Preface

The APHRS was founded in 2008 with the goal of establishing infrastructure in Asia-Pacific countries for basic and clinical research in the field of arrhythmia, in order to promote multinational research, and to provide systematic education opportunities for young researchers and clinicians who hope to specialize in this field.

In pursuit of this goal, the APHRS developed a White Book in 2010, collecting extensive basic statistical data and other information on the current status of interventional therapies for cardiac arrhythmia in Asia-Pacific countries, the need for which has been sorely felt in the region for years.

Adoption of interventional therapies for cardiac arrhythmia has developed rapidly in the Asia-Pacific region in recent decades, accompanied by rapid growth of electrophysiological procedures and implantations of cardiac implantable electronic devices (CIEDs) in most Asia-Pacific countries. However, significant inequalities exist in healthcare in general across Asian countries and regions and in treatment of cardiac arrhythmia specifically, which punctuates the importance and the necessity for the healthcare community to share, recognize, and communicate within itself the data and information relating to 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 arrhythmia, but also improve healthcare and reduce inequities for patients across Asia-Pacific countries and regions.

The APHRS White Book reports the most updated and comprehensive information on current situation 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, obstacles to guideline implementation, and more. We first presented such data across 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

6 years, the APHRS White Book has gained increasing attention from researchers and clinicians across Asia-Pacific countries and regions.

This year, my colleagues and I are proud to the Sixth Edition of the APHRS White Book. This new edition presents data from 19 countries and regions. As always, 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 or the data is 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 collect data on arrhythmia therapies in each country. My fellow members and I hope for more Asia-Pacific countries and regions to participate in the Seventh edition of APHRS White Book.

With the release of this Sixth Edition of the APHRS White Book, the APHRS appreciates the effort made by all authors, chairs and co-chairs from each of individual national HRS working groups, with special thanks to my team, for their devotion and hard work on the APHRS White Book.

Jonathan Kalman
President of APHRS (2018)

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 Sixth edition of the APHRS White Book. I owe particular thanks to the current president of APHRS, Professor Jonathan Kalman, 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, 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, who performed secondary research to verify and establish the quantitative and qualitative information contained in the book.

Shu Zhang, MD, PhD, FHRS, FESC
Chief Editor of the APHRS White Book

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Table of Contents

Country/Region: PR. China

1. Statistics

	2014	2015	2016	2017
Population(thousand)[1]	1367820	1367820	1382710	1396982
Hospitals	25860	25906	27587	31056
Beds(per 100,000 population) [2]	482.59	482.59	511.00	511.00
Physicians(per 1,000 population)[2]	1.74	1.74	2.21	2.21
Nurses(per 1,000 population)[2]	2.20	2.20	2.36	2.36
GDP (US$, billions)[3]	10,356.51	10,982.829	11,218.281	13173.585
Total expenditure on health as % GDP[2]	5.55%	5.55%	6.0%	6.2%
Government expenditure on health as %	30.0%	30.0%	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

1. www.census.gov
2. www.who.int
3. www.imf.org
4. www.stats.gov.cn

2. Pacemaker

	2014	2015	2016	2017
Total Pacemakers	59735	65785	73080	76717
New implants	48273	57683	62508	63312
Replacements	8305	8102	10572	13405
Single-chamber	17199	20393	21066	20762
Dual-chamber	35856	45392	51588	55955
Sick sinus syndrome	27294	26253	37202	38791
AV block	21262	21177	29107	31122
Implanting Centers	963	955	995	1055
Implanting Physicians	3000	3000	3000	3000
National Registry	☑	☑	☑	☑

3. Cardiac resynchronization therapy

	2014	2015	2016	2017
Total CRTs	2753	3092	3560	4138
CRT-P	1057	1330	1426	1633
CRT-P new implants	754	1052	1095	1135
CRT-P replacements/upgrade	180	278	331	498
CRT-D	1234	1762	2078	2505
CRT-D new implants	873	1456	1609	1993
CRT-D replacements/upgrade	254	306	469	512
Ischemic	528	866	1188	1319
Non-ischemic	1571	2226	2372	2819
Implanting Centers	383	374	396	403
Implanting Physicians	3000	3000	3000	3000
National Registry	☑	☑	☑	☑

4. Implantable cardioverter defibrillator

	2014	2015	2016	2017
Total ICDs	2333	2851	3317	4092
ICD new implants	1864	2601	2986	3541
ICD replacements	199	250	331	551
Single-chamber	1295	1939	2183	2550
Dual-chamber	622	912	1134	1542
Primary prevention	894	1197	1693	1821
Secondary prevention	1022	1654	1624	2271
Implanting Centers	368	363	408	433
Implanting Physicians	3000	3000	3000	3000
National Registry	☑	☑	☑	☑

5. Interventional electrophysiology

	2014	2015	2016	2017
Ablation procedures	101063	117021	132504	133897
SVT ablation procedures	54481	53176	73702	80809
AVNRT	27036	26916	36708	40874
AVRT/WPW	21653	20383	28318	28885
AFL (RA isthmus dependent)	3136	3074	4734	5903
AT	2656	2803	3942	5147
VT/VPC	494	-	-	-
Idiopathic	476	-	-	-
Structural	18	-	-	-
AF ablation procedures	17352	24545	30574	36615
Ablation centers	773	759	805	863
AF ablation centers	390	341	383	420
Structural VT ablation centers	-	-	-	-
Ablation physicians	2000	-	-	2000
AF ablation physicians	-	-	-	-
Structural VT ablation physicians	-	-	-	-
National Registry	☑	☑	☑	☑

6. Management

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

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

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

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

7. Source

Chinese Society of Pacing and Electrophysiology (CSPE)

Country/Region: Brunei Darussalam

1. Statistics

	2014	2015	2016	2017
Population (thousand)[1]	412	417	420	421
Hospitals	6	6	6	6
Beds	999*	1143*	1165*	
Physicians	700	739	739	
Nurses	2734	2756	2742	
GDP (US$, billions)	15.6	12.8	11.4	12.1
Total expenditure on health as % GDP	1.72	2.17	2.22	
Government expenditure on health (US$)	269,000,000	278,000,000	-	
Insured citizens (%)	-	-	-	
SCD patients	-	-	-	
Heart failure patients	-	-	-	
AF patients	-	-	-	

* excludes beds in private hospitals

2. Pacemaker

	2014	2015	2016	2017
Total Pacemakers	40	69	65	52
New implants	33	55	52	41
Replacements	7	14	13	11
Single-chamber	8	11	17	12
Dual-chamber	32	58	48	40
Sick sinus syndrome	-	-	-	-
AV block	-	-	-	-
Implanting Centers	2	2	2	2
Implanting Physicians	3	5	5	5
National Registry	☐	☐	☐	☐

	2014	2015	2016	2017
SSS	21	41	43	24
AVN	16	24	20	26
Bi Nodal	3	4	2	2
Others (VVS)	1			

3. Cardiac resynchronization therapy

	2014	2015	2016	2017
Total CRTs	19	16	14	16
CRT-P	4	2	0	6
CRT-P new implants	4	2	0	2
CRT-P replacements/upgrade	0	0	0	4
CRT-D	15	14	14	10
CRT-D new implants	8	6	5	5
CRT-D replacements/upgrade	7	8	9	5
Ischemic	5	2	7	3
Non-ischemic	10	12	7	13
Implanting Centers	2	2	2	2
Implanting Physicians	2	2	2	5
National Registry	☐	☐	☐	☐

*exclude CRT-P for ischemic & non ischemic.

4. Implantable cardioverter defibrillator

	2014	2015	2016	2017
Total ICDs	13	26	14	18
ICD new implants	12	23	13	14
ICD replacements	1	3	1	4
Single-chamber	0	2	0	3
Dual-chamber	13	24	14	15
Primary prevention	7	12	10	16
Secondary prevention	6	14	4	2
Implanting Centers	2	2	2	2
Implanting Physicians	2	5	5	5
National Registry	☐	☐	☐	☐

5. Lead Extraction

Lead extractions procedures and number of centers that performed lead extraction

	2014	2015	2016	2017
Total lead extraction procedures	2	4	0	3
Hospitals performed lead extraction	1	1	1	1
Cardiologists performing lead extraction	1	1	1	1
Surgeons performing lead extraction	0	0	0	0
National Registry	☐	☐	☐	☐

6. Interventional electrophysiology

	2014	2015	2016	2017
Ablation procedures	94	103	109	103
SVT ablation procedures	18	24	26	32
AVNRT	-	13	14	19
AVRT/WPW	-	3	6	4
AFL(RA isthmus dependent)	-	4	5	1
AT	-	-	5	8
VT/VPC	-	-	4	15
Idiopathic	-	-		9
Structural	-	-		6
AF ablation procedures	76	79	52	56
Ablation centers	-	-	-	-
AF ablation centers	1	1	1	1
Structural VT ablation centers	1	1	1	1
Ablation physicians	-	-	-	-
AF ablation physicians	1	2	2	2
Structural VT ablation physicians	1	1	1	1
National Registry	☐	☐	☐	☐

7. Management

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

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

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

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

8. Source

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

	2014	2015	2016	2017
Population(thousand)[1]	-	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

2. Pacemaker

	2014	2015	2016	2017
Total Pacemakers	125	161	211	212
New implants	120	155	202	200
Replacements	5	6	9	12
Single-chamber	59	81	95	93
Dual-chamber	61	74	107	119
Sick sinus syndrome	73	69	95	93
AV block	47	86	107	119
Implanting Centers	1	1	2	3
Implanting Physicians	1	1	1	3
National Registry	☐	☐	☐	☐

3. Cardiac resynchronization therapy

	2014	2015	2016	2017
Total CRTs	2	2	3	4
CRT-P	2	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	1	2	3
Implanting Physicians	1	1	1	3
National Registry	☐	☐	☐	☐

4. Implantable cardioverter defibrillator

	2014	2015	2016	2017
Total ICDs	-	4	4	5
ICD new implants	2	4	4	5
ICD replacements	-	-	-	0
Single-chamber	2	2	2	1
Dual-chamber	-	2	2	4
Primary prevention	-	-	-	-
Secondary prevention	-	4	4	5
Implanting Centers	1	1	1	3
Implanting Physicians	1	1	1	3
National Registry	☐	☐	☐	☐

5. Lead Extraction

Lead extractions procedures and number of centers that performed lead extraction

	2014	2015	2016	2017
Total lead extraction procedures				1
Hospitals performed lead extraction				1
Cardiologists performing lead extraction				1
Surgeons performing lead extraction				0
National Registry	☐	☐	☐	☐

6. Interventional electrophysiology

	2014	2015	2016	2017
Ablation procedures	101	152	185	192
SVT ablation procedures				
AVNRT	25	32	42	43
AVRT/WPW	0	0	0	7
AFL(RA isthmus dependent)	27	35	60	58
AT	26	59	59	54
VT/VPC	0	0	0	30
Idiopathic	23	26	24	30
Structural	3	0	0	0
AF ablation procedures	0	0	1	0
Ablation centers	-	-	-	0
AF ablation centers	1	1	1	0
Structural VT ablation centers	-	-	-	0
Ablation physicians	1	1	1	1
AF ablation physicians	-	-	-	0
Structural VT ablation physicians	-	-	-	0
National Registry	☐	☐	☐	☐

7. Management

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

Payment (%)	Pacemaker	ICD	CRT	Ablation
Government	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	☐	☐	☐	√	☐
Lack of reimbursement, limited financial resources	☐	☐	☐	√	☐
Lack of referral	☐	☐	√	☐	☐
Lack of trained personnel	☐	☐	☐	√	☐
Low awareness of guidelines	☐	☐	√	☐	☐
Lack of operators	☐	☐	☐	√	☐

8. Source

Name of national working group or arrhythmia body

Country/Region: Hong Kong SAR

1. Statistics

	2014	2015	2016	2017
Population (thousand)[1]	7,266	7,324	7,375	7392
Hospitals	53	53	53	54
Beds	36,965	38,287	39,090	39683
Physicians	13,417	13,726	14,013	14290
Nurses	35,821	37,670	39,178	40505
GDP (US$, billions)	274.948	307.3	308.28	341.15
Total expenditure on health as % GDP	2.64%	2.95%	3.23%	2.33%
Government expenditure on health (US$)	7,269mil	9,051 mil	9,949 mil	7936mil
Insured citizens (%)	-	-	-	
SCD patients	-	-	-	
Heart failure patients	-	-	-	
AF patients	-	-	-	

1. www.census.gov

2. Pacemaker

	2014	2015	2016	2017
Total Pacemakers	762	695	752	1513
New implants	620	594	625	1191
Replacements	142	101	127	322
Single-chamber	-	-	-	-
Dual-chamber	-	-	-	-
Sick sinus syndrome	-	-	-	-
AV block	-	-	-	-
Implanting Centers	-	-	-	-
Implanting Physicians	-	-	-	-
National Registry	☐	☐	☐	☐

3. Cardiac resynchronization therapy

	2014	2015	2016	2017
Total CRTs	-	-	-	-
CRT-P	-	-	-	-
CRT-P new implants	-	-	-	-
CRT-P replacements/upgrade	-	-	-	-
CRT-D	-	-	-	-
CRT-D new implants	-	-	-	-
CRT-D replacements/upgrade	-	-	-	-
Ischemic	-	-	-	-
Non-ischemic	-	-	-	-
Implanting Centers	-	-	-	-
Implanting Physicians	-	-	-	-
National Registry	☐	☐	☐	☐

4. Implantable cardioverter defibrillator

	2014	2015	2016	2017
Total ICDs	110	102	174	142
ICD new implants	77	60	99	83
ICD replacements	33	42	75	59
Single-chamber	-	-	-	-
Dual-chamber	-	-	-	-
Primary prevention	-	-	-	-
Secondary prevention	-	-	-	-
Implanting Centers	-	-	-	-
Implanting Physicians	-	-	-	-
National Registry	☐	☐	☐	☐

5. Lead Extraction

Lead extractions procedures and number of centers that performed lead extraction

	2014	2015	2016	2017
Total lead extraction procedures	-	-	-	-
Hospitals performed lead extraction	-	-	-	-
Cardiologists performing lead extraction	-	-	-	-
Surgeons performing lead extraction	-	-	-	-
National Registry	☐	☐	☐	☐

6. Interventional electrophysiology

	2014	2015	2016	2017
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	☐	☐	☐	☐

7. Management

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

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

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

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

8. Source

Name of national working group or arrhythmia body

Country/Region: India

1. Statistics

	2014	2015	2016	2017
Population (bn)	1.267[i]	1.311	1.326	1.342
Urban Hospitals (Govt. only)	14,432[ii]	-	-	-
Beds (Govt. only)	15,96,168[2]	-	-	-
Physicians	9,36,448[3]	-	-	-
Nurses	25,30,275[3]	-	-	-
GDP (US$ - billion)	2049.5[4]	-	2,250	2597
Total expenditure on health as % GDP	3.9%[4]	-	2.5%	2.5%
Government expenditure on health as %	21%[4]	-	-	-
Insured citizens (in Millions)	550	-	-	-
SCD patients[iii1] (in Thousands)	700[5]	-	NA	-
Heart failure patients[iv] (in Millions)	~4.6[6]	-	~8–10mn	-
AF patients (mn)	15.8	-	-	-

2. Pacemaker

	2014	2015	2016	2017
Total Pacemakers	32747	31230	35794	38700
New implants	80%	70%	75%	70%
Replacements	20%	30%	25%	30%
Single-chamber	18386	17066	19440	22200
Dual-chamber	14361	14161	16354	16500
Sick sinus syndrome[v]	25%	20%	25%	20%
AV block	75%	80%	75%	80%
Implanting Centers	930	945	970	1120
Implanting Physicians	1535	1540	1560	1560
National Registry	☐	☐	☐	☐

1. http://www.worldometers.info/world-population/india-population/
2. https://data.gov.in/catalog/number-government-hospitals-and-beds-rural-and-urban-areas
3. http://statisticstimes.com/economy/gdp-of-india.php.
4. https://www.ihs.com/country-industry-forecasting.html?ID=1065985237
5. http://www.japi.org/december_2014/006_ra_sudden_cardiac_death.pdf.
6. http://csiheartfailure2015.org/

3. Cardiac resynchronization therapy

	2014	2015	2016	2017
Total CRTs	2935	2147	2728	2500
CRT-P	1005	784	944	1000
CRT-P new implants	88%	88%	88%	80%
CRT-P replacements/upgrade	12%	12%	12%	20%
CRT-D	951	1363	1784	1500
CRT-D new implants	88%	85%	82%	75%
CRT-D replacements/upgrade	12%	15%	18%	25%
Ischemic	65%	-	-	
Non-ischemic	35%	-	-	
Implanting Centers	315	315	345	345
Implanting Physicians	380	380	395	395
National Registry	☐	☐	☐	☐

4. Implantable cardioverter defibrillator

	2014	2015	2016	2017
Total ICDs	2540	3061	3664	3500
ICD new implants	-	-	85%	75%
ICD replacements	-	-	15%	25%
Single-chamber	1755	1907	2464	2300
Dual-chamber	785	1154	1200	1200
Primary prevention	30%	30%	40%	20%
Secondary prevention	70%	70%	60%	80%
Implanting Centers	350	355	~380	400
Implanting Physicians	475	484	500	515
National Registry	☐	☐	☐	☐

5. Lead Extraction

Lead extractions procedures and number of centers that performed lead extraction

	2014	2015	2016	2017
Total lead extraction procedures	30	-	-	-
Hospitals performed lead extraction	5	-	-	-
Cardiologists performing lead extraction	6	-	-	-
Surgeons performing lead extraction	1	-	-	-
National Registry	☐	☐	☐	☐

6. Interventional electrophysiology

	2014	2015	2016	2017
Ablation procedures	16349	19370	22900	
SVT ablation procedures	10555	12033	14400	
AVNRT	5128	5846	7500	
AVRT/WPW	3618	4125	5000	
AFL (RA isthmus dependent)	713	813	900	
AT	1096	1249	1000	
VT/VPC	4792	6035	7100	
Idiopathic	1638	1998	3000	
Structural	3154	4037	4100	
AF ablation procedures	1002	1303	1400	
Ablation centers	143	160	176	
AF ablation centers	24	28	30	
Structural VT ablation centers	78	89	93	
Ablation physicians	102	109	135	
AF ablation physicians	33	40	41	
Structural VT ablation physicians	63	72	83	
National Registry	☐	☐	☐	

All EP data – Company internal and Market data

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	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	☐	☐	☑	☐	☐
Lack of reimbursement, limited financial resources	☐	☐	☐	☑	☐
Lack of referral	☐	☐	☑	☐	☐
Lack of trained personnel	☐	☐	☐	☑	☐
Low awareness of guidelines	☐	☐	☐	☑	☐
Lack of operators	☐	☐	☑	☐	☐

8. Source

Name of national working group or arrhythmia body

Country/Region: Indonesia

1. Statistics

	2014	2015	2016	2017
Population (thousand)[1]	252,101	255.461	260,580	261890
Hospitals	2,486	2,406*	2,147	2773
Beds	269,791	269,791	-	353136
Physicians	157,393	157,393	186,091	192879
Nurses	281,111	281,111	-	345276
GDP (US$, billions)	870.00	861.93	861.9	1015.539
Total expenditure on health as % GDP	-	2.8	2.9	3.4
Government expenditure on health (US$)	96.54	94.49	299	124
Insured citizens (%)	-	78.0	65	72.9
SCD patients	-	-	-	-
Heart failure patients	-	-	-	-
AF patients	-	-	-	-

2. www.census.gov

2. Pacemaker

	2014	2015	2016	2017
Total Pacemakers	717	707	1017	1049
New implants	688	657	972	969
Replacements	29	50	45	80
Single-chamber	436	405	541	693
Dual-chamber	281	302	476	356
Sick sinus syndrome	341	393	350	381
AV block	376	314	667	668
Implanting Centers	12	16	40	65
Implanting Physicians	23	76	86	111
National Registry	☐	☐	☐	☐

3. Cardiac resynchronization therapy

	2014	2015	2016	2017
Total CRTs	55	67	81	63
CRT-P	40	32	34	29
CRT-P new implants	40	27	30	21
CRT-P replacements/upgrade	0	4	4	8
CRT-D	15	35	47	34
CRT-D new implants	14	28	41	28
CRT-D replacements/upgrade	1	7	6	6
Ischemic	37	25	38	24
Non-ischemic	18	12	43	39
Implanting Centers	4	16	10	8
Implanting Physicians	11	23	16	15
National Registry	☐	☐	☐	☐

4. Implantable cardioverter defibrillator

	2014	2015	2016	2017
Total ICDs	19	24	38	45
ICD new implants	19	21	28	38
ICD replacements	0	3	10	7
Single-chamber	18	16	28	40
Dual-chamber	0	8	10	5
Primary prevention	12	2	8	15
Secondary prevention	6	43	30	30
Implanting Centers	7	15	10	11
Implanting Physicians	23	23	20	19
National Registry	☐	☐	☐	☐

5. Lead Extraction

Lead extractions procedures and number of centers that performed lead extraction

	2014	2015	2016	2017
Total lead extraction procedures	5	7	7	13
Hospitals performed lead extraction	2	2	5	9
Cardiologists performing lead extraction	2	2	8	17
Surgeons performing lead extraction	0	0	0	2
National Registry	☐	☐	☐	☐

6. Interventional electrophysiology

	2014	2015	2016	2017
Ablation procedures	416	491	740	760
SVT ablation procedures	174	268	395	343
AVNRT	75	115	190	210
AVRT/WPW	48	107	138	133
AFL (RA isthmus dependent)	31	31	48	18
AT	20	15	19	41
VT/VPC	12	147	268	296
Idiopathic	80	47	247	249
Structural	4	8	21	47
AF ablation procedures	39	65	77	55
Ablation centers	6	9	11	19
AF ablation centers	3	5	6	7
Structural VT ablation centers	2	2	6	7
Ablation physicians	-	22	18	23
AF ablation physicians	-	7	14	18
Structural VT ablation physicians	-	5	10	17
National Registry	☐	☐	☐	☐

7. Management

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

Payment (%)	Pacemaker	ICD	CRT	Ablation
Government	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	☐	☑	☐	☐	☐
Lack of reimbursement, limited financial resources	☐	☐	☐	☐	☐
Lack of referral	☐	☐	☑	☐	☐
Lack of trained personnel	☐	☐	☑	☐	☐
Low awareness of guidelines	☐	☐	☑	☐	☐
Lack of operators	☐	☐	☑	☐	☐

8. Source

Indonesian Heart Rhythm Society (InaHRS)

Country/Region: Japan

1. Statistics

	2014	2015	2016	2017
Population (thousand)[1]	127083	126990	126933	126706
Hospitals (per 100,000 population)	6.71	6.69	6.68	6.62
Beds	1691450	1611026	1559901	1652102
Physicians (per 1,000 population) [2]	2.38	2.39	2.45	
Nurses (per 1,000 population) [2]	7.99	8.41	8.56	
GDP (US$, billions) [3]	5008.57	4990.57	4758.75.	4884.49
Total expenditure on health as % GDP [2]	10.8	10.9	10.9	10.9
Government expenditure on health as % [2]	-	-	-	
Insured citizens (%)	-	-	-	
SCD patients	-	-	-	
Heart failure patients	1200000	1254300	1254300	
AF patients	1000000	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=
5http://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/529000000000000/106
7 http://www.mhlw.go.jp/toukei/saikin/hw/k-iryohi/13/dl/kekka.pdf
8http://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

	2014	2015	2016	2017
Total Pacemakers	57678	57337	58693	60137
New implants	39398	39292	40318	41895
Replacements	18280	17935	18375	18242
Single-chamber	11304	11109	10928	11734
Dual-chamber	45325	46118	47765	48403
Sick sinus syndrome	-	-	-	
AV block	-	-	-	
Implanting Centers	-	-	-	
Implanting Physicians	-	-	-	
National Registry	☐	☐	☐	☐

3. Cardiac resynchronization therapy

	2014	2015	2016	2017
Total CRTs	4405	4575	4722	4782
CRT-P	1049	1167	1188	1213
CRT-P new implants	-	729	817	922
CRT-P replacements/upgrade	-	438	371	291
CRT-D	3356	3408	3534	3569
CRT-D new implants	2139	2147	2179	2399
CRT-D replacements/upgrade	1217	1261	1355	1170
Ischemic	-	-	-	-
Non-ischemic	-	-	-	-
Implanting Centers	-	-	-	-
Implanting Physicians	-	-	-	-
National Registry	☐	☐	☐	☐

4. Implantable cardioverter defibrillator

	2014	2015	2016	2017
Total ICDs	5830	5780	6367	6691
ICD new implants	3650	3822	4208	4288
ICD replacements	2108	1958	2159	2403
Single-chamber	1440	1345	1627	1931
Dual-chamber	4289	4435	4740	4760
Primary prevention	-	-	-	-
Secondary prevention	-	-	-	-
Implanting Centers	-	-	-	-
Implanting Physicians	-	-	-	-
National Registry	☐	☐	☐	☐

5. Lead Extraction

Lead extractions procedures and number of centers that performed lead extraction

	2014	2015	2016	2017
Total lead extraction procedures	429	500	524	588
Hospitals performed lead extraction	35	58	66	96
Cardiologists performing lead extraction	32	52	59	87
Surgeons performing lead extraction	3	6	7	9
National Registry	☐	☐	☐	☐

6. Interventional electrophysiology

	2014	2015	2016	2017
Ablation procedures	59000	63000	65000	75000
SVT ablation procedures	15000	14500	15000	15000
AVNRT	-	-	-	-
AVRT/WPW	-	-	-	-
AFL (RA isthmus dependent)	-	-	-	-
AT	-	-	-	-
VT/VPC	6000	5500	6000	6000
Idiopathic	-	-	-	-
Structural	-	-	-	-
AF ablation procedures	38000	43000	45000	54000
Ablation centers	490	480	690	700
AF ablation centers	400	400	450	500
Structural VT ablation centers	-	-	-	-
Ablation physicians	1800	1800	2000	2200
AF ablation physicians	1200	1300	1500	1700
Structural VT ablation physicians	-	-	-	-
National Registry	☐	☐	☐	☐

7. Management

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

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

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

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

8. Source

Name of national working group or arrhythmia body

Japanese Heart Rhythm Society

Country/Region: Malaysia

1. Statistics

	2014	2015	2016	2017
Population (Thousand)	30,097.9	30, 331.0	31, 700.00	32042.00
Hospitals	142	145	146	147
Beds	40,126	42,056	42,100	42200
Physicians	51,453	53,132	53,225	53300
Nurses	92,681	103,465	104,500	104900
GDP (RM)	44,748	46,812	48, 918	49890
Total expenditure on health as % GDP	4.53	4.51	4.5	4.5
Government expenditure on health as %	51.96	50.12	50.2	50.2
Insured citizens (%)	-	-	-	-
SCD patients	-	-	-	-
Heart failure patients	-	-	-	-
AF patients	-	-	-	-

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

2. Pacemaker

	2014	2015	2016	2017
Total Pacemakers	659	755	460	640
New implants	482	569	345	516
Replacements	177	186	115	124
Single-chamber	285	299	155	159
Dual-chamber	374	456	305	481
Sick sinus syndrome	172	218	218	290
AV block	216	356	235	350
Implanting Centers	35	38	38	38
Implanting Physicians	101	122	122	122
National Registry	☑	☑	☑	☑

3. Cardiac resynchronization therapy

	2014	2015	2016	2017
Total CRTs	173	203	163	171
CRT-P	78	102	53	40
CRT-P new implants	45	68	23	26
CRT-P replacements/upgrade	33	34	30	14
CRT-D	95	101	110	128
CRT-D new implants	58	77	63	93
CRT-D replacements/upgrade	37	24	47	35
Ischemic	102	131	77	72
Non-ischemic	71	72	86	97
Implanting Centers	13	16	16	16
Implanting Physicians	24	31	31	31
National Registry	☑	☑	☑	☑

4. Implantable cardioverter defibrillator

	2014	2015	2016	2017
Total ICDs	143	201	158	213
ICD new implants	108	167	88	183
ICD replacements	35	34	90	30
Single-chamber	96	135	117	154
Dual-chamber	47	66	41	59
Primary prevention	49	65	69	80
Secondary prevention	94	136	89	133
Implanting Centers	18	21	21	21
Implanting Physicians	24	28	28	28
National Registry	☑	☑	☑	☑

5. Lead Extraction

Lead extractions procedures and number of centers that performed lead extraction

	2014	2015	2016	2017
Total lead extraction procedures	-	16	12	10
Hospitals performed lead extraction	-	3	2	5
Cardiologists performing lead extraction	-	6	6	9
Surgeons performing lead extraction	-	3	5	2
National Registry	☐	☐	☑	☑

6. Interventional electrophysiology

	2014	2015	2016	2017
Ablation procedures	612	793	664	979
SVT ablation procedures	328	362	443	647
AVNRT	201	226	193	283
AVRT/WPW	127	136	49/63	182
AFL (RA isthmus dependent)	94	86	92	124
AT	54	51	46	49
VT/VPC	116	181	127	232
Idiopathic	63	121	92	86
Structural	53	60	35	137
AF ablation procedures	89	113	94	94
Ablation centers		5	5	5
AF ablation centers	2	4	5	5
Structural VT ablation centers	1	2	2	2
Ablation physicians	7	9	5	12
AF ablation physicians	5	6	5	12
Structural VT ablation physicians	4	4	5	12
National Registry	☑	☑	☑	☑

7. Management

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

Payment (%)	Pacemaker	ICD	CRT	Ablation
Government	80	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	☐	☑	☐	☐	☐
Lack of reimbursement, limited financial resources	☐	☐	☐	☐	☑
Lack of referral	☐	☐	☐	☑	☐
Lack of trained personnel	☐	☐	☐	☑	☐
Low awareness of guidelines	☐	☐	☑	☐	☐
Lack of operators	☐	☐	☐	☑	☐

8 Data source

UMMC, Penang Hospital Heart Centre, IJN, UiTM, PPUKM, SGH, QEH2, Pantai Medical Centre

Country/Region: Mongolia

1. Statistics

	2014	2015	2016	2017
Population (thousand)[1]	2,995.9	3,057.8	3027.4	3177.9
Hospitals	13	13	13	13
Beds	20,576	21,720	22960	23897
Physicians	9,300	9,563	10000	10576
Nurses	10,948	11,357	11486	11939
GDP (US$, billions)	1.226	1.18	1.118	1.149
Total expenditure on health as % GDP	-	-	-	-
Government expenditure on health (US$)	3,951,611.3	3,622,815	3808000.0	3592390.4
Insured citizens (%)	-	-	-	-
SCD patients	-	-	-	-
Heart failure patients	-	-	-	-
AF patients	-	-	-	-

[1], www.census.gov

2. Pacemaker

	2014	2015	2016	2017
Total Pacemakers	-	113	123	115
New implants	-	93	118	112
Replacements	-	20	5	3
Single-chamber	-	-	-	-
Dual-chamber	-	-	-	-
Sick sinus syndrome	-	-	-	-
AV block	-	-	-	-
Implanting Centers	-	1	1	1
Implanting Physicians	-	1	3	3
National Registry	☐	☐	☐	☐

3. Cardiac resynchronization therapy

	2014	2015	2016	2017
Total CRTs	-	1	3	2
CRT-P	-	1	3	2
CRT-P new implants	-	1	3	2
CRT-P replacements/upgrade	-	-	-	-
CRT-D	-	-	-	-
CRT-D new implants	-	-	-	-
CRT-D replacements/upgrade	-	-	-	-
Ischemic	-	-	-	-
Non-ischemic	-	1	3	2
Implanting Centers	-	1	1	1
Implanting Physicians	-	1	1	1
National Registry	☐	☐	☐	☐

4. Implantable cardioverter defibrillator

	2014	2015	2016	2017
Total ICDs	-	-	-	2
ICD new implants	-	-	-	2
ICD replacements	-	-	-	-
Single-chamber	-	-	-	2
Dual-chamber	-	-	-	-
Primary prevention	-	-	-	-
Secondary prevention	-	-	-	2
Implanting Centers	-	-	-	1
Implanting Physicians	-	-	-	2
National Registry	☐	☐	☐	☐

5. Lead Extraction

Lead extractions procedures and number of centers that performed lead extraction

	2014	2015	2016	2017
Total lead extraction procedures	-	-	-	-
Hospitals performed lead extraction	-	-	-	-
Cardiologists performing lead extraction	-	-	-	-
Surgeons performing lead extraction	-	-	-	-
National Registry	☐	☐	☐	☐

6. Interventional electrophysiology

	2014	2015	2016	2017
Ablation procedures	-	-	38	49
SVT ablation procedures	-	-	38	44
AVNRT	-	-	18	20
AVRT/WPW	-	-	20	21
AFL(RA isthmus dependent)	-	-	-	2
AT	-	-	-	3
VT/VPC	-	-	-	3
Idiopathic	-	-	-	3
Structural	-	-	-	-
AF ablation procedures	-	-	-	2
Ablation centers	-	-	1	1
AF ablation centers	--	-	1	1
Structural VT ablation centers	-	-	1	1
Ablation physicians	-	-	1	1
AF ablation physicians	-	-	1	1
Structural VT ablation physicians	-	-	1	1
National Registry	☐	☐	☐	☐

7. Management

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

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

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

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

8. Source

Name of national working group or arrhythmia body

State Third Central Hospital, National Cardiac Center

Mongolian Heart Rhythm Society

Country/Region: Myanmar

1、Statistics

	2015	2016	2017
Population (thousand)	51480	51480	55000
Hospitals (implanting)	8	8	8
Beds	-	-	
Physicians	-	-	
Nurses	-	-	
GDP (US$, billions)		-	64.33
Total expenditure on health as % GDP		-	1.0
Government expenditure on health as %		-	45.9
Insured citizens (%)	-	-	
SCD patients	-	-	
Heart failure patients	-	-	
AF patients	-	-	

2. Pacemaker

	2015	2016	2017
Total pacemakers	485	515	554
New implants	475	495	529
Replacements	10	20	25
Single-chamber	470	474	513
Dual-chamber	15	41	41
Sick sinus syndrome	218	249	273
AV block	257	266	281
Implanting Centers	8	8	8
Implanting Physicians	8	15	18
National Registry	☐	☐	☐

3. Cardiac resynchronization therapy

	2015	2016	2017
Total CRTs	18	4	10
CRT-P	6	2	5
CRT-P new implants	6	2	5
CRT-P replacements/ upgrade			
CRT-D	12	2	5
CRT-D new implants	12	2	
CRT-D replacements/upgrade			
Ischaemic	18	4	9
Non-ischaemic			1
Implanting Centers	2	3	4
Implanting physicians	2	3	15
National Registry	☐	☐	☐

4. Implantable cardioverter defibrillator

	2015	2016	2017
Total ICDs	16	21	33
ICD new implants	16	19	32
ICD replacements		2	1
Single-chamber	11	17	31
Dual-chamber	5	4	2
Primary prevention	0	5	8
Secondary prevention	16	16	25
Implanting Centers	3	4	4
Implanting physicians	3	4	15
National Registry	☐	☐	☐

5. Lead extraction

	2015	2016	2017
Total lead extraction procedure	-	-	-
Hospitals performed lead extraction	-	-	-
Cardiologists performing lead extraction	-	-	-
Surgeons performing lead extraction	-	-	-
National Registry	-	-	-

6. Interventional Electrophysiology

	2015	2016	2017
Ablation procedures	530	618	751
SVT ablation procedures	481	561	672
AVNRT	240	318	362
AVRT/WPW	237	223	282
AFL (RA isthmus dependent)	3	17	15
AT	1	3	13
VT/PVC	46	44	66
Idiopathic	46	44	62
Structural	-	-	4
AF ablation procedures	3	13	13
Ablation centers			4
AF ablation centers	1	1	1
Structural VT ablation centers	-	-	1
Ablation physicians			10
AF ablation physicians	1	1	1
Structural VT ablation physicians	-	-	1
National Registry	☐	☐	☐

7. 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	☐	☐	☑	☐	☐
Lack of reimbursement, limited financial resources	☐	☐	☐	☑	☐
Lack of referral	☐	☐	☑	☐	☐
Lack of trained personnel	☐	☐	☑	☐	☐
Low awareness of guidelines	☐	☐	☑	☐	☐
Lack of operators	☐	☐	☑	☐	☐

8. Source

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

Country/Region: New Zealand

1. Statistics

	2014	2015	2016	2017
Population (thousand)[1]	4550	4600	4693	4844
Hospitals *(includes every small hosp.)*	184	184	184	
Beds *(includes every small hosp.)*	27000	12880	10793	
Physicians	14808	14678	14700	
Nurses	45293	52729	53000	
GDP(US$, billions)[2]	191.7	173.75	185	
Total expenditure on health as % GDP[2]	9%	10%	10%	
Government expenditure on health as %[2]	77%	80%	80%	
Insured citizens (%)	30%	30%	30%	
SCD patients	3500	3500	3700	
Heart failure patients	25000	26000	30000	
AF patients	-	-	-	

2. www.census.gov
3. www.imf.org

2. Pacemaker

	2014	2015	2016	2017
Total Pacemakers	2240	2470	2492	2582
New implants	1817	2010	1933	2140
Replacements	423	460	526	441
Single-chamber	750	960	730	703
Dual-chamber	1490	1510	1598	1783
Sick sinus syndrome	-	-	-	
AV block	-	-	-	
Implanting Centers	12	12	12	14
Implanting Physicians	31	36	38	38
National Registry	☑	☑	☑	☑

3. Cardiac resynchronization therapy

	2014	2015	2016	2017
Total CRTs		210	309	325
CRT-P		90	150	38
CRT-P new implants	68	70	89	91
CRT-P replacements/upgrade	17	20	61	37
CRT-D		120	159	39
CRT-D new implants	79	100	107	75
CRT-D replacements/upgrade	19	20	52	46
Ischemic				
Non-ischemic				
Implanting Centers	6	6	6	6
Implanting Physicians	14	20	22	22
National Registry	☐	☐	☑	☑

4. Implantable cardioverter defibrillator

	2014	2015	2016	2017
Total ICDs	624	625	638	654
ICD new implants	499	500	448	459
ICD replacements	125	125	100	161
Single-chamber	-	-	-	
Dual-chamber	-	-	-	
Primary prevention	-	-	-	
Secondary prevention	-	-	-	
Implanting Centers	7	7	7	9
Implanting Physicians	14	18	22	22
National Registry	☐	☐	☑	☑

5. Lead Extraction

Lead extractions procedures and number of centers that performed lead extraction

	2014	2015	2016	2017
Total lead extraction procedures	-	32	33	
Hospitals performed lead extraction	-	2	2	2
Cardiologists performing lead extraction	-	3	3	3
Surgeons performing lead extraction	-	0 (support)	support	
National Registry	☐	☐	☐	

6. Interventional electrophysiology

	2014	2015	2016	2017
Ablation procedures	1267	1290	1482	1640
SVT ablation procedures	788	813	881	901
AVNRT	266	293	322	315
AVRT/WPW	194	182	151	133
AFL (RA isthmus dependent)	260	252	331	336
AT	68	86	77	97
VT/VPC	141	76	135	158
Idiopathic	78	40	94	
Structural	14	36	41	
AF ablation procedures	355	363	405	510
Ablation centers				
AF ablation centers	6	8	8	8
Structural VT ablation centers	4	4	4	4
Ablation physicians				
AF ablation physicians	8	9	12	14
Structural VT ablation physicians	7	9	12	14
National Registry	☐	☐	☐	

7. Management

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

Payment (%)	Pacemaker	ICD	CRT	Ablation
Government	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	☐	☐	☑	☐	☐
Lack of reimbursement, limited financial resources	☐	☑	☐	☐	☐
Lack of referral	☐	☐	☑	☐	☐
Lack of trained personnel	☐	☑	☐	☐	☐
Low awareness of guidelines	☐	☐	☑	☐	☐
Lack of operators	☐	☑	☐	☐	☐

8. Source

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

Country/Region: Pakistan

1. Statistics

	2014	2015	2016	2017
Population (million)[1]	182	182	182.5	182.7
Hospitals	-	-	-	-
Beds(per thousand)	0.6	0.6	0.6	0.6
Physicians	0.5 /1000	05/1000	05/1000	0.5/1000
Nurses	-	-	-	-
GDP (US$, billions)	246.88	246	247	247
Total expenditure on health as % GDP	3.2	3.5	3.5	3.8
Government expenditure on health (US$)	-	-	4%	4.5%
Insured citizens (%)	0.1%	0.1%	0.1%	1
SCD patients	-	-	-	-
Heart failure patients	-	-	-	-
AF patients	-	1%	0.5%	0.5%

4. www.census.gov

2. Pacemaker

	2014	2015	2016	2017
Total Pacemakers	2222	2700	3450	4030
New implants	2000	2400	3000	4000
Replacements	222	300	450	500
Single-chamber	70%	70%	80%	80%
Dual-chamber	30%	30%	20%	20%
Sick sinus syndrome	20%	20%	20%	26%
AV block	80%	80%	80%	74%
Implanting Centers	25	27	29	31
Implanting Physicians	50	62	70	100
National Registry	☐	☐	☐	☐

3. Cardiac resynchronization therapy

	2014	2015	2016	2017
Total CRTs	45	76	137	416
CRT-P	30	56	102	290
CRT-P new implants	-	-	97	290
CRT-P replacements/upgrade	-	3	5	16
CRT-D	-		35	
CRT-D new implants	15	20	35	110
CRT-D replacements/upgrade	-	-	-	-
Ischemic	90%	90%	90%	80%
Non-ischemic	10%	10%	10%	20%
Implanting Centers	4	5	6	8
Implanting Physicians	6	-	7	8
National Registry	☐	☐	☐	☐

4. Implantable cardioverter defibrillator

	2014	2015	2016	2017
Total ICDs	-	-	-	-
ICD new implants	100	112	150	350
ICD replacements				
Single-chamber	90%	90%	92%	85
Dual-chamber				
Primary prevention	20%	20%	18%	32%
Secondary prevention	80%	80%	82%	68%
Implanting Centers	5	6	8	9
Implanting Physicians	7	8	8	8
National Registry	☐	☐	☐	☐

5. Lead Extraction

Lead extractions procedures and number of centers that performed lead extraction

	2014	2015	2016	2017
Total lead extraction procedures	-	-	-	-
Hospitals performed lead extraction	-	-	-	-
Cardiologists performing lead extraction	-	-	-	-
Surgeons performing lead extraction	-	-	-	-
National Registry	☐	☐	☐	☐

6. Interventional electrophysiology

	2014	2015	2016	2017
Ablation procedures	-	-	-	-
SVT ablation procedures	-	765	870	1200
AVNRT	-	61%	63%	65%
AVRT/WPW	-	24%	25%	25%
AFL (RA isthmus dependent)	-	5%	5%	6%
AT	-	2%	7%	5%
VT/VPC	-	6%	8%	11%
Idiopathic	-	3%	7%	10%
Structural	-			
AF ablation procedures	-	5	10	20
Ablation centers	-	1	8	
AF ablation centers	-	1	2	2
Structural VT ablation centers	-	1	1	2
Ablation physicians	-	1		
AF ablation physicians	-	1	2	1
Structural VT ablation physicians	-	1	1	
National Registry	☐	☐	☐	☐

7. Management

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

Payment (%)	Pacemaker	ICD	CRT	Ablation
Government	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	☐	☐	☐	☑	☐
Lack of reimbursement, limited financial resources	☐	☐	☐	☑	Y
Lack of referral	☐	☐	☑	☐	☐
Lack of trained personnel	☐	☐	☑	☐	☐
Low awareness of guidelines	☐	☐	☑	☐	☐
Lack of operators	☐	☑	☐	☐	☐

8. Source

Pakistan Heart Rhythm Society

Country/Region: Philippines

1. Statistics

	2014	2015	2016	2017
Population (thousand) *	100,096	102,435	103,796	104918
Hospitals	1921	1974	1823	1436
Beds (per 100,000 population)	100	100	102	100
Physicians (per 1,000 population) **	1.5	1.15	1.16	1.16
Nurses (per 1,000 population) ***	6	6	6	24
GDP (US$, billions) ****	284.58	291.97	304.9	313.6
Total expenditure on health as % GDP	4.4%	4.7%	4.71	4.5%
Government expenditure on health as %	31.6%	34.3%	10.1	10.5%
Insured citizens (%)	80%	80%	33%	92%
SCD patients	-	43	-	-
Heart failure patients	-			1.6%
AF patients	-	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.tradingeconomics.com/philippines/gdp-growth-annual

2. Pacemaker

	2014	2015	2016	2017
Total Pacemakers	1528	1049	1225	649
New implants	677	913	973	609
Replacements	87	136	252	40
Single-chamber	395	523	584	308
Dual-chamber	369	526	637	336
Sick sinus syndrome	-	-	353	355
AV block	-	-	64	78
Implanting Centers	37	42	98	46
Implanting Physicians	100	95	160	51
National Registry	☐	☐	☐	☐

3. Cardiac resynchronization therapy

	2014	2015	2016	2017
Total CRTs	17	28	34	17
CRT-P	2	2	7	3
CRT-P new implants	0	2	2	6
CRT-P replacements/upgrade	2	0	0	2
CRT-D	15	26	26	12
CRT-D new implants	12	21	22	12
CRT-D replacements/upgrade	3	5	4	
Ischemic	-	-	4	5
Non-ischemic	-	-	2	4
Implanting Centers	23	21	16	6
Implanting Physicians	15	18	5	6
National Registry	☐	☐	☐	☐

4. Implantable cardioverter defibrillator

	2014	2015	2016	2017
Total ICDs	52	53	104	60
ICD new implants	50	44	84	58
ICD replacements	2	9	20	2
Single-chamber	20	38	55	38
Dual-chamber	32	15	49	22
Primary prevention	-	-	15	18
Secondary prevention	-	-	89	-
Implanting Centers	23	21	7	9
Implanting Physicians	15	18	6	11
National Registry	☐	☐	☐	☐

5. Lead Extraction

Lead extractions procedures and number of centers that performed lead extraction

	2014	2015	2016	2017
Total lead extraction procedures	-	-	-	4
Hospitals performed lead extraction	-	-	-	3
Cardiologists performing lead extraction	-	-	-	3
Surgeons performing lead extraction	-	-	-	
National Registry	☐	☐	☐	

6. Interventional electrophysiology

	2014	2015	2016	2017
Ablation procedures	77	97	151	142
SVT ablation procedures	-	68	29	-
AVNRT	25	38	62	53
AVRT/WPW	33	28	25	46
AFL (RA isthmus dependent)	3	1	1	8
AT	1	1	0	5
VT/VPC	-	22	17	15
Idiopathic	6	19	8	-
Structural	3	3	2	-
AF ablation procedures	6	7	13	15
Ablation centers	-	3	4	4
AF ablation centers	1	1	1	1
Structural VT ablation centers	1	1	1	4
Ablation physicians	-	10	-	-
AF ablation physicians	6		-	-
Structural VT ablation physicians	6	6	-	-
National Registry	☐	☐	☐	☐

7. Management

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

Payment (%)	Pacemaker	ICD	CRT	Ablation
Government	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	☐	☐	☑	☐	☐
Lack of reimbursement, limited financial resources	☐	☐	☐	☐	☑
Lack of referral	☐	☐	☑	☐	☐
Lack of trained personnel	☐	☐	☐	☑	☐
Low awareness of guidelines	☐	☐	☐	☑	☐
Lack of operators	☐	☐	☐	☑	☐

8. Source

Philippine Heart Rhythm Society, Inc.

Other Source: Medtronic, Phils.

Country/Region: Singapore

1. Statistics

	2014	2015	2016	2017
Population ('000)[1]	**5,469.7**	**5,535.0**	**5,607.3**	**5612.3**
Hospitals [2]	25	27	28	27
a. Public Sector	10	13	13	13
- Acute Hospitals	8	9	9	9
- Psychiatric Hospitals	1	1	1	1
- Community Hospitals	*1*	*3*	*3*	3
b. Not-for-Profit	*5*	*5*	*5*	5
- Acute Hospitals	*1*	*1*	*1*	1
- Psychiatric Hospitals				
- Community Hospitals	*4*	*4*	*4*	4
c. Private Sector	*10*	*9*	*10*	9
- Acute Hospitals	*9*	*9*	*9*	8
-Psychiatric Hospitals				
-Community Hospitals	*1*	*0*	*1*	1
Beds[2]	23386	25584	27126	29050
a. Public Sector	11156	13109	14335	16568
-Acute Hospitals	7652	8128	8561	8623
-Psychiatric Hospitals	1950	1950	1950	1950
-Community Hospitals	142	503	690	690
-Nursing Homes	1372	2488	3110	5281
-Inpatient Hospices	40	40	24	24
b. Not-for-Profit	*7310*	7180	7484	7267
- Acute Hospitals	*283*	316	316	271
- Psychiatric Hospitals	*0*	0	0	0
- Community Hospitals	*905*	961	961	969
- Nursing Homes	*6021*	5802	6058	5872
- Inpatient Hospices	*101*	101	149	155
c. Private Sector	*4920*	5295	5307	5215
-Acute Hospitals	*1327*	1400	1441	1446
-Psychiatric Hospitals	*0*	0	0	0
-Community Hospitals	*18*	0	12	4
-Nursing Homes	3575	3895	3854	3765
-Inpatient Hospices	0	0	0	0
Physicians[3]	11,733	12,459	12,967	13386
a. Public Sector	*7,330*	*7,909*	8,358	8573
b. Private Sector	*3,790*	*3,914*	3,979	4107
c. *Not in active Practice*	*613*	*636*	*630*	706

	2014	2015	2016	2017
Nurses/Midwives[3]	37,618	39,005	40,561	41440
- *Registered Nurses*	*28,864*	*29,894*	31,615	32672
- *Enrolled Nurses*	*8,528*	*8,931*	8,781	8631
-Registered Midwives	*226*	*180*	*165*	137
Advanced Practice Nurses[3]	145	172	197	218
GDP (US$, billions)				
Government Health Expenditure (as % of GDP)[3]	1.8	2.1	-	
Government Health Expenditure (as % of Total Government Expenditure)[3]	11.9	12.9	-	
Insured citizens (%)	-			
SCD patients	-			
Heart failure patients	-			
AF patients	-			

Source: Singapore Health Facts, Ministry of Health, Singapore as of 3 May 2016[1], 9 June 2016[2] and 20 May 2016[4] (www.moh.gov.sg).

2. Pacemaker

	2014	2015	2016	2017
Total Pacemakers[4]	**646**	**698**	**827**	**801**
- New implants	540	530	580	574
Replacements/Upgrades	83	98	126	121
Others	23	70	121	106
- Single-chamber	162	141	145	141
Dual-chamber	470	488	588	562
Not applicable	14	60	94	98
- Sick sinus syndrome	316	344	391	387
AV block*	188	182	219	195
Implanting Centers[4]	5	5	5	6
Implanting Physicians[4]	~26	~19	~18	~24
National Registry[4]	☑	☑	☑	☑

Source: CGH, KTPH, NHCS, NUH, TTSH, SCDB as of 02 August 2016[4]

** refer to Complete AV Block only.*

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

3. Cardiac resynchronization therapy

	2014	*2015*	*2016*	*2017*
Total CRTs[4]	**147**	**154**	**166**	**178**
- CRT-P	12	24	26	20
CRT-P new implants	8	12	10	11
CRT-P replacements/upgrade	3	12	15	9
Others	1	-	1	-
- CRT-D	135	129	140	158
CRT-D new implants	90	98	94	91
CRT-D replacements/upgrade	41	25	39	58
Others	4	6	7	9
- Ischemic	99	82	87	91
Non-ischemic	11	11	46	48
Implanting Centers[4]	5	5	5	6
Implanting Physicians[4]	~18	~17	~16	~20
National Registry[4]	☑	☑	☑	☑

Source: CGH, KTPH, NHCS, NUH, TTSH, SCDB as of 02 August 2016[4]

4. Implantable cardioverter defibrillator

	2014	*2015*	*2016*	*2017*
Total ICDs[4]	**289**	**332**	**339**	**378**
- ICD new implants	238	274	239	277
ICD replacements/upgrade	37	40	57	64
Others	14	18	43	37
- Single-chamber	239	273	272	295
Dual-chamber	39	50	45	59
Others	11	9	22	24
- Primary prevention	184	211	225	248
Secondary prevention	105	121	114	130
Others	-	-	-	
Implanting Centers[4]	5	5	5	6
Implanting Physicians[4]	~22	~17	~17	~23
National Registry[4]	☑	☑	☑	☑

Source: CGH, KTPH, NHCS, NUH, TTSH, SCDB as of 02 August 2016[4]

5. Lead Extraction

Lead extractions procedures and number of centers that performed lead extraction

	2014	*2015*	*2016*	*2017*
Total lead extraction procedures	35	27	48	45
Hospitals performed lead extraction	~4	~5	~4	~5
Cardiologists performing lead extraction	~10	~11	~14	~18
Surgeons performing lead extraction	~1	-	~2	~2
National Registry	☑	☑	☑	☑

Inclusive of Explantation of PPM / ICD

6. Interventional electrophysiology

	2014	*2015*	*2016*	*2017*
Ablation procedures[4]	**659**	**707**	**764**	**844**
SVT ablation procedures	-	-	-	
AVNRT	160	171	201	185
AVRT/WPW	123	112	134	114
AFL (RA isthmus dependent)	136	139	146	188
AT	46	41	38	43
VT/VPC	51	63	45	107
Idiopathic	-	-	-	-
Structural	-	-	-	-
AF ablation procedures	101	115	132	181
Others	42	66	68	26
Ablation centers[4]	3	3	3	3
AF ablation centers	2	2	2	2
Structural VT ablation centers	3	3	3	3
Ablation physicians[4]	~17	~16	~18	~15
AF ablation physicians	-	-	-	-
Structural VT ablation physicians	-	-	-	-
National Registry[4]	☑	☑	☑	☑

Source: CGH, KTPH, NHCS, NUH, TTSH, SCDB as of 02 August 2016[4]

7. Management

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

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

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

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

8. Source

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

Country/Region: South Korea (Republic of Korea)

1. Statistics

	2014	2015	2016	2017
Population (thousand)[1]	51314	50293	51619	-
Hospitals[2]	-	66,896	68,476	-
Beds (per 100,000 population)[2]	1181	1,341	1,327	-
Physicians (per 1,000 population)[2]	2.2	2.4	2.3	-
Nurses (per 1,000 population)[2]	5.6	6.4	6.8	-
GDP (US$, billions)[3]	1,421.31	1,321.2	1,404.30	-
Total expenditure on health as % GDP[3]	7.2%	7.2%	-	-
Government expenditure on health as %[3]	-	-	-	-
Insured citizens (%)	100	100	100	100
SCD patients	-	-	-	-
Heart failure patients	-	-	-	-
AF patients	-	-	-	-

5. www.census.gov
6. www.who.int
7. www.imf.org

2. Pacemaker

	2014	2015	2016	2017
Total Pacemakers	4259	4480	5007	5347
New implants	3349	3224	4319	4336
Replacements	910	1256	688	1011
Single-chamber	1125	1058	2126	2106
Dual-chamber	2594	3397	2881	3241
Sick sinus syndrome	1846	2283	1371	1828
AV block	2420	2343	1817	2716
Implanting Centers	157	122	-	-
Implanting Physicians	184	210	91	247
National Registry	☐	☐	☐	☐

3. Cardiac resynchronization therapy

	2014	2015	2016	2017
Total CRTs	190	265	281	350
CRT-P	14	18	24	49
CRT-P new implants	9	10	14	32
CRT-P replacements/upgrade	5	8	10	17
CRT-D	176	247	257	301
CRT-D new implants	157	207	204	251
CRT-D replacements/upgrade	19	40	53	50
Ischemic	43	22	15	15
Non-ischemic	110	186	213	284
Implanting Centers	11	14	-	-
Implanting Physicians	12	15	71	57
National Registry	☐	☐	☐	☐

4. Implantable cardioverter defibrillator

	2014	2015	2016	2017
Total ICDs	800	1015	1113	1157
ICD new implants	680	844	887	1022
ICD replacements	120	171	226	135
Single-chamber	472	651	544	666
Dual-chamber	328	364	569	491
Primary prevention	199	324	195	361
Secondary prevention	532	627	638	688
Implanting Centers	-	77	-	-
Implanting Physicians	-	95	80	112
National Registry	☐	☐	☐	☐

5. Lead Extraction

Lead extractions procedures and number of centers that performed lead extraction

	2014	2015	2016	2017
Total lead extraction procedures	30	-	41	-
Hospitals performed lead extraction	-	-	47	-
Cardiologists performing lead extraction	30	-	47	-
Surgeons performing lead extraction	-	-	0	-
National Registry	☐	☐	☐	☐

6. Interventional electrophysiology

	2014	2015	**2016**	**2017**
Ablation procedures	7059	7026	5617	3961
SVT ablation procedures	4829	464	2921	2160
AVNRT	2263(46.86%)	2321	1905	1045
AVRT/WPW	1613(33.41%)	1681	1259	626
AFL (RA isthmus dependent)	694(14.37%)	941	620	489
AT	259(5.36%)	394	279	187
VT/VPC	360	283	407	172
Idiopathic	332(92.28%)	354	282	140
Structural	28(7.72%)	34	68	32
AF ablation procedures	1870	2097	2324	1375
Ablation centers	66	74	39	24
AF ablation centers	39	50	39	22
Structural VT ablation centers	21	24	28	15
Ablation physicians	-	-	68	44
AF ablation physicians	46	-	64	33
Structural VT ablation physicians	24	-	46	26
National Registry	☐	☐	☐	☐

7. Management

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

Payment (%)	Pacemaker	ICD	CRT	Ablation
Government	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	☑	☐	☐	☐	☐
Lack of reimbursement, limited financial resources	☐	☐	☑	☐	☐
Lack of referral	☐	☐	☑	☐	☐
Lack of trained personnel	☐	☑	☐	☐	☐
Low awareness of guidelines	☐	☐	☑	☐	☐
Lack of operators	☐	☑	☐	☐	☐

8. Source

KHRS (Korean Heart Rhythm Society)

Country/Region: SRI LANKA

1. Statistics

	2014	2015	2016	2017
Population (thousand)[1]	20771	20966	21158	21444
Hospitals	624	631	634	637
Beds	79,975	80,581	80,768	80896
Physicians (MO s)	17595	18243	18487	18574
Nurses	38295	42420	45363	45780
GDP (US$, billions)	80.74	81.32	82.87	87.17
Total expenditure on health as % GDP	1.78	1.66	1.81	1.96
Government expenditure on health (US$)	-	-	6.22%	2568million
Insured citizens (%)	-	-	-	
SCD patients	-	-	-	
Heart failure patients	-	-	-	
AF patients	-	-	-	

[1], www.census.gov

2. Pacemaker

	2014	2015	2016	2017
Total Pacemakers	1092	1138	1268	1442
New implants	1006	1064	1187	1231
Replacements	86	74	81	211
Single-chamber	824	843	936	896
Dual-chamber	268	295	332	546
Sick sinus syndrome	347	366	406	562
AV block	745	771	861	912
Implanting Centers	10	10	11	11
Implanting Physicians	09	10	12	12
National Registry	☐	☐	☐	☐

3. Cardiac resynchronization therapy

	2014	2015	2016	2017
Total CRTs	16	21	18	32
CRT-P	8	15	10	21
CRT-P new implants	7	12	7	15
CRT-P replacements/upgrade	1	3	3	6
CRT-D	4	3	4	11
CRT-D new implants	3	2	3	6
CRT-D replacements/upgrade	1	1	1	5
Ischemic	4	5	4	7
Non-ischemic	12	16	14	25
Implanting Centers	3	4	4	4
Implanting Physicians	3	4	5	7
National Registry	☐	☐	☐	☐

4. Implantable cardioverter defibrillator

	2014	2015	2016	2017
Total ICDs	42	36	48	65
ICD new implants	-	-	-	57
ICD replacements	-	-	-	8
Single-chamber	-	-	-	
Dual-chamber	-	-	-	
Primary prevention	-	-	-	
Secondary prevention	-	-	-	
Implanting Centers	4	5	6	8
Implanting Physicians	3	4	5	8
National Registry	☐	☐	☐	☐

5. Lead Extraction

Lead extractions procedures and number of centers that performed lead extraction

	2014	2015	2016	2017
Total lead extraction procedures	-	-	-	
Hospitals performed lead extraction	-	-	-	
Cardiologists performing lead extraction	-	-	-	
Surgeons performing lead extraction	-	-	-	
National Registry	☐	☐	☐	☐

6. Interventional electrophysiology

	2014	2015	2016	2017
Ablation procedures	464	513	402	578
SVT ablation procedures	247	304	263	364
AVNRT	138	171	156	238
AVRT/WPW	102	121	91	98
AFL(RA isthmus dependent)	2	5	10	16
AT	5	7	6	10
VT/VPC	157	209	139	214
Idiopathic	157	209	139	212
Structural	-	-	-	
AF ablation procedures	-	-	-	
Ablation centers	3	4	4	
AF ablation centers	-	-	-	
Structural VT ablation centers	-	-	-	
Ablation physicians	3	5	6	
AF ablation physicians	-	-	-	
Structural VT ablation physicians	-	-	-	
National Registry	☐	☐	☐	☐

7. Management

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

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

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

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

8. Source

Name of national working group or arrhythmia body

Sri Lanka Heart Association

Country/Region: Taiwan

1. Statistics

	2014	2015	2016	2017
Population (thousand)[1]	23433	23492	23,540	23571
Hospitals	497	486	494	478
Beds	161,491	162,163	133,335	164590
Physicians	44,539	44,006	43,961	46311
Nurses	147,773	148,223	126,458	135969
GDP (US$, billions)[2]	529.587	523.009	529,676	
Total expenditure on health as % GDP	6.6	6.19	5.94	6.3
Government expenditure on health as %	30	6.83	6.92	
Insured citizens (%)	100%	99%	99%	99%
SCD patients	~17,242	-	-	
Heart failure patients	~58,679	-	-	
AF patients	~353,243	-	-	

2. Pacemaker

	2014	2015	2016	2017
Total Pacemakers	4734	5916	6661	6222
New implants	3642	75%	78%	85%
Replacements	1092	25%	22%	15%
Single-chamber	1312	24%	24%	23%
Dual-chamber	3422	76%	76%	77%
Sick sinus syndrome	2440	59%	62%	59%
AV block	1563	41%	38%	41%
Implanting Centers	96	104	108	110
Implanting Physicians	234	435	484	538
National Registry	☑	☑	☑	☑

3. Cardiac resynchronization therapy

	2014	2015	2016	2017
Total CRTs	207	265	331	328
CRT-P	158	182	238	243
CRT-P new implants	122	58%	68%	60%
CRT-P replacements/upgrade	36	42%	32%	40%
CRT-D	49	83	93	85
CRT-D new implants	40	67%	67%	52%
CRT-D replacements/upgrade	9	33%	33%	48%
Ischemic	25	46%	24%	31%
Non-ischemic	92	54%	76%	69%
Implanting Centers	24	55	51	60
Implanting Physicians	46	105	117	166
National Registry	☑	☑	☑	☑

4. Implantable cardioverter defibrillator

	2014	2015	2016	2017
Total ICDs	458	583	649	695
ICD new implants	378	71%	82%	85%
ICD replacements	80	29%	18%	15%
Single-chamber	136	32%	37%	42%
Dual-chamber	322	68%	63%	58%
Primary prevention	0	1%	1%	2%
Secondary prevention	458	99%	99%	98%
Implanting Centers	40	59	67	69
Implanting Physicians	71	130	177	206
National Registry	☑	☑	☑	☑

5. Lead Extraction

Lead extractions procedures and number of centers that performed lead extraction

	2014	2015	2016	2017
Total lead extraction procedures	12	-	-	
Hospitals performed lead extraction	6	-	-	
Cardiologists performing lead extraction	8	-	-	
Surgeons performing lead extraction	2	-	-	
National Registry	☐	☑	☐	☐

6. Interventional electrophysiology

	2014	2015	2016	2017
Ablation procedures	3740	3861	4345	4997
SVT ablation procedures	2309	2812	2983	3443
AVNRT	1126	1447	1466	1828
AVRT/WPW	620	785	764	766
AFL (RA isthmus dependent)	450	436	547	646
AT	113	144	175	203
VT/VPC	463	493	685	816
Idiopathic	248	386	402	548
Structural	186	107	81	135
AF ablation procedures	531	556	596	738
Ablation centers	-	37	36	15
AF ablation centers	-	13	16	15
Structural VT ablation centers	-	10	8	15
Ablation physicians	57	81	47	89
AF ablation physicians	34	47	38	66
Structural VT ablation physicians	28	22	32	65
National Registry	☐	☐	☐	☐

7. Management

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

Payment (%)	Pacemaker	ICD	CRT	Ablation
Government	100	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	☑	☐	☐	☐	☐
Lack of reimbursement, limited financial resources	☐	☐	☐	☑	☐
Lack of referral	☑	☐	☐	☐	☐
Lack of trained personnel	☑	☐	☐	☐	☐
Low awareness of guidelines	☑	☐	☐	☐	☐
Lack of operators	☑	☐	☐	☐	☐

8. Source

Taiwan Heart Rhythm Society

***http://www.tma.tw/stats/stater.asp**

#http://www.dgbas.gov.tw/ct.asp?xItem=14616&CtNode=3566&mp=1

+http://www.mohw.gov.tw/cht/DOS/Statistic.aspx?f_list_no=312&fod_list_no=1828

$http://www.stat.gov.tw/ct.asp?xItem=15428&CtNode=3638&mp=4

&http://www.mohw.gov.tw/cht/DOS/Statistic_P.aspx?f_list_no=312&fod_list_no=2220&doc_no=43390

Country/Region: Thailand

1. Statistics

	2014	2015	2016	2017
Population	67,091,120	67,959,357	68,146,609	69037513
Hospitals	1318(1002 public)	1318	583	
Beds(per 100,000 population)	210(as 2010)	210(as 2010)	2.1 beds/1,000 population (2010)	
Physicians	0.3:1000	0.3:1000	0.39 physicians/1,000 population (2010)	
Nurses	2.8:1000	2.8:1000	2.07:1000 (2010)	
GDP (US$, billions)	373.536		USD406 billion	USD403.6billion
Total expenditure on health as % GDP	4.6%	6.5%(2014)		
Government expenditure on health as %	-	77% of healthcare (2011)	6.5% of GDP (2014)	3.76% of GDP
Insured citizens (%)	99.5%		100	
SCD patients	-	-	-	
Heart failure patients	-	-	-	
AF patients	-	-	-	

2. Pacemaker

	2014	2015	2016	2017
Total Pacemakers	3078	2963	3046	3749
New implants	2834	2728	2897	2985
Replacements	244	235	149	784
Single-chamber	35.9%	26.2%	33%,	28.6%
Dual-chamber	62.86%	73.8%	67%	71.4%
Sick sinus syndrome	43.9%	40.1%	49%	
AV block	42.64%	51.2	51%	
Implanting Centers	70	70	85	16
Implanting Physicians	115	120	140	
National Registry	☑	☑	☑	☑

3. Cardiac resynchronization therapy

	2014	2015	2016	2017
Total CRTs	123	139	111	389
CRT-P	42		111	
CRT-P new implants		24	78	51
CRT-P replacements/upgrade				20
CRT-D				
CRT-D new implants	81	115	226	262
CRT-D replacements/upgrade				56
Ischemic				
Non-ischemic				
Implanting Centers		70		
Implanting Physicians		120	20	
National Registry	☐	☐	☑	☑

4. Implantable cardioverter defibrillator

	2014	2015	2016	2017
Total ICDs	700	837	960	950
ICD new implants	627	761	841	1091
ICD replacements	73	76	119	174
Single-chamber	78.47%	78.8	72% 2 S-ICD	710
Dual-chamber	8.61%	6.1	13%	119
Primary prevention				
Secondary prevention				
Implanting Centers		70	70	
Implanting Physicians		120		
National Registry	☐	☑	☐	☐

5. Lead Extraction

Lead extractions procedures and number of centers that performed lead extraction

	2014	2015	2016	2017
Total lead extraction procedures	-	-	-	33
Hospitals performed lead extraction	2	1	1	3
Cardiologists performing lead extraction	4	-	1	
Surgeons performing lead extraction	-	-	-	
National Registry	☐	☐	☐	☐

6. Interventional electrophysiology

	2014	2015	2016	2017
Ablation procedures	-	-	-	
SVT ablation procedures	-	-	-	
AVNRT	-	-	-	1296
AVRT/WPW	-	-	-	702
AFL(RA isthmus dependent)	-	-	-	244
AT	-	-	-	156
VT/VPC	-	-	-	
Idiopathic	-	-	-	413
Structural	-	-	-	6
AF ablation procedures	-	-	-	128
Ablation centers	-	-	-	16
AF ablation centers	-	-	-	
Structural VT ablation centers	-	-	-	
Ablation physicians	-	-	-	40
AF ablation physicians	-	-	-	
Structural VT ablation physicians	-	-	-	
National Registry	☐	☐	☐	☐

7. Management

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

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

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

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

8. Source

Name of national working group or arrhythmia body

Country/Region: Vietnam

1. Statistics

	2014	2015	2016	2017
Population (thousand)[1]	90,700	93,448	94,444	94971
Hospitals	1.069	-	-	
Beds	954.165	-	-	
Physicians	71,8000	-	-	
Nurses	102,000	-	-	
GDP (US$, billions)	178	-	200	220
Total expenditure on health as % GDP	-	-	-	
Government expenditure on health (US$)	-	-	-	
Insured citizens (%)	70.8	78	80	86.4
SCD patients	-	-	-	
Heart failure patients	-	-	-	
AF patients	-	-	-	

2. www.census.gov

2. Pacemaker

	2014	2015	2016	2017
Total Pacemakers	2740	2.722	2.588	2805
New implants	-	-	-	2595
Replacements	-	-	-	210
Single-chamber	1.482	1.658	1.214	1.118
Dual-chamber	1.258	916	1.185	1.687
Sick sinus syndrome	-	-	-	1.825
AV block	-	-	-	980
Implanting Centers	30	32	37	43
Implanting Physicians	66	74	98	110
National Registry	☐	☐	☐	☐

3. Cardiac resynchronization therapy

	2014	2015	2016	2017
Total CRTs	55	59	76	95
CRT-P	45	49	65	71
CRT-P new implants	-	-	-	67
CRT-P replacements/upgrade	-	-	-	4
CRT-D	10	10	11	14
CRT-D new implants	-	-	-	13
CRT-D replacements/upgrade	-	-	-	1
Ischemic	-	-	-	12
Non-ischemic	-	-	-	83
Implanting Centers	10	12	8	14
Implanting Physicians	24	32	24	30
National Registry	☐	☐	☐	☐

4. Implantable cardioverter defibrillator

	2014	2015	2016	2017
Total ICDs	90	89	73	153
ICD new implants	-	-	-	144
ICD replacements	-	-	-	9
Single-chamber	72	77	58	148
Dual-chamber	18	12	15	5
Primary prevention	-	-	-	122
Secondary prevention	-	-	-	31
Implanting Centers	20	20	12	16
Implanting Physicians	40	40	30	36
National Registry	☐	☐	☐	☐

5. Lead Extraction

Lead extractions procedures and number of centers that performed lead extraction

	2014	2015	2016	2017
Total lead extraction procedures	-	-	-	5
Hospitals performed lead extraction	-	-	-	2
Cardiologists performing lead extraction	-	-	-	4
Surgeons performing lead extraction	-	-	-	1
National Registry	☐	☐	☐	☐

6. Interventional electrophysiology

	2014	2015	2016	2017
Ablation procedures	1964	2100	2958	4022
SVT ablation procedures	-	-	-	
AVNRT	936	976	837	1.478
AVRT/WPW	442	444	868	936
AFL (RA isthmus dependent)	50	36	35	121
AT	24	30	35	38
VT/VPC	494	574	1183	1290
Idiopathic	-	-	-	1280
Structural	-	-	-	10
AF ablation procedures	18	24	79	159
Ablation centers	-	-	19	20
AF ablation centers	14	16	6	7
Structural VT ablation centers	-	-	-	4
Ablation physicians	-	-	36	44
AF ablation physicians	8	12	14	14
Structural VT ablation physicians	-	-	-	7
National Registry	☐	☐	☐	☐

7. Management

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

Payment (%)	Pacemaker	ICD	CRT	Ablation
Government				
Insurance				
Public insurance	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	☐	☐	☐	☐	☐
Lack of reimbursement, limited financial resources	☑	☐	☐	☐	☐
Lack of referral	☑	☐	☐	☐	☐
Lack of trained personnel	☐	☑	☐	☐	☐
Low awareness of guidelines	☑	☐	☐	☐	☐
Lack of operators	☐	☐	☑	☐	☐

8. Source

Name of national working group or arrhythmia body

The APHRS White Book: Sixth 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 Sixth 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 2014, 2015, 2016 and 2017 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 2014 to 2017, and the device implantation rates or catheter ablation rates and centers in 2017.

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 14 of the 19 countries and regions in 2017 as compared with 2016. The implantation of pacemaker kept to maintain above 10% of increasing rate in Hongkong, Thailand, Malaysia, Sri Lanka and Pakistan, and about 8%-9% of increasing rate in India, Myanmar and Vietnam. For Hong Kong and Malaysia, the implantation of pacemaker demonstrated a significant increasing rate 101.20% and 39.13%. The implantation of pacemaker kept to maintain above 5% of increasing rate in India, South Korea, Thailand, Pakistan, Vietnam and Myanmar. In New Zealand, Indonesia, Japan and China, the increasing rate was 3.61%, 3.15%, 2.46% and 4.98% respectively. In contrast, the implantation of permanent pacemaker decreased in Taiwan, Singapore, Mongolia and Brunei. And for Philippines, the permanent pacemaker implantation rate was dramatically decreased.

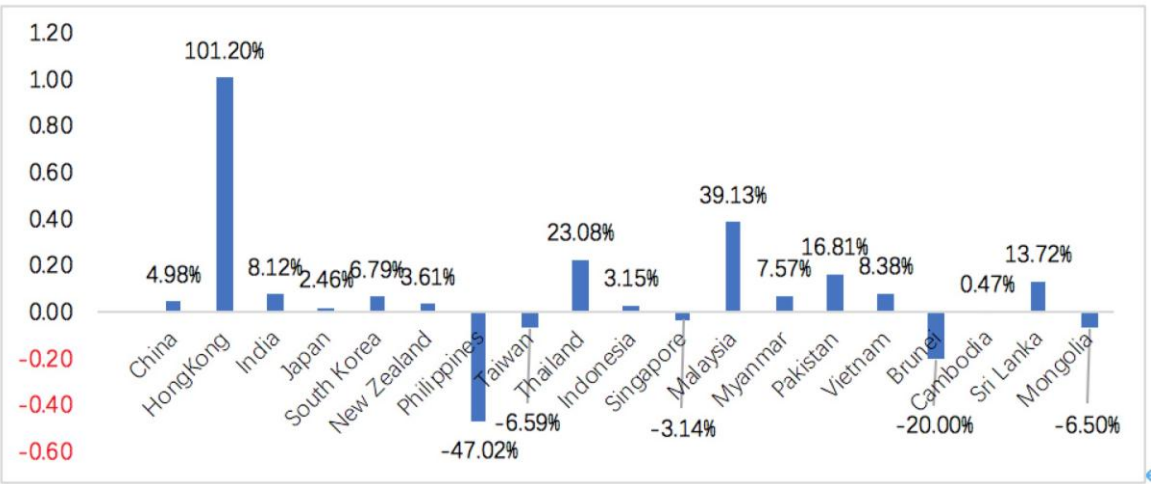

Figure 1: Increasing rate of pacemaker implantation in 2017 as compared with 2016

3.2 Pacemaker implantation rate

As shown in Table 1, data in 2017 were analyzed by evaluating pacemaker implantation rates. Across the 18 countries and 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 (537.9) and Japan (474.6) and the lowest in Indonesia (4.0). The pacemaker implantation rates per million inhabitants were also low in Philippines (6.2) and Myanmar (10.1). The large gap in the number of pacemaker implanting center per million inhabitants still remained among the 18 countries and regions. In data for 2017, Taiwan and Brunei jumped as the top two regions where had the same highest implanting centers per million inhabitants (4.8), while the second with high pacemaker implanting centers per million inhabitants were and New Zealand (2.9). The countries with lowest density of implanting centers in 2017 data were Mainland China (0.1), Myanmar (0.1), Pakistan (0.2), Indonesia (0.2), Cambodia (0.2) and Mongolia (0.3). Other countries remained similar level to that in 2016. Although the reported data in 2017 did not differ significantly from that in 2016, our analysis still found a significant change as compared to last several years. 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 2017. The influence of GDP on pacemaker implants did not differ as compared with that in 2016. The countries with highest GDP per capita of the 18 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.

4. ICD and Cardiac Resynchronization Therapy devices (CRT)

4.1 The implantation of ICD in 2017

Similar to data last year, the increasing trend of implantation of ICD was observed in 14 APHRS countries and regions in 2017 as compared with 2016 (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 Vietnam and Pakistan as compared to last year (109.59% and 133.33%). Mainland China, Indonesia, Singapore, Malaysia, Myanmar, Cambodia, Sri Lanka and Brunei kept the increasing trend about 10% in ICD implantation. The ICD implantation was still rare in some Asia-Pacific countries like Indonesia (45), Myanmar (33), Cambodia (5), and Mongolia (2).

We also analyzed the data on ICD primary or secondary prevention from 14 countries and regions: China mainland, India, South Korea, Philippines, Taiwan, Indonesia, Singapore, Malaysia, Myanmar, Pakistan, Vietnam, Brunei, Cambodia and Mongolia. The use of ICD for primary prevention in Indonesia, Myanmar, South Korea, Pakistan, and Taiwan increased slightly (from 21.1% to 33.3%, from 23.8% to 24.2%, from 17.5% to 31.2%, from 20.0% to 32.0% and from 1% to 2%, respectively). China mainland, Malaysia, and Singapore were with decrease slightly in ICD primary implantation (from 51.0% to 44.5%, from 43.7% to 37.6%, and from 66.4% to 65.6%,

respectively). Brunei was the country having the highest ratio of primary prevention in Asia-Pacific countries and regions (88.9%). However, ICD primary implantation in India decreased sharply (from 40.0% to 20.0%).

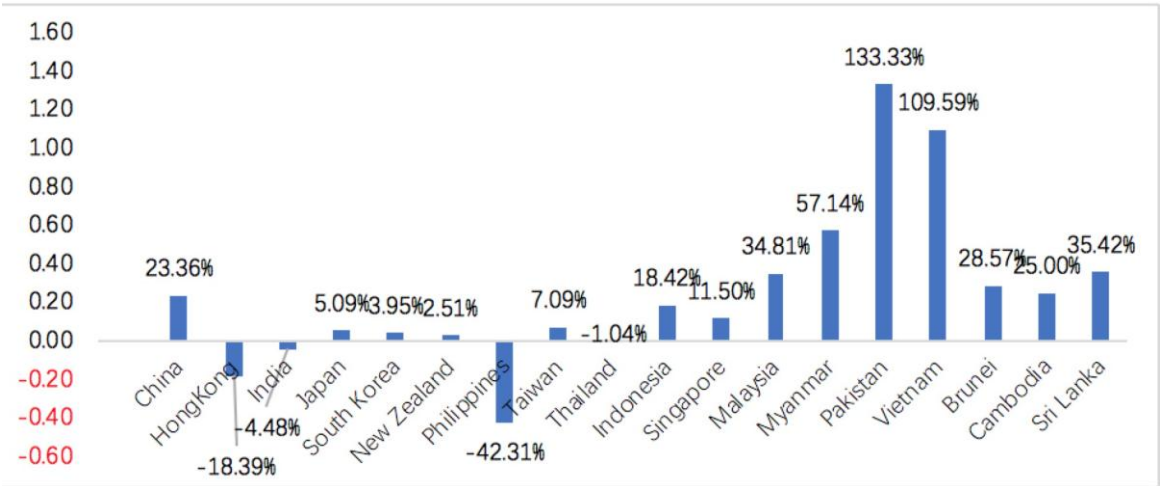

Figure 2: Increasing rate of ICD implantation in 2017 as compared with 2016

4.2 ICD implantation rate

As shown in table 1, New Zealand was still the country with highest reported ICD implantation rate per million inhabitants (136.3). Singapore (67.5) and Japan (52.8) were the other countries with high ICD implants/million. Some countries kept increasing ICD implants/million, including Brunei (42.9), Taiwan (30.2), Hong Kong (19.2), Sri Lanka (3.0), Mainland China (2.9) and India (2.6). Countries with low ICD implants/million were Indonesia (0.2), Cambodia (0.3), Philippines (0.6), and Myanmar (0.6). 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 2017 data, the countries with more than 1 ICD implanting centers per million inhabitants were Brunei (4.8), Taiwan (3.0), New Zealand (1.9), and Singapore (1.1). The other countries and regions with less than 1 implanting centers per million inhabitants included Malaysia (0.7), Sri Lanka (0.4), India (0.3), Mainland China (0.3), Mongolia (0.3), Vietnam (0.2), Cambodia (0.2), Myanmar (0.1), Pakistan (0.1), and Philippines (0.1).

4.3 CRT utilization in Asia-Pacific area

In 2017, the rising trend in CRT implantation still remains in 13 among the data from 17 Asia-Pacific countries and regions, except for India, Philippine, Indonesia with decreased CRT implantation. Especially for Philippine, the decreasing rate was up to 50.00% (see Figure 3). Still in 2017, the countries with total number of CRTs implantation more than 1000 were Japan (4782), Mainland China (4138) and India (2500), and those with CRT implantation between 100 and 1000 were Pakistan (416), Thailand (389), South Korea (350), Taiwan (328), New Zealand (325), Singapore (178) and Malaysia (171). Countries with the increase rates of CRT implant more than 50% in 2017 included Thailand (250.45%), Pakistan (203.65%) Myanmar (150.00%), and Sri Lanka

(77.78%), and other 4 countries and regions were with an increase below 10%, including Japan (1.27%), Malaysia (4.91%) New Zealand (5.18%) and Singapore (7.23%). In contrast, 4 countries and region presented as minus increase in CRT implantation, including Philippines (-50.00%), Indonesia (-22.22%), India (-8.36%), Taiwan (-0.91%). Besides Mongolia, the total number of CRT implant was also relatively low in 4 countries and regions, including Philippines (17), Brunei (16), and Myanmar (10), although some of them had been demonstrated as an increasing trend.

The CRT implantation rate per million inhabitants in 2017 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 67.7/million in New Zealand, 38.1 in Brunei, 37.7 in Japan and 31.8 in Singapore. And a slightly increasing trend continued was seen in the CRT implantation rate per million inhabitants in most Asia-Pacific countries and regions, including Taiwan (from 14.1 in 2016 to 14.3 in 2017), China mainland (from 2.6 in 2016 to 3.0 in 2017), Malaysia (from 5.1 in 2016 to 5.3 in 2017), except for a decreasing trend in India (from 2.1 in 2016 to 1.9 in 2017). There was also significant variability in the ratio of CRT-D/CRT-P implants. The number of “CRT implant centers” in 15 countries and regions were analyzed. Most of the Asia-Pacific countries and regions were with more than 50% CRT-D implantation rate, in which Singapore were shown with the highest CRT-D/total CRT ratio (88.8%). CRT-D implantation rate between 50% to 80% were shown in 9 countries and regions, including Cambodia (75.0%), Malaysia (74.9%), Japan (74.6%), Philippines (70.6%), Brunei (62.5%), Mainland China (60.5%), India (60.0%), Indonesia (54.0%) and Myanmar (50.0%). However, CRT-D implant rate was less than 30% in 4 countries and regions, including Taiwan (25.9%), Vietnam (14.7%) and New Zealand (12.0%). In 2017 data, the countries and regions with more than 1 CRT implanting centers per million inhabitants were Brunei (4.8), Taiwan (2.6), New Zealand (1.3) and Singapore (1.1), while that in most of other countries were between 0.05 to 0.5.

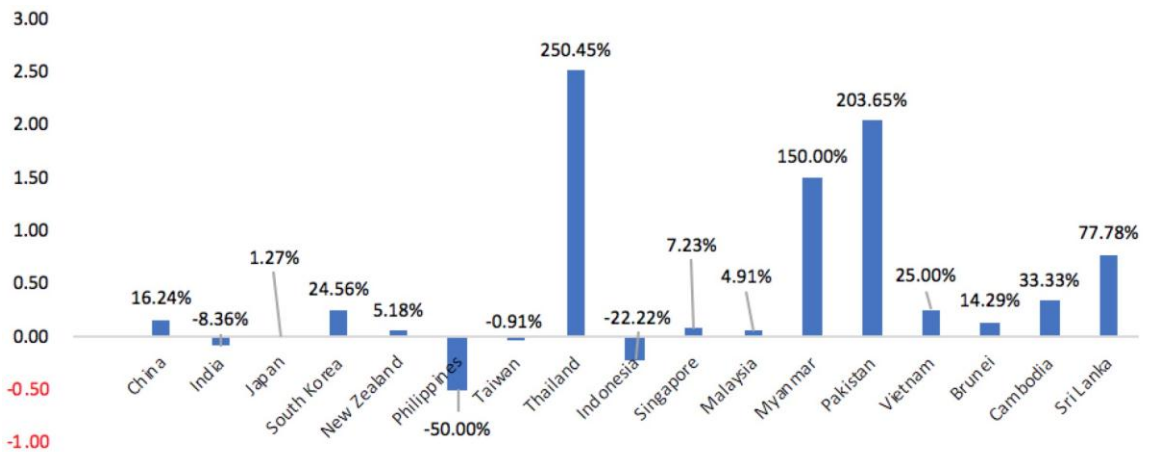

Figure 3: Increasing rate of CRT implantation in 2017 as compared with 2016

5. Catheter Ablation

5.1 General information of Catheter Ablation

We received data about catheter ablation from 14 countries and regions in 2017. China mainland was still the country having the highest cases receiving catheter ablations (133897). Japan was the other countries with high cases of 75000. The ablation procedures in other 11 countries and regions were less than 10000. An increasing trend was observed in ablation procedures across 12 countries. Malaysia, Sri Lanka and Vietnam were the countries with the highest ablation increasing rate (47.4%, 43.9% and 36.0%, respectively). There were 4 countries and regions with an increasing rate between 10% and 20%, including Japan (15.4%), Taiwan (15.0%), New Zealand (10.7%), and Singapore (10.5%). The increasing rate in Cambodia (3.8%), Indonesia (2.7%) and Mainland China (1.05%) were relatively low as compared with other countries. However, Philippine (-5.9%) demonstrated a significant decrease in catheter ablation.

5.2 Ablation procedure rates

Table 2 is shown the ablation procedures per million inhabitants in 13 countries and regions. An increasing trend in ablation rate was observed in 10 countries and regions except for Philippines and Brunei. Japan was the country which continued having increasing ablation procedures per million inhabitants, from 496.2 in 2015 to 512.1 in 2016, and then to 591.9 in 2017. New Zealand was the second with highest increment ablation procedures per million inhabitants (from 315.8 to 341.7). Countries having more than one hundred ablation procedures per million inhabitants included Brunei (245.2), Taiwan (217.3), and Singapore (150.7). Philippines (1.4) and Indonesia (2.9) had the lowest ablation procedures per million inhabitants. In China mainland, the ablation procedures/ million inhabitants increased from 73.9 in 2014 to 85.6 in 2015, and to 95.8 in 2016 and 2017. Regarding ablation centers per million inhabitants in 2017, the highest density was recorded in Japan (5.5) and the lowest in Indonesia (0.1) and Myanmar (0.1).

5.3 Atrial fibrillation (AF) catheter ablation

We had the data of AF ablation from 14 countries and regions this year. In 2017, AF ablation procedures increased almost in all countries. Japan was still the country with the highest number of AF ablation procedures (54000 cases). As shown in Table 2, the AF ablation rate per million inhabitants was increased from 354.5 to 426.2 in Japan, which was the highest among APHRS member countries and regions. Indonesia (0.2), Pakistan (0.1) and Philippines (0.1) were the countries with the lowest AF ablation rate. Regarding the ratio of AF ablation/total ablation, there was also a large gap among 12 countries and regions, with highest ratio of AF ablation/total ablation in Japan (72.0%), and lowest AF ablation ratio in Myanmar (1.73%). And the AF ablation ratio was 7.2% in Indonesia, 10.6% in Philippines, 14.8% in Taiwan, 21.5% in Singapore, 14.8% in Taiwan, 27.4% in Mainland China and 31.1% in New Zealand.

6. 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 2017 in 15 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
Mainland China	54.9	0.1	2.9	3.0	0.3
Hong Kong	204.4	no data	19.2	no data	no data
India	28.8	0.8	2.6	1.9	0.3
Indonesia	4.0	0.2	0.2	0.2	0.04
Japan	474.6	no data	52.8	37.7	no data
Malaysia	20.0	1.2	6.7	5.3	0.7
New Zealand	537.9	2.9	136.3	67.7	1.9
Pakistan	22.1	0.2	1.9	2.3	0.05
Philippines	6.2	0.4	0.6	0.2	0.09
Singapore	143.0	1.1	67.5	31.8	1.1
Taiwan	270.5	4.8	30.2	14.3	2.9
Thailand	54.3	0.2	0.2	0.2	1.0
Myanmar	10.1	0.1	0.6	0.2	0.07
Vietnam	29.6	0.5	1.6	1.0	0.2
Brunei	123.8	4.8	42.9	38.1	4.8
Cambodia	13.1	0.2	0.3	0.2	0.19
Sri Lanka	67.4	0.5	3.0	1.5	0.3
Mongolia	37.1	0.3	0.6	0.6	0.3

Table 2 The ablation procedure rate and centers per million inhabitants for the year 2017 in 15 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
Mainland China	95.8	0.6	26.2	0.3	27.35%
Indonesia	2.9	0.1	0.2	0.0	7.3%
Japan	591.9	5.5	426.2	3.9	72.0%
Malaysia	no data	no data	no data	no data	9.6%
New Zealand	341.7	no data	106.3	1.7	31.1%
Pakistan	no data	no data	0.1	0.0	no data
Philippines	1.4	no data	0.1	no data	10.6%
Singapore	150.7	0.5	32.3	0.4	21.5%
Taiwan	217.3	0.7	32.1	0.7	14.8%
Thailand	no data	0.2	1.9	no data	no data
Myanmar	13.7	0.1	0.2	no data	1.7%
Vietnam	42.4	0.2	1.7	0.1	4.0%
Brunei	245.2	no data	133.3	2.4	54.3%
Cambodia	11.9	0.0	0.0	0.0	0%
Sri Lanka	27.0	no data	no data	no data	no data
Mongolia	15.8	0.3	0.6	0.3	4.1%

1. http://www.worldometers.info/world-population/india-population/
2. https://data.gov.in/catalog/number-government-hospitals-and-beds-rural-and-urban-areas
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