Preface

The APHRS was founded in 2008 with its goal to establish infrastructure for basic and clinical researches in the arrhythmia field of Asia-Pacific countries, to provide systematic educational opportunities for young researchers and clinicians wanting to specialize in this field, and to promote multinational researches.

In 2010, the need of White Book focusing on basic statistical data and current status of interventional therapies of cardiac arrhythmia in Asia-Pacific countries has been keenly felt.

The interventional therapies for cardiac arrhythmia have developed rapidly in Asia-Pacific region within past few decades. There is a rapidly growing trend in electrophysiological procedures and implantation of cardiac implantable electronic devices (CIEDs) in most of Asia-Pacific countries. However, significant inequalities exist in healthcare and treatment of cardiac arrhythmia across Asian countries and regions, which make it important and necessary for the healthcare community to share, recognize, and communicate with each other on the data and information relating to current status of cardiac electrophysiology and arrhythmia treatment. We hope annually updated White Book will not only promote scientific, technological, and clinical development for better therapy of cardiac arrhythmia but also improve and equalize healthcare for patients across countries and regions in Asia.

The APHRS White Book reports the most updated information about today of activities 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, etc. Since Professor Shu Zhang first presented valuable data across 7 countries in the scientific session of APHRS 2012, we decided to publish the first edition of the APHRS White Book during the scientific session of APHRS2013.

This second edition of the APHRS White Book 2014 includes data from 11 countries and regions on the use of CIEDs and electrophysiological procedures in the past three years. Data collection is mostly the result of voluntary participation of national Society of Pacing and Electrophysiology or national Heart Rhythm Society in each country or region. In some

other Asia countries, there are currently no registries or the data is limited. Thus, the APHRS White Book can be a cradle of international registry or collaboration and also provocative to adopt a systematic approach to collect data on arrhythmia therapies in each country. We hope more Asian countries and regions will participate in the future edition of APHRS White Book.

With the release of this second edition of the APHRS White Book, the APHRS appreciate the effort made by all authors, chairs and co-chairs from each of individual national HRS working groups, and expresses special thanks to Professor Shu Zhang, China, who devoted his precious time to annually updated APHRS White Book.

Young-Hoon Kim, MD.

President
APHRS

Acknowledgement

As a member of APHRS and the chief editor of this book, I would like to express my deepest joy and appreciation for the publication of the first edition of the APHRS White Book. I owe particular thanks to the current president of APHRS, Professor Young-Hoon Kim, immediate past president of APHRS, Professor Shih-Ann CHEN who led the preparation of this edition of the APHRS White Book. I would also like to thank our board members for their support of this work. I will express my appreciation to our contributors, the national Society of Pacing and Electrophysiology and the national Heart Rhythm Society of 11 member countries or regions of Asia. Without their voluntary collection of data, the publication of this book would not have been possible. In addition, I am very grateful to members of my working group, Dr. Xiaohan Fan and Miss. Na Lin, especially to Shigeno, secretary of our society, they performed the secondary research to cross verify and establish the quantitative and qualitative information contained in the book.

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Country/Region: CHINA

1. Statistics

	2011	2012	2013
Population(thousand)[1]	1336718	1343240	1349586
Hospitals[2]	21979	23170	25000
Beds(per 100,000 population) [2]	384.14	424.19	468.41
Physicians(per 1,000 population)[2]	1.49	1.58	1.67
Nurses(per 1,000 population)[2]	1.67	1.85	2.05
GDP (US$, billions)[3]	7,298.15	7,991.74	9,469.12
Total expenditure on health as % GDP[2]	5.15%	5.36%	5.57%
Government expenditure on health as %[2]	30.7%	30.0%	30.1%
Insured citizens (%)	60%	70%	70%
SCD patients	0.54m	0.54m	0.54m
Heart failure patients	6m	6m	6m
AF patients	6m	6m	6m

1. www.census.gov
2. www.nhfpc.gov.cn
3. www.imf.org

2. Pacemaker

	2011	2012	2013
Total Pacemakers	42986	49502	51752
New implants	35573	41889	43917
Replacements	7413	7613	7835
Single-chamber	16309	18117	17706
Dual-chamber	25905	29747	33753
Sick sinus syndrome	21762	24980	26318
AV block	16765	19144	20240
Implanting Centers	840	938	933
Implanting Physicians	3000	3000	3000
National Registry	☒	☒	☒

3. Cardiac resynchronization therapy

	2011	2012	2013
Total CRTs	1876	2210	2198
CRT-P	987	1020	959
CRT-P new implants	903	892	840
CRT-P replacements/upgrade	84	128	119
CRT-D	835	1173	1220
CRT-D new implants	762	1062	1066
CRT-D replacements/upgrade	73	111	154
Ischemic	548	587	542
Non-ischemic	1289	1623	1656
Implanting Centers	330	358	353
Implanting Physicians	3000	3000	3000
National Registry	☒	☒	☒

4. Implantable cardioverter defibrillator

	2011	2012	2013
Total ICDs	1228	1553	1903
ICD new implants	1126	1424	1745
ICD replacements	102	129	158
Single-chamber	879	1044	1300
Dual-chamber	349	509	603
Primary prevention	506	663	855
Secondary prevention	722	890	1048
Implanting Centers	260	309	323
Implanting Physicians	3000	3000	3000
National Registry	☒	☒	☒

5. Interventional electrophysiology

	2011	2012	2013
Ablation procedures	63355	74410	83450
SVT ablation procedures	41688	46499	50990
AVNRT	20483	23097	25588
AVRT/WPW	18415	20325	21809
AFL (RA isthmus dependent)	1363	1495	1781
AT	1427	1582	1812
VT/VPC	351	392	478
Idiopathic	334	369	423
Structural	17	23	16
AF ablation procedures	8921	11214	14752
Ablation centers	658	732	737
AF ablation centers	316	331	345
Structural VT ablation centers			
Ablation physicians	2000	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	60%	30%	30%	70%
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: Hong Kong SAR

1. Statistics

	2011	2012	2013
Population(thousand)[1]	7123	7154	7219
Hospitals	53	53	53
Beds	35,500	35,500	35,790
Physicians	12,634	12,800	13,203
Nurses	30,308	31,500	34,597
GDP (US$, billions)	243.302	260.471	272.481
Total expenditure on health as % GDP	1.96%	2.05%	2.17%
Government expenditure on health (US$)	4,406 mil	4,916 mil	5,905 mil
Insured citizens (%)			
SCD patients			
Heart failure patients			
AF patients			

1. www.census.gov

2. Pacemaker

	2011	2012	2013
Total Pacemakers	859	987	537
New implants	670	818	470
Replacements	189	169	67
Single-chamber			
Dual-chamber			
Sick sinus syndrome			
AV block			
Implanting Centers			
Implanting Physicians			
National Registry	☐	☐	☐

3. Cardiac resynchronization therapy

	2011	2012	2013
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

	2011	2012	2013
Total ICDs	148	116	79
ICD new implants	123	79	57
ICD replacements	25	37	22
Single-chamber			
Dual-chamber			
Primary prevention			
Secondary prevention			
Implanting Centers			
Implanting Physicians			
National Registry	☐	☐	☐

5. Interventional electrophysiology

	2011	2012	2013
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	☐	☐	☐

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

Name of national working group or arrhythmia body

Country/Region: India

1. Statistics

	2011	2012	2013
Population (bn)[1]	1.21	1.23	1.252[2]
Urban Hospitals (Govt. only)[3]	11,993	11,993	13,761
Beds[3] (Govt. only)	7,84,000	8,32,000	14,38,738
Physicians[4]	9,22,177	8,83,812	9,19,812
Nurses (K)[4]	21,24,667	22,27,912	23,61,591
GDP (US$ - billion)[5]	1,838	1,824	1,877
Total expenditure on health as % GDP[6]	3.9%	4.0%	4.0%
Government expenditure on health as %[6]	30.5%	33.1%	33.1%
Insured citizens (in Millions)[6]	300	370	410
SCD patients[7] (in Thousands)	600	615	627
Heart failure patients[8] (in Millions)	2.34	2.38	2.31
AF patients (mn)	12.1	12.3	12.7

2. Pacemaker

	2011	2012	2013
Total Pacemakers	23542	27518	36,322
New implants	90.3%	91.1%	85.8%
Replacements	9.7%	8.9%	14.4%
Single-chamber	10809	12392	14,477
Dual-chamber	4885	5952	21,846
Sick sinus syndrome[9]	25%	25%	25%
AV block	65%	65%	65%
Implanting Centers	774	810	888
Implanting Physicians	1392	1480	1500
National Registry	☐	☐	☐

1. http://www.worldpopulationstatistics.com/india-population-2013/
2. http://data.worldbank.org/country/india
3. http://data.gov.in
4. http://apps.who.int/gho/data/node.main.A1443?lang=en&showonly=HWF.
5. http://data.worldbank.org/country/india
6 IRDA Annual reports
7 Indian Heart Journal, v.63, No.4, July-August 2011.
8. http://www.sph.umn.edu/img/assets/25422/Lyle_Joyce.pdf
9 Mondo HG, *et al.* PACE v43, August 2011. p.1013.

3. Cardiac resynchronization therapy

	2011	2012	2013
Total CRTs	1205	1514	1830
CRT-P			
CRT-P new implants	690	745	850
CRT-P replacements/upgrade	81	89	95
CRT-D			
CRT-D new implants	390	612	800
CRT-D replacements/upgrade	44	68	85
Ischemic	65%	65%	
Non-ischemic	35%	35%	
Implanting Centers	180	207	300
Implanting Physicians	240	306	360
National Registry	☐	☐	☐

4. Implantable cardioverter defibrillator

	2011	2012	2013
Total ICDs	1190	1540	1950
ICD new implants	1012	1309	1630
ICD replacements	179 (15%)	308 (20%)	320
Single-chamber	940	1120	1350
Dual-chamber	250	420	550
Primary prevention	273 (23%)	415 (27%)	
Secondary prevention	916 (77%)	1124 (73%)	
Implanting Centers	213	230	340
Implanting Physicians	328	358	440
National Registry	☐	☐	☐

5. Interventional electrophysiology

	2011	2012	2013
Ablation procedures	8900	10230	13455
SVT ablation procedures	6894	8046	9179
AVNRT	3650	3985	4436
AVRT/WPW	2166	2733	3143
AFL (RA isthmus dependent)	388	498	630
AT	690	830	970
VT/VPC	2200	2800	3768
Idiopathic	760	988	1324
Structural	1440	1812	2444
AF ablation procedures	350	500	760
Ablation centers	90	100	126
AF ablation centers	15	20	20
Structural VT ablation centers	50	65	69
Ablation physicians	78	90	95
AF ablation physicians	18	25	27
Structural VT ablation physicians	35	48	51
National Registry	☐	☐	☐

All EP data – Company internal and Market data

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	20	20	20	15
Insurance	10	10	10	10
Public insurance	7	7	7	7
Private insurance	3	3	3	3
Individual	70	70	70	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	☐	☐	☒	☐	☐

7. Source

Name of national working group or arrhythmia body

Country/Region: Japan

1. Statistics

	2011	2012	2013
Population(thousand)[1]	127470	127368	127298
Hospitals(per 100,000 population)	6.73	6.71	6.71
Beds	1712539	1706326	1695210
Physicians(per 1,000 population) [2]		2.14	2.38
Nurses(per 1,000 population) [2]		7.47	7.98
GDP (US$, billions)[3]	5,869.47	5,981.00	5040.95
Total expenditure on health as % GDP [2]	8.1%	7.9%	7.3%
Government expenditure on health as %[2]	80%		
Insured citizens (%)		81%	
SCD patients			
Heart failure patients	1087000	1087000	108700
AF patients	929000	941000	902521

1. www.census.gov
2. www.who.int
3. www.imf.org

2. Pacemaker

	2011	2012	2013
Total Pacemakers	59209	59441	59487
New implants	37714	38893	39290
Replacements	21495	20548	20197
Single-chamber	12983	12163	11676
Dual-chamber	45422	45589	46876
Sick sinus syndrome			
AV block			
Implanting Centers	1365		
Implanting Physicians			
National Registry	☐	☐	☐

3. Cardiac resynchronization therapy

	2011	2012	2013
Total CRTs	3868	4209	4260
CRT-P	784	839	935
CRT-P new implants			
CRT-P replacements/upgrade			
CRT-D	3084	3371	3325
CRT-D new implants	2486	2439	2217
CRT-D replacements/upgrade	598	932	1108
Ischemic			
Non-ischemic			
Implanting Centers	345		
Implanting Physicians			
National Registry	☐	☐	☐

4. Implantable cardioverter defibrillator

	2011	2012	2013
Total ICDs	5059	5594	6373
ICD new implants	3515	3655	3775
ICD replacements	1544	1939	2598
Single-chamber	961	1087	1308
Dual-chamber	4098	4507	5065
Primary prevention			
Secondary prevention			
Implanting Centers	376	394	
Implanting Physicians			
National Registry	☐	☐	☐

5. Interventional electrophysiology

	2011	2012	2013
Ablation procedures	38000	42000	46000
SVT ablation procedures		15000	15000
AVNRT			
AVRT/WPW			
AFL (RA isthmus dependent)			
AT			
VT/VPC		6000	6000
Idiopathic			
Structural			
AF ablation procedures	17000	21000	25000
Ablation centers	570	600	550
AF ablation centers	300	350	350
Structural VT ablation centers			
Ablation physicians	1425	1500	1600
AF ablation physicians	750	875	1000
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

Name of national working group or arrhythmia body

Japanese Heart Rhythm Society

Country/Region: MALAYSIA

1. Statistics

	2012	2013	
Population (Thousand)	29,336.8	29,714.7	
Hospitals	132	141	
Beds	38,978	39,728	
Physicians	38,718	46,916	
Nurses	84,968	89,167	
GDP (RM)	35,075	37,542	
Total expenditure on health as % GDP	4.58	4.40	
Government expenditure on health as %	55.11	52.73	
Insured citizens (%)			
SCD patients			
Heart failure patients			
AF patients			

***The data for 2014 is not available yet**

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

2. Pacemaker

	2013	2012	
Total Pacemakers	577	29,336.8	
New implants	430	132	
Replacements	147	38,978	
Single-chamber	255	38,718	
Dual-chamber	322	84,968	
Sick sinus syndrome	151	35,075	
AV block	183	4.58	
Implanting Centers	18	55.11	
Implanting Physicians	54		
National Registry	**X**		
Total Pacemakers			
New implants			

3. Cardiac resynchronization therapy

	2013	2014	
Total Pacemakers	109	63	
New implants	57	22	
Replacements	36	14	
Single-chamber	21	12	
Dual-chamber	64	43	
Sick sinus syndrome	39	29	
AV block	25	14	
Implanting Centers	58	35	
Implanting Physicians	51	28	
National Registry	11	13	
	17	24	
	X	X	

4. Implantable cardioverter defibrillator

	2013	2014	
Total ICDs	119	67	
ICD new implants	89	55	
ICD replacements	30	12	
Single-chamber	72	46	
Dual-chamber	47	21	
Primary prevention	29	20	
Secondary prevention	90	47	
Implanting Centers	11	13	
Implanting Physicians	17	24	
National Registry	**X**	**X**	

5. Interventional electrophysiology

	2013	2014	
Ablation procedures	522	386	
SVT ablation procedures	297	240	
AVNRT	179	148	
AVRT/WPW	118	92	
AFL (RA isthmus dependent)	46	31	
AT	31	36	
VT/VPC	82	58	
Idiopathic	53	29	
Structural	22	24	
AF ablation procedures	57	23	
Ablation centers			
AF ablation centers	0	0	
Structural VT ablation centers	0	0	
Ablation physicians	4	4	
AF ablation physicians	3	3	
Structural VT ablation physicians	3	3	
National Registry	**X**	**X**	

6. Management

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

Payment (%)	Pacemaker	ICD	CRT	Ablation	
Government	60	90	90	70	
Insurance	20	5	5	20	
Public insurance	0	0	0	0	
Private insurance	20	5	5	20	
Individual	10	5	5	10	

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

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

*Data source: UMMC, Penang Hospital Heart Centre, IJN, UiTM, PPUKM, SGH, QEH2, Pantai Medical Centre

Country/Region: New Zealand

1. Statistics

	2011	2012	2013
Population(thousand)[1]	4290	4328	4511
Hospitals*(includes every small hosp.)*	184	184	184
Beds*(includes every small hosp.)*	27000	27000	27000
Physicians	14333	14500	14686
Nurses		34000	42400
GDP(US$, billions)[2]	161.85	180.55	179.8
Total expenditure on health as % GDP[2]	10.1%	9%	8.9%
Government expenditure on health as %[2]	83.2%		77%
Insured citizens (%)		32%	30%
SCD patients		3500	3500
Heart failure patients		25000	25000
AF patients		Unknown	unknown

1. www.census.gov
2. www.imf.org

2. Pacemaker

	2011	2012	2013
Total Pacemakers	1956	2100	2200
New implants	1662	1800	1850
Replacements	294	300	350
Single-chamber	700	700	750
Dual-chamber	1256	1400	1350
Sick sinus syndrome			
AV block			
Implanting Centers	12	12	12
Implanting Physicians	30	31	31
National Registry	☐no	☐no	☐yes

3. Cardiac resynchronization therapy

	2011	2012	2013
Total CRTs		78	95
CRT-P			
CRT-P new implants			
CRT-P replacements/upgrade			
CRT-D			
CRT-D new implants		63	75
CRT-D replacements/upgrade		15	20
Ischemic			
Non-ischemic			
Implanting Centers	4	5	6
Implanting Physicians	12	13	13
National Registry	☐no	☐no	☐yes

4. Implantable cardioverter defibrillator

	2011	2012	2013
Total ICDs	454	535	560
ICD new implants	382	423	435
ICD replacements	72	112	125
Single-chamber			
Dual-chamber			
Primary prevention		203	207
Secondary prevention		220	228
Implanting Centers	4	5	6
Implanting Physicians	12	13	13
National Registry	☐yes	☐yes	☐yes

5. Interventional electrophysiology

	2011	2012	2013
Ablation procedures			720
SVT ablation procedures		No data	410
AVNRT			
AVRT/WPW			
AFL (RA isthmus dependent)			
AT			
VT/VPC		No data	60
Idiopathic			25
Structural			35
AF ablation procedures			230
Ablation centers	7		
AF ablation centers	4	4	4
Structural VT ablation centers		4	4
Ablation physicians	11		
AF ablation physicians	4	6	7
Structural VT ablation physicians		7	7
National Registry	☐	☐no	☐no

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	95%	99%	99%	95%
Insurance				
Public insurance				
Private insurance				4%
Individual	5%	1%	1%	1%

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

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

7. Source

Name of national working group or arrhythmia body

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

Country/Region: Philippines

1. Statistics

	2011	2012	2013
Population(thousand)[1]	101834	103775	105720
Hospitals			1840
Beds(per 100,000 population)2		50	100
Physicians(per 1,000 population)	1.2	1.2	1.2
Nurses(per 1,000 population)			
GDP (US$, billions)[3]	213.129	227.584	272.02
Total expenditure on health as % GDP[3]	4.1%	4.5%	4.4%
Government expenditure on health as %[3]	36.3%		27%
Insured citizens (%)			
SCD patients			
Heart failure patients			
AF patients			

1. www.census.gov
2. www.who.int
3. www.imf.org

2. Pacemaker

	2011	2012	2013
Total Pacemakers	711	779	1389
New implants	648	710	631
Replacements	63	69	102
Single-chamber	464	485	378
Dual-chamber	247	294	278
Sick sinus syndrome			
AV block			
Implanting Centers	36		36
Implanting Physicians	74		84
National Registry	☐	☐	☐

3. Cardiac resynchronization therapy

	2011	2012	2013
Total CRTs	13	8	18
CRT-P	2	1	2
CRT-P new implants	2	1	2
CRT-P replacements/upgrade	0	0	0
CRT-D	11	7	
CRT-D new implants	9	7	15
CRT-D replacements/upgrade	2	0	1
Ischemic			
Non-ischemic			
Implanting Centers	10	10	10
Implanting Physicians	11	12	13
National Registry	☐	☐	☐

4. Implantable cardioverter defibrillator

	2011	2012	2013
Total ICDs	30	38	48
ICD new implants	29	35	44
ICD replacements	1	3	4
Single-chamber	23	27	
Dual-chamber	7	11	
Primary prevention			
Secondary prevention			
Implanting Centers	10	10	10
Implanting Physicians	11	12	13
National Registry	☐	☐	☐

5. Interventional electrophysiology

	2011	2012	2013
Ablation procedures	50	80	82
SVT ablation procedures			
AVNRT	16	21	25
AVRT/WPW	25	30	37
AFL (RA isthmus dependent)	0	5	2
AT	0	1	3
VT/VPC			
Idiopathic	9	8	9
Structural	0	2	2
AF ablation procedures	0	5	7
Ablation centers			
AF ablation centers	0	1	1
Structural VT ablation centers	0	1	1
Ablation physicians			
AF ablation physicians	0	4	4
Structural VT ablation physicians	0	2	2
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	50%	10%	5%	20%
Insurance				
Public insurance	0	0	0	0%
Private insurance	0	0	0	0%
Individual	50%	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	☐	☐	☐	☒	☐

7. Source

Name of national working group or arrhythmia body

Philippine Heart Rhythm Society, Inc.

Country: Singapore

1. Statistics

	2011	*2012*	*2013*
Population ('000)[1]	**5,183.7**	**5,312.4**	**5,399.2**
Hospitals [1]	**23**	**25**	**25**
a. Public Sector	*15*	*15*	*15*
- Acute Hospitals	*7*	*7*	*7*
- Specialty Centres	*8*	*8*	*8*
b. Private Sector	*8*	*10*	*10*
- Acute Hospitals	*7*	*9*	*9*
- Other Hospitals	*1*	*1*	*1*
Beds[1]	**10,334**	**10,755**	**10,969**
a. Public Sector	*8,935*	*9,180*	*9,387*
-Acute Hospitals	*6,740*	*6,985*	*7,192*
-Specialty Centres	*2,195*	*2,195*	*2,195*
b. Private Sector	*1,399*	*1,575*	*1,582*
-Acute Hospitals	*1,379*	*1,555*	*1,562*
-Other Hospitals	*20*	*20*	*20*
Physicians[2]	**9,646**	**10,225**	**10,953**
a. Public Sector	*5,621*	*6,131*	*6,661*
b. Private Sector	*3,449*	*3,515*	*3,678*
c.Not in active Practice	*576*	*579*	*614*
Nurses/Midwives[2]	**31,749**	**34,507**	**36,075**
- Registered Nurses	*23,598*	*25,971*	*27,556*
- Enrolled Nurses	*7,869*	*8,274*	*8,273*
- Registered Midwives	*282*	*262*	*246*
Advanced Practice Nurses[2]	**78**	**88**	**117**
GDP (US$, billions)			
Government Health Expenditure (as % of GDP)[3]	**1.2**	**1.4**	**1.6**
Government Health Expenditure (as % of Total Government Expenditure)[3]	**8.2**	**9.5**	**10.7**
Insured citizens (%)	-	-	-
SCD patients	-	-	-
Heart failure patients	-	-	-
AF patients	-	-	-

Source: Singapore Health Facts, Ministry of Health, Singapore as of 1April 2014[1], 2 April 2014[2]and 15 May 2014[3](www.moh.gov.sg).

2. Pacemaker

	2011	*2012*	*2013*
Total Pacemakers[4]	**532**	**536**	**618**
-New implants	436	455	513
Replacements	84	65	76
Others	12	16	29
-Single-chamber	*166*	*159*	*162*
Dual-chamber	*361*	*370*	*439*
Not applicable	*5*	*7*	*17*
-Sick sinus syndrome	286	291	325
AV block*	141	136	165
Implanting Centers[4]	5	5	5
Implanting Physicians[4]	~17	~ 22	~ 20
National Registry[4]	☒	☒	☒

Source: CGH, KTPH, NHCS, NUH, TTSH, SCDB as of 24 July 2014[4]

** refer to Complete AV Block only.*

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

3. Cardiac resynchronization therapy

	2011	*2012*	*2013*
Total CRTs[4]	**87**	**121**	**129**
- CRT-P	12	15	19
CRT-P new implants	6	6	12
CRT-P replacements/upgrade	6	8	6
Others	0	1	1
- CRT-D	75	106	110
CRT-D new implants	54	77	77
CRT-D replacements/upgrade	12	23	29
Others	9	6	4
- Ischemic	41	70	77
Non-ischemic	23	22	15
Implanting Centers[4]	4	5	5
Implanting Physicians[4]	~10	~15	~14
National Registry[4]	☒	☒	☒

Source: CGH, KTPH, NHCS, NUH, TTSH, SCDB as of 24 July 2014[4]

4. Implantable cardioverter defibrillator

	2011	*2012*	*2013*
Total ICDs[4]	**233**	**309**	**293**
- ICD new implants	195	255	249
ICD replacements	28	44	35
Others	10	10	9
- Single-chamber	205	268	245
Dual-chamber	22	39	44
Others	6	2	4
- Primary prevention	135	174	183
Secondary prevention	97	135	109
Others	1	-	1
Implanting Centers[4]	5	5	5
Implanting Physicians[4]	~16	~16	~15
National Registry[4]	☒	☒	☒

Source: CGH, KTPH, NHCS, NUH, TTSH, SCDB as of 24 July 2014[4]

5. Interventional electrophysiology

	2011	*2012*	*2013*
Ablation procedures[4]	**412**	**543**	**541**
SVT ablation procedures	-	-	-
AVNRT	103	155	141
AVRT/WPW	72	125	115
AFL (RA isthmus dependent)	81	93	96
AT	18	19	38
VT/VPC	46	58	42
Idiopathic	-	-	-
Structural	-	-	-
AF ablation procedures	84	82	82
Others	8	11	27
Ablation centers[4]	2	2	2
AF ablation centers	2	2	2
Structural VT ablation centers	2	2	2
Ablation physicians[4]	~11	~15	~14
AF ablation physicians			
Structural VT ablation physicians			
National Registry[4]	☒	☒	☒

Source: CGH, KTPH, NHCS, NUH, TTSH, SCDB as of 24 July 2014[4]

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

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

Country/Region: South Korea (Republic of Korea)

1. Statistics

	2011	2012	2013
Population(thousand)[1]	48755	48861	51266
Hospitals[2]	1,711		1,738
Beds(per 100,000 population)[2]		1030	1,068
Physicians(per 1,000 population)[2]		2.02	2.16
Nurses(per 1,000 population)[2]		5.29	5.45
GDP (US$, billions)[3]	1,116.25	1,155.87	1,449.49
Total expenditure on health as % GDP[3]	7.2%		7.6%
Government expenditure on health as %[3]	57.3%		58.2%
Insured citizens (%)	100	100	100
SCD patients	n/a	n/a	28,342 OHCA
Heart failure patients	n/a		
AF patients			800,000

1. www.census.gov
2. www.who.int
3. www.imf.org

2. Pacemaker

	2011	2012	2013
Total Pacemakers	3217	3541	3890
New implants	72.8%	75.8%	3280
Replacements	27.2%	24.2%	610
Single-chamber	28.5%	29.9%	1189
Dual-chamber	71.5%	70.1%	2701
Sick sinus syndrome	41.8%	42.2%	43.7%
AV block	58.2%	57.8%	56.3%
Implanting Centers	140	n/a	146
Implanting Physicians			156
National Registry	☐	☐	☐

3. Cardiac resynchronization therapy

	2011	2012	2013
Total CRTs	100	112	166
CRT-P	19	6	16
CRT-P new implants	18	5	9
CRT-P replacements/upgrade	1	1	7
CRT-D	81	106	150
CRT-D new implants	74	99	125
CRT-D replacements/upgrade	7	7	25
Ischemic	13.2%	23.8%	17.9%
Non-ischemic	86.8%	762%	82.1%
Implanting Centers	32		
Implanting Physicians			
National Registry	☐	☐	☐

4. Implantable cardioverter defibrillator

	2011	2012	2013
Total ICDs	440	562	667
ICD new implants	360	460	580
ICD replacements	80	102	67
Single-chamber	247	349	401
Dual-chamber	193	213	246
Primary prevention	26.5%	28.4%	347
Secondary prevention	73.5%	71.6%	288
Implanting Centers	73	90	96
Implanting Physicians			
National Registry	☐	☐	☐

5. Interventional electrophysiology

	2011	2012	2013
Ablation procedures	5349	5950	6875
SVT ablation procedures	3694	3966	4380
AVNRT	1607	1777	1866
AVRT/WPW	1382	1487	1523
AFL (RA isthmus dependent)	362	381	502
AT	257	257	489
VT/VPC	369	423	512
Idiopathic	88.2%	87.6%	85.8%
Structural	11.8%	12.4%	14.2%
AF ablation procedures	1286	1561	1983
Ablation centers			53
AF ablation centers	27	30	34
Structural VT ablation centers	15	16	19
Ablation physicians			
AF ablation physicians			31
Structural VT ablation physicians			19
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	95%	95%	95%	90%
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	☐	☒	☐	☐	☐

7. Source

KHRS (Korean Heart Rhythm Society)

Country/Region: Taiwan

1. Statistics

	2011	2012	2013
Population (thousand)[1]	23224	23315	23373
Hospitals	479	487	495
Beds	146,377	146,510	146,648
Physicians	41,455	42,490	43,556
Nurses	133,092	N/A	144,855
GDP (US$, billions)[2]	464.03	473.97	489.13
Total expenditure on health as % GDP	5.8	5.8	5.8
Government expenditure on health as %	~34%	~35%	57%
Insured citizens (%)	99.8%	100%	100%
SCD patients	~16,954	~17,020	~17,082
Heart failure patients	~580,622	~582,895	~584,880
AF patients	~348,373	~349,737	~351,025

2. Pacemaker

	2011	2012	2013
Total Pacemakers	3945	4043	4156
New implants	2564	2830	3056
Replacements	1381	1213	1100
Single-chamber	1381	1291	1162
Dual-chamber	2564	2752	2994
Sick sinus syndrome	2485	2426	2380
AV block	1445	1602	1537
Implanting Centers	98	101	103
Implanting Physicians	~160	~170	~175
National Registry	**x**	**x**	**x**

3. Cardiac resynchronization therapy

	2011	2012	2013
Total CRTs	208	179	162
CRT-P	150	145	132
CRT-P new implants	122	114	104
CRT-P replacements/upgrade	28	31	28
CRT-D	58	34	30
CRT-D new implants	32	26	24
CRT-D replacements/upgrade	26	8	6
Ischemic	41	36	33
Non-ischemic	167	143	129
Implanting Centers	37	40	41
Implanting Physicians	~160	~170	~175
National Registry	**x**	**x**	**x**

4. Implantable cardioverter defibrillator

	2011	2012	2013
Total ICDs	347	348	379
ICD new implants	281	278	308
ICD replacements	66	70	71
Single-chamber	104	97	112
Dual-chamber	243	251	266
Primary prevention	0	1	0
Secondary prevention	347	348	379
Implanting Centers	37	40	42
Implanting Physicians	~160	~170	~175
National Registry	**x**	**x**	**x**

5. Interventional electrophysiology

	2011	2012	2013
Ablation procedures	2390	~2500	2754
SVT ablation procedures	1450	~1500	~1910
AVNRT			~1130
AVRT/WPW			~515
AFL (RA isthmus dependent)	330	~330	~250
AT			
VT/VPC	200	~220	160
Idiopathic	N/A	N/A	70
Structural			80
AF ablation procedures	410	~450	434
Ablation centers			10
AF ablation centers			5
Structural VT ablation centers			3
Ablation physicians			
AF ablation physicians			
Structural VT ablation physicians			
National Registry	No	No	No

6. Management

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

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

	2011	2012	2013
Population	64,076,033	64,456,695	67,367,943
Hospitals	n/a	n/a	583
Beds(per 100,000 population)	210		210(2010)
Physicians	n/a	n/a	0.3:1000
Nurses	n/a	n/a	2.8:1000
GDP (US$)	USD345 billion	USD366 billion	USD365.97 billion
Total expenditure on health as % GDP	0.000019%	0.000019%	4.3%(2009)
Government expenditure on health as %	9.6%		
Insured citizens (%)	100	100	99.5%
SCD patients			
Heart failure patients			95,390/year extrapolated
AF patients			3.6/1000 (1999)

2. Pacemaker

	2011	2012	2013
Total Pacemakers			2401
New implants	**2153**	2326	2198
Replacements	**122**	293	203
Single-chamber		44%	33.65%
Dual-chamber	51%	54%	64.93%
Sick sinus syndrome		34.4%	43.34%
AV block		36%	47,15%
Implanting Centers	60	70	55
Implanting Physicians	44	115	115
National Registry	yes	yes	

3. Cardiac resynchronization therapy

	2011	2012	2013
Total CRTs	88	111	
CRT-P	52	65	
CRT-P new implants	52	65	
CRT-P replacements/upgrade			
CRT-D	36	46	
CRT-D new implants	36	46	99
CRT-D replacements/upgrade			
Ischemic			
Non-ischemic			
Implanting Centers			55
Implanting Physicians		20	115
National Registry	x	x	

4. Implantable cardioverter defibrillator

	2011	2012	2013
Total ICDs	487	662	662
ICD new implants	436	583	
ICD replacements	51	79	71
Single-chamber	82.5%	83.4%	77.34%
Dual-chamber	8.72%	5.5%	7.7%
Primary prevention			
Secondary prevention			
Implanting Centers			55
Implanting Physicians			115
National Registry			

5. Interventional electrophysiology

	2011	2012	2013
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			N/A

6. Management

National certification for physicians	PM	CRT	ICD	Ablation
National accreditation for centers	PM	CRT	X ICD	Ablation
Guidelines followed	XNational	XU.S.	XEurope	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			x		
Lack of reimbursement, limited financial resources					x
Lack of referral				x	
Lack of trained personnel			x		
Low awareness of guidelines				x	
Lack of operators		x			

The APHRS White Book: Second edition

-The current status of cardiac electrophysiology in APHRS member countries

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1. Foreword

The publication of the First edition of White Book of Asia Pacific Heart Rhythm Society (APHRS) represents a successful attempt by the leading of APHRS to serve its principle mission: to promote excellence and advancement in the diagnosis and treatment of the patients with heart rhythm disorders. 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 leadership by president Professor Young-Hoon KIM and immediate past president Professor Shih-Ann CHEN, the second edition of APHRS White Book offers data of electrophysiological procedures and CIEDs from 11 member countries and regions of the APHRS: mainland China, India, Japan, Korea, New Zealand, Philippines, Singapore, Malaysia, Taiwan, Hong Kong and Thailand. We are so happy to have data from Malaysia, a new participant in the second edition of APHRS White Book, although Malaysia provided only data for 2013 and 2014 (partly). 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 2011, 2012, and 2013 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 10 APHRS member countries and regions provided their data. The analysis was performed on the trend of device implantation and catheter ablation from 2011 to 2013, and the device implantation rates or catheter ablation rates and procedure centers in 2013.

3. Permanent Pacemaker Implantation

3.1 **Increase in pacemaker implantation:**

The increasing trend of more than 5.0% of the implantation of permanent pacemaker was seen in Philippines, Singapore, Korea, and India in 2013 compared with 2012. Data from Philippines, the implantation of permanent pacemaker increased 78.3%, from 779 in 2012 to 1389 in 2013. The pacemaker use was also increased significantly by almost 32.0% last year in India, from 27518 to 36,322. The increase rates in pacemaker implantation were 15.3% in Singapore and 9.9% in Korea (3541 to 3890) from 2012 to 2013. The overall use of pacemaker remained constant last year as compared with 2012in Japan (59487 vs. 59441), New Zealand (2200 vs. 2100), Taiwan (4156 vs. 4043), and mainland China (51752 vs. 49502).

3.2 **Pacemaker implantation rate**

Data for 2013 were analyzed by evaluating pacemaker implantation rates. Across the 11 countries and regions, a marked heterogeneity was observed in the pacemaker implantation rate per million inhabitants (Table 1) with the highest reported implantation rate in New Zealand (488.9) and Japan (467.3). The large gap in the number of pacemaker implanting center per million inhabitants still remained among the 11 countries and regions. Based on data 2013, there were 4.4 implanting centers per million inhabitants in Taiwan and 2.8 in Korea. By contrast, the countries with lowest density of implanting centers were Philippines (0.6), Malaysia (0.6), India (0.7) and mainland China (0.7). Significant differences were also noted in the pacemaker implants per center, 163 implants per center were performed in New Zealand, 121.5 in India , 56.4 in mainland China 44.7 in Japan, while the numbers of implants/center were only 22.9 in Korea, 25.8 in Philippines. In general, the reported data presented different features in each country. For example, Japan had the highest total number of pacemaker implantations (59209) and implantation rate per million inhabitants (464.5) in 2011, but a relatively low number of implants (44.7) per center. By contrast, New Zealand had the lowest total number of pacemaker use (1956) in 2011, but a relatively higher implantation rate per million inhabitants (455.9) and implantations per center (163). The influence of GDP was also analyzed by evaluating implantation rate per million inhabitants in countries with different GDP per capita. Obviously, the countries with highest GDP per capita of the 7 countries and regions were

Japan, Korea, New Zealand and Taiwan, and the countries with highest implantation rate per million inhabitants were also Japan, and New Zealand, then Taiwan (170.2), and Korea (65.8). Whereas the country with lowest GDP per capita and implantation rate per million inhabitants was Philippines.

4. ICD and Cardiac Resynchronization Therapy devices (CRT)

4.1 Three-year trends in implantation of ICD

The implantation of ICD has increased over time from 2010 through 2013 in almost all APHRS countries and regions. Japan was the country with highest ICD implantation in Asia-Pacific regions, and the ICD use was increased by 26% from 5059 in 2011, and 6373 in 2013. We also observed a significant increase in ICD implantation in India (63.8%), Korea (51.6%), and Thailand (35.9%) through the last three years. However, the increase in ICD use compared to last year was slightly placid in Singapore (from 309 in 2012 to 293 in 2013), mainland China (from 1553 in 2012 to 1903 in 2011), and in New Zealand (from 535 in 2012 to 560 in 2013). Although Philippines is the country with the lowest implants of ICD in Asia-Pacific regions, the increase was great of 60.0%, from 30 in 2011 to 48 in 2013.

Five countries provide additional unique information on ICD primary or secondary prevention: mainland China, Korea, Singapore, New Zealand, and Taiwan. The use of ICD for primary prevention has significantly increased in mainland China (from 42.7% in 2012 to 44.9% in 2013), and Korea (from 28.4% in 2012 to 52% in 2013). However, a slightly decrease in ICD use was observed in Singapore (from 56.3% in 2012 to 37.5% in 2013) and New Zealand (from 37.9% in 2012 to 36.9% in 2013). In Taiwan, the ratio of ICD implantation for primary prevention was 0 in 2013.

4.2 ICD implantation rate

It was reported a total number of 13033 ICD implants across the 11 countries and regions in 2013.New Zealand was still the Country with highest reported ICD implantation rate per million inhabitants (124) (Table 1). Singapore (54.3) and Japan (50) were the other countries with high ICD implants/million, while Taiwan had 16.2, Korea had 13.0, Thailand had 9.8 ICD implants/million. Philippines (0.4), mainland China (1.4), and India (1.5) were the countries with lowest ICD implants/million. The available data also showed a large gap among the 11 countries and regions in the number of ICD implanting center per million inhabitants. The countries with more than 1 ICD implanting centers per million inhabitants were Korea (1.8), Taiwan (1.8), and New Zealand (1.3) in 2013.The number of ICD implanting centers increased from 4 in 2011 to 6 in 2013 in New Zealand. By contrast, the other countries with less than 1implanting centers per million inhabitants included Singapore (0.9), India (0.3), Philippines (0.009), and mainland China (0.3). It might be just because New Zealand had the high ICD implants/million and less implanting centers, the highest implants per center were recorded in New Zealand (93.3).The numbers of ICD implants/center were only 6.0 in Korea, 4.8 in Philippines, 5.9 in mainland China, and 5.7 in India.

4.3 CRT utilization in Asia-Pacific area

The rising trend in CRT implants was similar to the implantation of ICD in Asia-Pacific countries and regions from 2010 through 2013. The countries with total number of CRTs implantation more than 1000 in 2013 still were Japan, India, and mainland China, with the highest CRT implantation in Japan (4260). The increase in CRT implantation was slightly decreased compared with previous 3 years, 20.6% in mainland China, from 1822 in 2011 to 2198 in 2013, by 51.8% in India, from 1205 in 2011 to 1830 in 2013, and by 10.1% in Japan, from 3868 in 2011 to 4260 in 2013. The reported total number of CRT implantation in other countries and regions also exceeded 100 in 2013 except for Philippine. And a significant increasing trend in CRT implantation was also observed in Korea (from 100 in 2011 to 166 in 2013), in Singapore (from 87 in 2011 to 129), and Philippines (from 14 in 2011 to 18 in 2013). The CRTs use was slightly placid in Taiwan (from 208 in 2011 to 162 in 2013). However, no data were available for New Zealand and Hong Kong.

The collected data showed a total number of 8971 CRT implants in 9 Asia-Pacific countries and regions in 2013. The number of implants continued showing great heterogeneity from as low as 0.2/million (Philippines) to as high as 33.5/million (Japan). In Taiwan, 6.8 implants/million were performed, while India had only 1.5, Korea 3.2, mainland China had 1.6. There was also significant variability in the ratio of CRT-D/CRT-P implants. The ratio of CRT-D implants was 78.1% in Japan, 90.4% in Korea, 43.7% in India, 55.5% mainland China, and 18.7% in Taiwan. CRT implantation is still technically challenging and is not performed in all pacemaker implanting centers. The number of "CRT centers" shows great geographical variability

5. Catheter Ablation

5.1 General information of Catheter Ablation

Nine countries and regions submitted their data of catheter ablation. The number of ablation procedures was significantly higher in mainland China, and Japan than those in other countries and regions. Also an increasing trend was observed in ablation procedures across all 9 countries and regions from 2011 to 2013. In mainland China, the catheter ablations increased significantly from 63355 in 2011 to 83450 in 2013, and which also rose in Japan from 38000 in 2011 to 46000 in 2013. The total number of ablations was less than 10000 in other countries and regions (Korea, India, Philippines, Malaysia, New Zealand, Singapore, and Taiwan).

5.2 Ablation procedure rates

By 2013, a total number of 154,399 ablations were reported in 9 Asia-Pacific countries and regions (mainland China, Japan, Korea, India, Philippines, Singapore, New Zealand, and Taiwan). As shown in Table 2, the highest number of ablation procedures per million inhabitants was recorded in Japan (361.3), New Zealand (160),and Taiwan (117.8), and the lowest in India (10.7) and Philippines

(0.8). In mainland China, only 61.8 ablation procedures/million inhabitants were performed. Regarding ablation centers per million inhabitants in 2013, the highest density was recorded also in Japan (4.3) and the lowest in India (0.1).The distribution of ablation procedures per center also showed a marked heterogeneity. It was reported 107.7 ablation procedures/center in mainland China, 103.8/center in Korea, 66.7/center in Japan, 53.3/center in India, and only 5.8/center in Philippines. The data also showed a significant impact of GDP on the catheter ablation rate per million inhabitants. The top 3 countries with GDP per capita above 30 thousands US dollars in 2011 were Japan, Korea, and Taiwan. The three countries were also the top 3 countries with the high number of ablation procedures per million inhabitants. By contrast, Philippines and India were lowest of the both GDP and ablation procedures/million.

5.3 **Atrial fibrillation (AF) catheter ablation**

In this edition, we got more the data of AF ablation compared with last year, including data from Japan, mainland China, Korea, Taiwan, Malaysia, India, New Zealand, Philippine, and Singapore (no data available for Hong Kong and Thailand) although data were not available in some countries. However, with the increase in AF ablation procedures, the increase rates decreased in some countries. Japan was still the country with the highest number of AF ablation procedures since 2009. Compared with 2012, the AF ablations in 2013 significantly increased by 19% (from 21,000 to 25,000) in Japan, and by 31.5% in mainland China (from 11214 to 14752). There was also an increase of 27.0% in the number of AF ablations from 2012 to 2013 in Korea (from 1561 to 1983). Taiwan showed a flat trend in the AF catheter ablations over the past three years (410 in 2011, 450 in 2012, and 434 in 2013).Across the 9 countries and regions with available data for 2013 (Table 2),a total number of 39305 AF ablation procedures were performed, with the highest reported AF ablation rate per million inhabitants in Japan (196.4), and the low ablation rate in India (0.6) and Philippine (0.06). The number of AF ablations per million inhabitants was 38.7 in Korea. Regarding the ratio of AF/total ablations, there was also a large gap among 9 countries and regions, with highest reported AF ablation ratio in New Zealand (56%) and Japan (54.3%), and lowest AF ablation ratio in India (5.6%). And the AF ablation ratio was 45.3% in Korea, 17.8% in mainland China, and 15.8% in Taiwan, which was increased compared to last year.

6. Conclusion and future work

The current report just brings together the data on implantation of cardiovascular electronic devices and electrophysiological procedures in 11 APHRS countries and regions. Primary analysis of these data showed a growing trend in arrhythmia interventional treatment in many Asia-Pacific countries and regions. However, there is still a great gap between Asian and Western countries. The 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. But in some Asian countries, currently there are no registry data available. 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 2013 in 11 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	38.3	0.7	1.4	1.6	0.3
Hong Kong	74.6	No data	10.9	No data	No data
India	29	0.7	1.5	1.5	0.3
Japan	467.3	No data	50	33.5	No data
New Zealand	488.9	2.7	124	21	1.3
Philippines	13.1	0.6	0.4	0.2	0.09
Singapore	114.5	0.9	54.3	23.9	0.9
South Korea	75.9	2.8	13	3.2	1.8
Taiwan	177.8	4.4	16.2	6.8	1.8
Thailand	35.6	0.8	9.8	No data	0.8
Malaysia	19.4	0.6	4.0	3.7	0.4

Table 2 The ablation procedure rate and centres per million inhabitants for the year 2013 in 11 Asia-Pacific countries and regions

Countries and regions	Ablation procedure rate/million inhabitants	Ablation centers/million inhabitants	AF ablation rate/million inhabitants	AF ablation centres/million inhabitants	AF ablation/ abltion procedure
Mainland China	61.8	0.55	10.9	0.3	17.8%
Hong Kong	No data	No data	No data	No data	No data
India	10.7	0.1	0.6	0.01	5.6%
Japan	361.3	4.3	196.4	2.8	54.3%
New Zealand	160	No data	51	0.9	56%
Philippines	0.8	No data	0.06	No data	8.5%
Singapore	100	0.4	15.2	0.4	15.2%
South Korea	85.4	1.0	38.7	0.7	45.3%
Taiwan	117.8	0.4	18.6	0.3	15.8%
Thailand	No data	No data	No data	No data	
Malaysia	17.6	0	1.9	0	10.9%