<b>2017</b>	<b>2018</b>
Ablation procedures <sup>4</sup>	<b>707</b>	<b>764</b>	<b>844</b>	<b>951</b>
SVT ablation procedures	-	-	-	-
AVNRT	171	201	185	193
AVRT/WPW	112	134	114	116
AFL (RA isthmus dependent)	139	146	188	205
AT	41	38	43	42
VT/VPC	63	45	107	128
Idiopathic	-	-	-	-
Structural	-	-	-	-
AF ablation procedures	115	132	181	244
Others	66	68	26	23
Ablation centers <sup>4</sup>	3	3	3	3
AF ablation centers	2	2	2	2
Structural VT ablation centers	3	3	3	3
Ablation physicians <sup>4</sup>	~16	~18	~15	~20
AF ablation physicians	–	–	–	–
Structural VT ablation physicians	–	–	–	–
National Registry <sup>4</sup>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

Source: CGH, KTPH, NHCS, NTFGH, NUH, TTSH, SCDB as of 30 April 2019<sup>4</sup>

## 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	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Lack of reimbursement, limited financial resources	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Lack of referral	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Lack of trained personnel	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Low awareness of guidelines	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Lack of operators	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

## 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

	2015	2016	2017	2018
Population (thousand) <sup>1</sup>	50293	51619	50982	51164
Hospitals <sup>2</sup>	66,896	68,476	-	
Beds (per 100,000 population) <sup>2</sup>	1,341	1,327	-	
Physicians (per 1,000 population) <sup>2</sup>	2.4	2.3	2.3	-
Nurses (per 1,000 population) <sup>2</sup>	6.4	6.8	6.9	-
GDP (US\$, billions) <sup>3</sup>	1,321.2	1,404.30	1,530.7	
Total expenditure on health as % GDP <sup>3</sup>	7.2%	7.3%	7.6%	
Government expenditure on health as % <sup>3</sup>	-	-	-	
Insured citizens (%)	100	100	100	100
SCD patients	-	-	-	
Heart failure patients	-	-	-	
AF patients	-	-	-	

<sup>9</sup> [www.census.gov](http://www.census.gov)

<sup>10</sup> [www.who.int/](http://www.who.int/) / [http://apps.who.int/nha/database/country\\_profile/Index/en](http://apps.who.int/nha/database/country_profile/Index/en)

<sup>11</sup> [www.imf.org](http://www.imf.org)

### 2. Pacemaker

	2015	2016	2017	2018
Total Pacemakers	4480	5007	5347	5408
New implants	3224	4319	4336	4457
Replacements	1256	688	1011	951
Single-chamber	1058	2126	2106	-
Dual-chamber	3397	2881	3241	-
Sick sinus syndrome	2283	1371	1828	-
AV block	2343	1817	2716	-
Implanting Centers	122	-	-	-
Implanting Physicians	210	91	247	84

National Registry	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	No
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### 3. Cardiac resynchronization therapy

	2015	2016	2017	2018
Total CRTs	265	281	350	272
CRT-P	18	24	49	-
CRT-P new implants	10	14	32	-
CRT-P replacements/upgrade	8	10	17	-
CRT-D	247	257	301	-
CRT-D new implants	207	204	251	-
CRT-D replacements/upgrade	40	53	50	-
Ischemic	22	15	15	-
Non-ischemic	186	213	284	-
Implanting Centers	14	-	-	-
Implanting Physicians	15	71	57	62
National Registry	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	No

### 4. Implantable cardioverter defibrillator

	2015	2016	2017	2018
Total ICDs	1015	1113	1157	1542
ICD new implants	844	887	1022	1366
ICD replacements	171	226	135	176
Single-chamber	651	544	666	-
Dual-chamber	364	569	491	-
Primary prevention	324	195	361	-
Secondary prevention	627	638	688	-
Implanting Centers	77	-	-	-
Implanting Physicians	95	80	112	76
National Registry	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	No

### 5. Lead Extraction

#### Lead extractions procedures and number of centers that performed lead extraction

	2015	2016	2017	2018
Total lead extraction procedures	-	41	-	92

Hospitals performed lead extraction	–	47	–	12
Cardiologists performing lead extraction	–	47	–	31
Surgeons performing lead extraction	–	0	–	2
National Registry	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	No

## 6. Interventional electrophysiology

	2015	2016	2017	2018
Ablation procedures	7026	5617	3961	9545
SVT ablation procedures	464	2921	2160	5040
AVNRT	2321	1905	1045	-
AVRT/WPW	1681	1259	626	-
AFL (RA isthmus dependent)	941	620	489	-
AT	394	279	187	506
VT/VPC	283	407	172	461
Idiopathic	354	282	140	-
Structural	34	68	32	-
AF ablation procedures	2097	2324	1375	3538
Ablation centers	74	39	24	40
AF ablation centers	50	39	22	37
Structural VT ablation centers	24	28	15	17
Ablation physicians	–	68	44	66
AF ablation physicians	–	64	33	54
Structural VT ablation physicians	–	46	26	42
National Registry	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Yes

## 7. Management

National certification for physicians	<input type="checkbox"/> PM	<input type="checkbox"/> CRT	<input type="checkbox"/> ICD	<input type="checkbox"/> Ablation
National accreditation for centers	<input type="checkbox"/> PM	<input type="checkbox"/> CRT	<input type="checkbox"/> ICD	<input type="checkbox"/> Ablation

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

Payment (%)	Pacemaker	ICD	CRT	Ablation
Government	95%	95%	95%	95%
Insurance				
Public insurance	100%	100%	100%	100%
Private insurance				
Individual				

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

	1	2	3	4	5
Lack of centers	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Lack of reimbursement, limited financial resources	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Lack of referral	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Lack of trained personnel	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Low awareness of guidelines	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Lack of operators	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

## 8. Source

**KHRS (Korean Heart Rhythm Society)**

## Country/Region: SRI LANKA

### 1. Statistics

	2015	2016	2017	2018
Population (thousand) <sup>1</sup>	20966	21158	21444	21670
Hospitals	631	634	637	639
Beds	80,581	80,768	80896	80980
Physicians ( MO s )	18243	18487	18574	18679
Nurses	42420	45363	45780	45930
GDP (US\$, billions)	81.32	82.87	87.17	88.22
Total expenditure on health as % GDP	1.66	1.81	1.96	1.97
Government expenditure on health (US\$)	-	6.22%	2568million	
Insured citizens (%)	-	-		-
SCD patients	-	-		-
Heart failure patients	-	-		-
AF patients	-	-		-

12. [www.census.gov](http://www.census.gov)

### 2. Pacemaker

	2015	2016	2017	2018
Total Pacemakers	1138	1268	1442	2215
New implants	1064	1187	1231	1463
Replacements	74	81	211	752
Single-chamber	843	936	896	1003
Dual-chamber	295	332	546	460
Sick sinus syndrome	366	406	562	886
AV block	771	861	912	1329
Implanting Centers	10	11	11	11
Implanting Physicians	10	12	12	12
National Registry	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>



### 3. Cardiac resynchronization therapy

	2015	2016	2017	2018
Total CRTs	21	18	32	34
CRT-P	15	10	21	22
CRT-P new implants	12	7	15	18
CRT-P replacements/upgrade	3	3	6	4
CRT-D	3	4	11	12
CRT-D new implants	2	3	6	11
CRT-D replacements/upgrade	1	1	5	1
Ischemic	5	4	7	9
Non-ischemic	16	14	25	23
Implanting Centers	4	4	4	6
Implanting Physicians	4	5	7	7
National Registry	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

### 4. Implantable cardioverter defibrillator

	2015	2016	2017	2018
Total ICDs	36	48	65	83
ICD new implants	-	-	57	73
ICD replacements	-	-	8	8
Single-chamber	-	-		76
Dual-chamber	-	-		7
Primary prevention	-	-		-
Secondary prevention	-	-		-
Implanting Centers	5	6	8	8
Implanting Physicians	4	5	8	9
National Registry	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

### 5. Lead Extraction

**Lead extractions procedures and number of centers that performed lead extraction**

	2015	2016	2017	2018
--	------	------	------	------

Total lead extraction procedures	-	-		3
Hospitals performed lead extraction	-	-		3
Cardiologists performing lead extraction	-	-		
Surgeons performing lead extraction	-	-		3
National Registry	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

## 6. Interventional electrophysiology

	2015	2016	2017	2018
Ablation procedures	513	402	578	891
SVT ablation procedures	304	263	364	
AVNRT	171	156	238	401
AVRT/WPW	121	91	98	133
AFL(RA isthmus dependent)	5	10	16	10
AT	7	6	10	01
VT/VPC	209	139	214	346
Idiopathic	209	139	212	344
Structural	-	-		2
AF ablation procedures	-	-		
Ablation centers	4	4		5
AF ablation centers	-	-		-
Structural VT ablation centers	-	-		-
Ablation physicians	5	6		7
AF ablation physicians	-	-		
Structural VT ablation physicians	-	-		
National Registry	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

## 7. Management

National certification for physicians	<input type="checkbox"/> PM	<input type="checkbox"/> CRT	<input type="checkbox"/> ICD	<input type="checkbox"/> Ablation
National accreditation for centers	<input type="checkbox"/> PM	<input type="checkbox"/> CRT	<input type="checkbox"/> ICD	<input type="checkbox"/> Ablation
Guidelines followed	<input type="checkbox"/> National	<input checked="" type="checkbox"/> U.S.	<input checked="" type="checkbox"/> Europe	<input type="checkbox"/> AP

Payment (%)	Pacemaker	ICD	CRT	Ablation
Government	95	60	65	55

Insurance	-	08	08	10
Public insurance	-	5	5	7
Private insurance	-	3	3	3
Individual	-	32	27	35

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

	1	2	3	4	5
Lack of centers	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Lack of reimbursement, limited financial resources	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Lack of referral	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Lack of trained personnel	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Low awareness of guidelines	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Lack of operators	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

## 8. Source

**Name of national working group or arrhythmia body**

**Sri Lanka Heart Association**

## Country/Region: Taiwan

### 1. Statistics

	2015	2016	2017	2018
Population (thousand) <sup>1</sup>	23492	23,540	23571	23590
Hospitals <sup>2</sup>	486	494	478	473
Beds <sup>2</sup>	162,163	133,335	164590	148947
Physicians <sup>3</sup>	44,006	43,961	46311	46356
Nurses <sup>3</sup>	148,223	126,458	135969	159621
GDP (US\$, billions) <sup>4</sup>	523.009	529.676	574.895	589.391
Total expenditure on health as % GDP <sup>5</sup>	6.19	5.94	6.3	6.1
Government expenditure on health as % <sup>6</sup>	6.83	6.92		
Insured citizens (%)	99%	99%	99%	99%
SCD patients	–	–		
Heart failure patients	–	–		
AF patients	–	–		

### 2. Pacemaker

	2015	2016	2017	2018
Total Pacemakers	5916	6661	6222	6735
New implants	75%	78%	85%	85%
Replacements	25%	22%	15%	15%
Single-chamber(Leadless included)	24%	24%	23%	23%
Leadless	0	0	0	1.7%
Dual-chamber	76%	76%	77%	7%
Sick sinus syndrome	59%	62%	59%	55%
AV block	41%	38%	41%	45%
Implanting Centers	104	108	110	112
Implanting Physicians	435	484	538	552
National Registry	☑	☑	☑	☑

### 3. Cardiac resynchronization therapy

	2015	2016	2017	2018
Total CRTs	265	331	328	312
CRT-P	182	238	243	227
CRT-P new implants	58%	68%	60%	70%
CRT-P replacements/upgrade	42%	32%	40%	30%
CRT-D	83	93	85	85
CRT-D new implants	67%	67%	52%	71%
CRT-D replacements/upgrade	33%	33%	48%	29%
Ischemic	46%	24%	31%	34%
Non-ischemic	54%	76%	69%	66%
Implanting Centers	55	51	60	52
Implanting Physicians	105	117	166	122
National Registry	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

### 4. Implantable cardioverter defibrillator

	2015	2016	2017	2018
Total ICDs	583	649	695	816
ICD new implants	71%	82%	85%	80%
ICD replacements	29%	18%	15%	20%
Single-chamber	32%	37%	42%	44%
Dual-chamber	68%	63%	58%	56%
Primary prevention	1%	1%	2%	2%
Secondary prevention	99%	99%	98%	98%
Implanting Centers	59	67	69	82
Implanting Physicians	130	177	206	234
National Registry	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

## 5. Lead Extraction

### Lead extractions procedures and number of centers that performed lead extraction

	2015	2016	2017	2018
Total lead extraction procedures	–	–		<b>55</b>
Hospitals performed lead extraction	–	–		<b>6</b>
Cardiologists performing lead extraction	–	–		<b>44</b>
Surgeons performing lead extraction	–	–		<b>11</b>
National Registry	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

## 6. Interventional electrophysiology

	2015	2016	2017	2018
Ablation procedures	3861	4345	4997	5069
SVT ablation procedures	2812	2983	3443	2514
AVNRT	1447	1466	1828	1757
AVRT/WPW	785	764	766	740
AFL (RA isthmus dependent)	436	547	646	621
AT	144	175	203	158
VT/VPC	493	685	816	1056
Idiopathic	386	402	548	676
Structural	107	81	135	135
AF ablation procedures	556	596	738	1241
Ablation centers	37	36	15	38
AF ablation centers	13	16	15	15
Structural VT ablation centers	10	8	15	15
Ablation physicians	81	47	89	94
AF ablation physicians	47	38	66	67
Structural VT ablation physicians	22	32	65	66
National Registry	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

## 7. Management

National certification for physicians	<input type="checkbox"/> PM	<input type="checkbox"/> CRT	<input checked="" type="checkbox"/> ICD	<input checked="" type="checkbox"/> Ablation
National accreditation for centers	<input type="checkbox"/> PM	<input type="checkbox"/> CRT	<input type="checkbox"/> ICD	<input type="checkbox"/> Ablation
Guidelines followed	<input checked="" type="checkbox"/> National	<input checked="" type="checkbox"/> U.S.	<input checked="" type="checkbox"/> Europe	<input checked="" type="checkbox"/> AP

Payment (%)	Pacemaker	ICD	CRT	Ablation
Government	100	100	100	95
Insurance				
Public insurance				
Private insurance				
Individual				5

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

	1	2	3	4	5
Lack of centers	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Lack of reimbursement, limited financial resources	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Lack of referral	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Lack of trained personnel	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Low awareness of guidelines	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Lack of operators	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

## 8. Source

### Taiwan Heart Rhythm Society

<sup>1</sup><https://www1.stat.gov.tw/np.asp?ctNode=4649&mp=3>

<sup>2</sup><https://dep.mohw.gov.tw/DOS/cp-1735-3246-113.html>

<sup>3</sup><https://dep.mohw.gov.tw/DOS/cp-1735-3245-113.html>

<sup>4</sup><https://www1.stat.gov.tw/point.asp?index=1#>

<sup>5</sup><https://iiqsw.mohw.gov.tw/InteractiveIntro.aspx?TID=9FBD55607C91A331>

<sup>6</sup><https://dep.mohw.gov.tw/DOS/lp-2156-113.html>

## Country/Region: THAILAND

2017 EP & Implant data(Black) limited to government hospitals, (Red) are national total from device companies

### 1. Statistics

	2016	2017	2018
Population	68,146,609	69,037,513	69,282,825
Hospitals	583		
Beds(per 100,000 population)	2.1 beds/1,000 population (2010)		
Physicians	0.39 physicians/1,000 population (2010)		
Nurses	2.07:1000 (2010)		
GDP (US\$)	USD406 billion	USD 403.6 billion	
Total expenditure on health as % GDP			
Government expenditure on health as %	6.5% of GDP (2014)	3.76% of GDP	
Insured citizens (%)	100		
SCD patients			
Heart failure patients			
AF patients			

### 2. Pacemaker

	2016	2017	2018
Total Pacemakers	3046	2306(3749)	3863
New implants	2897	1862(2985)	3301
Replacements	149	252(784)	562
Single-chamber	33%, 2 micra	325(14.1%), (1094) 10 micra	1160
Dual-chamber	68%	1729(74.9%) (2736)	2633



Sick sinus syndrome	49%		
AV block	51%		
Implanting Centers	85	16	
Implanting Physicians	140		
National Registry	yes	no	

### 3. Cardiac resynchronization therapy

	2016	2017	2018
Total CRTs	111	329 (389)	384
CRT-P			
CRT-P new implants	78	46 (51)	50
CRT-P replacements/upgrade		14 (20)	20
CRT-D			
CRT-D new implants	226	245 (262)	234
CRT-D replacements/upgrade		24 (56)	80
Ischemic			
Non-ischemic			
Implanting Centers			
Implanting Physicians	20		
National Registry	yes		

### 4. Implantable cardioverter defibrillator

	2016	2017	2018
Total ICDs	960	927 (950)	949
ICD new implants	841	919 (1091), 3SICD	820
ICD replacements	119	8 (174)	129
Single-chamber	72% 2 SICD	575 (710)	809
Dual-chamber	13%	82 (119)	148
Primary prevention			
Secondary prevention			
Implanting Centers			
Implanting Physicians			
National Registry	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

### 5. Lead Extraction

## Lead extractions procedures and number of centers that performed lead extraction

	2016	2017	2018
Total lead extraction procedures		33	42
Hospitals performed lead extraction	1	3	5
Cardiologists performing lead extraction			
Surgeons performing lead extraction			
National Registry	<input type="checkbox"/> no	<input type="checkbox"/>	<input type="checkbox"/>

## 6. Interventional electrophysiology

	2016	2017	2018
Ablation procedures			
SVT ablation procedures			
AVNRT		1296	1158
AVRT/WPW		702	667
AFL (RA isthmus dependent)		244	181
AT		156	116
VT/VPC			
Idiopathic		413	384
Structural		6	10
AF ablation procedures		128	131
Ablation centers		16	18
AF ablation centers			
Structural VT ablation centers			
Ablation physicians		40	
AF ablation physicians			
Structural VT ablation physicians			
National Registry	<input type="checkbox"/>	<input type="checkbox"/>	N/A

## 7. Management

National certification for physicians	<input type="checkbox"/> PM	<input type="checkbox"/> CRT		<input type="checkbox"/> Ablation
National accreditation for centers	<input type="checkbox"/> PM	<input type="checkbox"/> CRT	ICD	<input type="checkbox"/> Ablation
Guidelines followed	XNational	XU.S.	XICD	<input type="checkbox"/> AP
			XEurope	

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	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Lack of reimbursement, limited financial resources	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Lack of referral	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Lack of trained personnel	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Low awareness of guidelines	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Lack of operators	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

## Country/Region: Vietnam

### 1. Statistics

	2015	2016	2017	2018
Population (thousand) <sup>1</sup>	93,448	94,444	94,971	96,452
Hospitals	-	-	-	-
Beds	-	-	-	-
Physicians	-	-	-	-
Nurses	-	-	-	-
GDP (US\$, billions)	-	200	220	241
Total expenditure on health as % GDP	-	-	-	-
Government expenditure on health (US\$)	-	-	-	-
Insured citizens (%)	78	80	86.4	87.7
SCD patients	-	-		-
Heart failure patients	-	-		-
AF patients	-	-		-

<sup>13</sup> [www.census.gov](http://www.census.gov)

### 2. Pacemaker

	2015	2016	2017	2018
Total Pacemakers	2.722	2.588	2805	3242
New implants	-	-	2595	2594
Replacements	-	-	210	648
Single-chamber	1.658	1.214	1.118	1450
Dual-chamber	916	1.185	1.687	1792
Sick sinus syndrome	-	-	1.825	2107
AV block	-	-	980	1135
Implanting Centers	32	37	43	44
Implanting Physicians	74	98	110	120
National Registry	□	□	□	

### 3. Cardiac resynchronization therapy

	2015	2016	2017	2018
Total CRTs	59	76	95	94
CRT-P	49	65	71	54
CRT-P new implants	-	-	67	48
CRT-P replacements/upgrade	-	-	4	6
CRT-D	10	11	14	40
CRT-D new implants	-	-	13	35
CRT-D replacements/upgrade	-	-	1	5
Ischemic	-	-	12	-
Non-ischemic	-	-	83	-
Implanting Centers	12	8	14	14
Implanting Physicians	32	24	30	30
National Registry	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

### 4. Implantable cardioverter defibrillator

	2015	2016	2017	2018
Total ICDs	89	73	153	192
ICD new implants	-	-	144	168
ICD replacements	-	-	9	24
Single-chamber	77	58	148	170
Dual-chamber	12	15	5	22
Primary prevention	-	-	122	154
Secondary prevention	-	-	31	38
Implanting Centers	20	12	16	18
Implanting Physicians	40	30	36	40
National Registry	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

## 5. Lead Extraction

### Lead extractions procedures and number of centers that performed lead extraction

	2015	2016	2017	2018
Total lead extraction procedures	-	-	5	-
Hospitals performed lead extraction	-	-	2	-
Cardiologists performing lead extraction	-	-	4	-
Surgeons performing lead extraction	-	-	1	-
National Registry	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

## 6. Interventional electrophysiology

	2015	2016	2017	2018
Ablation procedures	2100	2958	4022	3483
SVT ablation procedures	-	-		
AVNRT	976	837	1,478	1729
AVRT/WPW	444	868	936	804
AFL (RA isthmus dependent)	36	35	121	49
AT	30	35	38	129
VT/VPC	574	1183	1290	1343
Idiopathic	-	-	1280	1343
Structural	-	-	10	0
AF ablation procedures	24	79	159	101
Ablation centers	-	19	20	21
AF ablation centers	16	6	7	7
Structural VT ablation centers	-	-	4	4
Ablation physicians	-	36	44	45
AF ablation physicians	12	14	14	14
Structural VT ablation physicians	-	-	7	7
National Registry	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

## 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	50%	20%	25%	80%
Private insurance				
Individual	50%	80%-	75%	20%

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

	1	2	3	4	5
Lack of centers	<input type="checkbox"/>	<input checked="" type="checkbox"/> X	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Lack of reimbursement, limited financial resources	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Lack of referral	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Lack of trained personnel	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Low awareness of guidelines	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Lack of operators	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

**8. Source**

**Vietnam Heart Rhythm Society: Pham Tran Linh, Vien Hoang Long at all**

# **The APHRS White Book: Seventh edition**

-The current status of cardiac electrophysiology in APHRS member countries

Shu Zhang, M.D.FHRS, FESC

Professor of Medicine, Chief of Department of Cardiology

Director of Clinical EP Lab and Arrhythmia Center

National Center for Cardiovascular Disease & Fu Wai Cardiovascular Hospital,

Chinese Academy of Medical Sciences & Beijing Union Medical College

President, Chinese Society of Arrhythmias

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 Seventh edition of APHRS White Book was finally released with data from 19 countries and regions, including China mainland, Hong Kong, India, Indonesia, Japan, Korea, Malaysia, Myanmar, New Zealand, Pakistan, Philippines, Singapore, Taiwan, 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 2015, 2016, 2017 and 2018 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 19 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 2015 to 2018, and the device implantation rates or catheter ablation rates and centers in 2018.

### 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 19 countries or regions in 2018 as compared with 2017. For Brunei Darussalam, Indonesia, Mongolia, Philippines and Sri Lanka, the implantation of pacemaker demonstrated a significant increasing rate at about 50%. The implantation of pacemaker kept to maintain above 10% of increasing rate in Hongkong, India, Malaysia, Myanmar and Vietnam. The pacemaker implantation in China, Pakistan, Singapore and Taiwan show an increasing rate over 5%. In Cambodia, Japan, New Zealand, South Korea and Thailand, the increasing rate was 2.83%, 1.83%, 2.05%, 1.14% and 3.04% respectively.

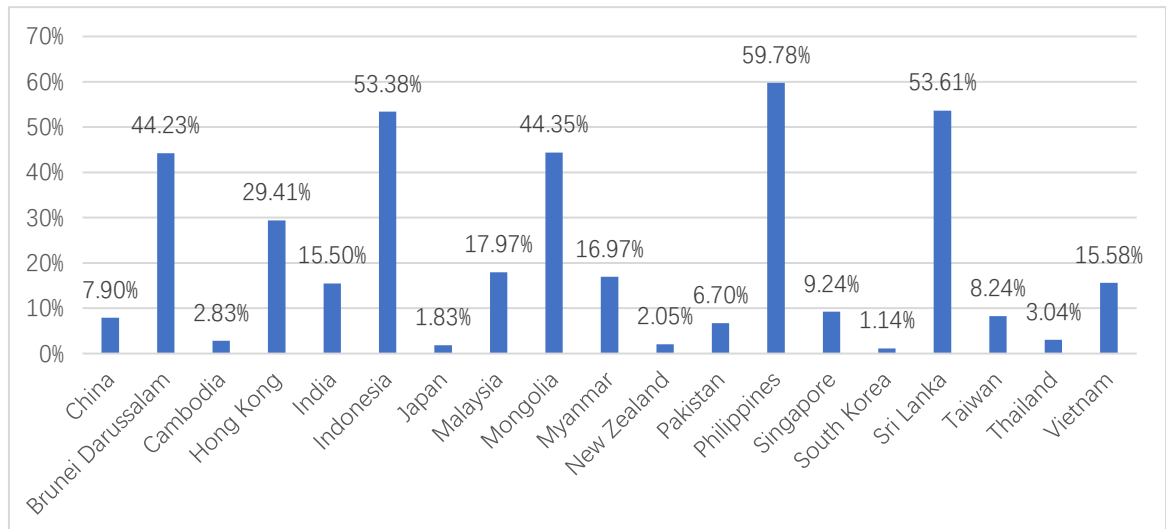


Figure 1: Increasing rate of pacemaker implantation in 2018 as compared with 2017

#### 3.2 Pacemaker implantation rate

As shown in Table 1, data in 2018 were analyzed by evaluating pacemaker implantation rates. Across the 19 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 New Zealand (534.5) and Japan (484.1) and the lowest in Indonesia (6.1). The pacemaker implantation rates per million inhabitants were also low in Philippines (9.7) and Myanmar (12.0). The large gap in the number of pacemaker implanting center per million inhabitants still remained among the 19 countries and regions. In 2018, Taiwan jumped as the top region where had the same highest implanting centers per million inhabitants (4.7), while the second with high pacemaker implanting centers per million inhabitants were Brunei(4.5). The countries with lowest density of implanting centers in 2018 data were Myanmar (0.2), Pakistan (0.2), Indonesia (0.2), Cambodia (0.2). While Mainland China (0.8)and Mongolia (0.6)experienced a slight but obvious rise. Other countries remained similar level to that in 2017. Although the reported data in 2018 did not differ significantly from that in 2017, 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 2018. The influence of GDP on pacemaker implants did not differ as compared with that in 2017. The countries with highest GDP per capita of the 19 countries and regions were Hong Kong, New Zealand, Japan, Korea and, Taiwan. The countries with highest implantation rate per million inhabitants were also Japan, New Zealand and Taiwan.

### **3. ICD and Cardiac Resynchronization Therapy devices (CRT)**

#### **3.1 The implantation of ICD in 2018**

Similar to data last year, the increasing trend of implantation of ICD was observed in 15 APHRS countries and regions in 2018 as compared with 2017 (Figure 2). Most Asia-Pacific countries and region kept an increasing trend in ICD implantation. And the implantation rates of ICD were significantly increased in Hong Kong and Brunei as compared to last year (88.73% and 72.22%). The countries with the increase rates of ICD implant more than 20% in 2018 were Malaysia(20.19%), Philippines(20%), South Korea(33.28%), Vietnam(25.49%) and Sri Lanka(27.69%). Mainland China and Indonesia kept the increasing trend about 10% in ICD implantation. The ICD implantation was still rare in some Asia-Pacific countries like Cambodia (2 cases) and Mongolia (5 cases).

We also analyzed the data on ICD primary or secondary prevention from 13 countries and regions: China mainland, India, Philippines, Taiwan, Indonesia, Singapore, Malaysia, Myanmar, Pakistan, Vietnam, Brunei, Cambodia and Mongolia. The use of ICD for primary prevention in China mainland, Brunei, India, Malaysia, Myanmar, Singapore, Vietnam and Taiwan increased slightly (20%, 40%, 20%, 10%, 10%, 10%, 30%, 10%, respectively). Indonesia and Pakistan were

with decrease in ICD primary implantation (from 33.3% to 18.4%, from 32% to 26.9%, respectively). Vietnam was the country having the highest ratio of primary prevention in Asia-Pacific countries and regions (80.2%).

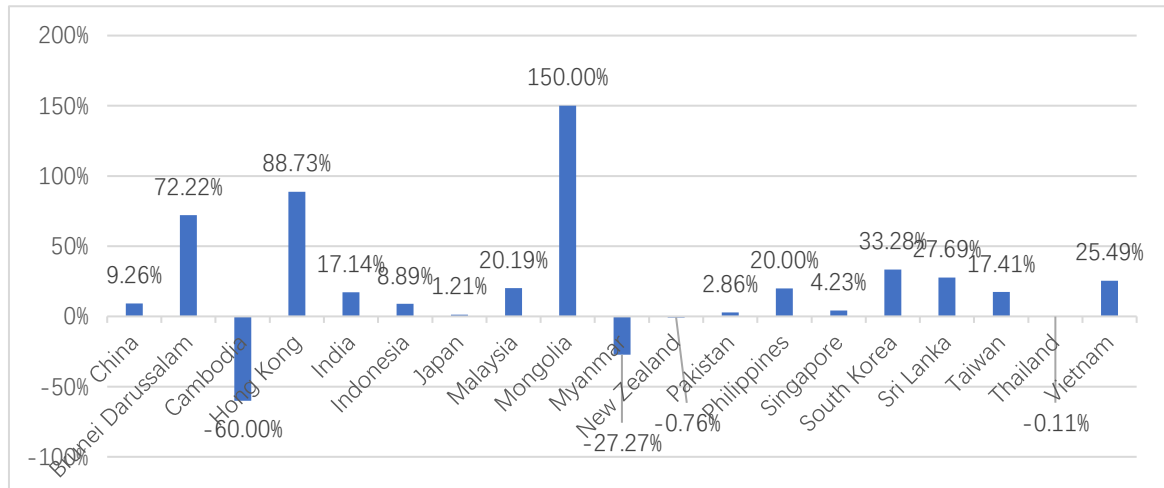


Figure 2: Increasing rate of ICD implantation in 2018 as compared with 2017

### 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 (131.6). Brunei(70.5), Singapore (69.9) and Japan (53.5) were the other countries with high ICD implants/million. Some countries kept increasing ICD implants/million, including Taiwan (34.6), Hong Kong (35.8), South Korea(30.1), and Thailand(13.7). Countries with low ICD implants/million were Indonesia (0.2), Cambodia (0.1), Philippines (0.7), and Myanmar (0.4). The available data also showed a large gap among the 18 countries and regions in the number of ICD implanting center per million inhabitants. In 2018 data, the countries with more than 1 ICD implanting centers per million inhabitants were Brunei (4.5), Taiwan (3.5), New Zealand (1.6), and Singapore (1.1). The other countries and regions with less than 1 implanting centers per million inhabitants included India (0.3), Indonesia(0.1), Malaysia (0.6), Mongolia (0.3), Myanmar (0.1), Sri Lanka (0.4), Philippines (0.1), Mainland China (0.3), Vietnam (0.2), and Cambodia (0.1).

### 3.3 CRT utilization in Asia-Pacific area

In 2018, we had data on CRT implantation from 18 Asia-Pacific countries and regions (Figure 3). The rising trend in CRT implantation remains in 8 among the data from 18 countries and regions, there were 9 countries and regions which showed decreased CRT implantation. There was no CRT implantation data in Hong Kong until 2018.

In 2018, the countries with total number of CRTs implantation more than 1000 were Japan (4778), Mainland China (4432) and India (3000), and those with CRT implantation between 100 and 1000 were Thailand (384), Pakistan (360), New Zealand (329), Taiwan (312), South Korea

(272), Singapore (184), Hong Kong (179), and Malaysia (177). The countries with the increase rates of CRT implant more than 10% in 2018 were Mongolia(50%), Myanmar (30%) and India (20%), and the countries and regions with an increase below 10% included China(7.1%), Sri Lanka(6.25%), Malaysia (3.51%), Singapore (3.37%), and New Zealand (0.92%). In contrast, 9 countries and region presented as decrease in CRT implantation, including South Korea(-22.29%), Brunei(-18.75%), Pakistan(-13.46%), Philippines (-11.76%), Taiwan (-4.88%),Indonesia (-1.59%), Thailand (-1.19%), Vietnam(-1.05%), and Japan(-0.08%),. Besides Mongolia, the total number of CRT implant was also relatively low in 4 countries and regions, including Philippines (15), Brunei (13), and Myanmar (13), although some of them had been demonstrated as an increasing trend.

The CRT implantation rate per million inhabitants in 2018 seemed to be increased as compared to last year. However, still a great heterogeneity was seen similar to last year, from as low as 0.08-0.8/million (Myanmar, Indonesia, Mongolia and Philippines) to as high as 66.7/million in New Zealand, 37.8 in Japan, 32.6 in Singapore, and 29.5 in Brunei. And a slightly increasing trend continued was seen in the CRT implantation rate per million inhabitants in most Asia-Pacific countries and regions, including India (from 1.9 in 2017 to 2.2 in 2018), China mainland (from 3.0 in 2017 to 3.2 in 2018), Malaysia (from 5.3 in 2017 to 5.5 in 2018), except for a decreasing trend in Taiwan (from 14.3 in 2017 to 13.2 in 2018).

There was also significant variability in the ratio of CRT-D/CRT-P implants. The number of “CRT implant centers” in 18 countries and regions were analyzed. Most of the Asia-Pacific countries and regions were with more than 50% CRT-D implantation rate, in which Philippines were shown with the highest CRT-D/total CRT ratio (82.4%). CRT-D implantation rate above 50% were shown in other 7 countries and regions, including China(65.4%), Malaysia (71.3%), Japan (72.1%), Brunei 56.3%), Singapore (82%), India (72.0%), Thailand(80.7%). However, CRT-D implant rate was less than 30% in 4 countries and regions, including Myanmar(1.1%), Pakistan(14.4%), Taiwan (25.9%) and Mongolia(0%). In 2018 data, the countries and regions with more than 1 CRT implanting centers per million inhabitants were Brunei (4.5), Taiwan (2.2), New Zealand (1.6) and Singapore (1.1), while that in most of other countries were between 0.05 to

0.5.

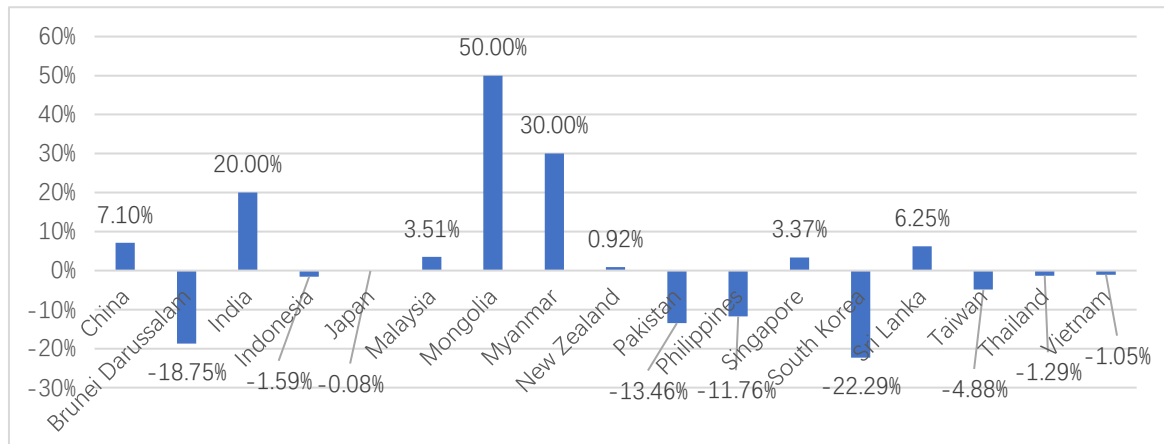


Figure 3: Increasing rate of CRT implantation in 2018 as compared with 2017

## 4 Catheter Ablation

### 4.1 General information of Catheter Ablation

We received data about catheter ablation from 18 countries and regions in 2018. China mainland was still the country having the highest cases receiving catheter ablations (151595). Japan was the other countries with high cases of 80000. The ablation procedures in other 16 countries and regions were less than 10000. An increasing trend was observed in ablation procedures across 12 countries. Sri Lanka, Mongolia, Brunei and Myanmar were the countries with the highest ablation increasing rate (52.3%, 44.6%, 38.1% and 30.1% respectively). There were 4 countries and regions with an increasing rate between 10% and 20%, including Mainland China (13.4%), Indonesia (14.5%), and Singapore (11.9%). The increasing rate in Japan (6.8%), New Zealand (2.4%), Cambodia (3.9%), were relatively low as compared with other countries. However, Philippine (-8.1%), Vietnam(-1.1%) and Taiwan(-14.8%) demonstrated a significant decrease in catheter ablation.

### 4.2 Ablation procedure rates

Table 2 is shown the ablation procedures per million inhabitants in 18 countries and regions. An increasing trend in ablation rate was observed in 11 countries and regions except for Philippines, Vietnam and Taiwan. Japan was the country which continued having increasing ablation procedures per million inhabitants, from 512.1 in 2016 to 591.9 in 2017, and then to 632.4 in 2018. New Zealand was the second with highest increment ablation procedures per million inhabitants (from 315.8 to 349.9). Countries having more than one hundred ablation procedures per million inhabitants included Mainland China (108.6), Brunei (338.6), Taiwan

(214.9), South Korea(186.6) and Singapore (168.6). Philippines (1.3) and Indonesia (3.3) had the lowest ablation procedures per million inhabitants. In China mainland, the ablation procedures/ million inhabitants increased from 85.6 in 2015 to 95.8 in 2016 and 2017, and to 108.6 in 2018. Regarding ablation centers per million inhabitants in 2018, the highest density was recorded in Japan (5.5) and the lowest in Pakistan (0.01) and Philippines (0.04).

#### 4.3 Atrial fibrillation (AF) catheter ablation

We had the data of AF ablation from 16 countries and regions this year. In 2018, AF ablation procedures increased almost in all countries. Japan was still the country with the highest number of AF ablation procedures (59000 cases). As shown in Table 2, the AF ablation rate per million inhabitants was increased from 426.2 to 466.4 in Japan, which was the highest among APHRS member countries and regions. Pakistan (0.1), Myanmar(0.2) and Philippines (0.2) were the countries with the lowest AF ablation rate. Regarding the ratio of AF ablation/total ablation, there was also a large gap among 16 countries and regions, with highest ratio of AF ablation/total ablation in Japan (73.8%), and lowest AF ablation ratio in Myanmar (1.15%). And the AF ablation ratio was 39.6% in Brunei, 2.72% in India, 7.6% in Indonesia, 12.3% in Malaysia, 5.41% in Mongolia, 1.19% in Pakistan, 37.1% in South Korea, 5.0% in Thailand, 13.1% in Philippines, 24.5% in Taiwan, 25.7% in Singapore, 2.9% in Vietnam, 31.87% in Mainland China and 32.6% in New Zealand.

## 5 Conclusion and future work

This edition of APHRS White book had made a great progress with collection of data from 19 APHRS countries and regions although some data were not available. Primary analysis of these data showed a growing trend in arrhythmia interventional treatment in most Asia-Pacific countries and regions. However, there is still a great gap between Asia and Western countries. These data also highlight significant inequalities covering all arrhythmia interventional therapies in Asia-Pacific countries. The overview of these data indicated that more supervision, cardiac education training and guideline implementation are needed to promote the development of arrhythmia interventional therapy. The APHRS White Book needs indispensable support and participation of all member countries in Asia-Pacific regions. The APHRS White book may serve as motivation for these countries to adopt a systematic approach to key data on arrhythmia therapy in the future.

Table 1. The CIEDs implantation rates and implanting centers per million inhabitants for the year 2018 in 19 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	59.3	0.8	3.2	3.2	0.3
Brunei	170.5	4.5	70.5	29.5	4.5
Cambodia	13.4	0.2	0.1	No data	0.1
Hong Kong	261.8	No data	35.8	23.9	No data
India	33.0	0.8	3.0	2.2	0.3
Indonesia	6.1	0.2	0.2	0.2	0.1
Japan	484.1	No data	53.5	37.8	No data
Malaysia	23.3	1.2	7.9	5.5	0.6
Mongolia	51.2	0.6	1.5	0.9	0.3
Myanmar	12.0	0.2	0.4	0.2	0.1
New Zealand	534.5	2.8	131.6	66.7	1.6
Pakistan	22.6	0.2	1.9	1.9	No data
Philippines	9.7	0.7	0.7	0.1	0.1
Singapore	155.1	1.1	69.9	32.6	1.1
South Korea	105.7	No data	30.1	5.3	No data
Sri Lanka	102.2	0.5	3.8	1.6	0.4
Taiwan	285.5	4.7	34.6	13.2	3.5
Thailand	55.8	No data	13.7	5.5	No data
Vietnam	33.6	4.5	2.0	1.0	0.2

Table 2 The ablation procedure rate and centers per million inhabitants for the year 2018 in 18 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 s
PR. China	108.6	0.63	34.6	0.31	31.87%
Brunei	338.6	No data	134.1	2.27	39.6%
Cambodia	12.4	0.06	No data	No data	No data
India	5.8	0.05	0.2	0.02	2.72%

Indonesia	3.3	0.06	0.3	0.03	7.61%
Japan	632.4	5.53	466.4	3.95	73.75%
Malaysia	25.4	0.15	3.1	0.15	12.29%
Mongolia	22.8	0.31	1.2	0.31	5.41%
Myanmar	17.8	0.09	0.2	0.02	1.15%
New Zealand	349.9	1.62	114.2	0.81	32.64%
Pakistan	7.1	0.01	0.1	0.01	1.19%
Philippines	1.3	0.04	0.2	0.04	13.14%
Singapore	168.6	0.53	43.3	0.35	25.66%
South Korea	186.6	0.78	69.2	0.72	37.07%
Sri Lanka	41.1	0.23	No data	No data	No data
Taiwan	214.9	1.61	52.6	0.64	24.48%
Thailand	38.2	0.26	1.9	No data	4.95%
Vietnam	36.1	0.22	1.0	0.07	2.90%

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