

# Epidemiologic Burden of Hospitalization Among Adult Filipinos for Cardiac Arrhythmias Requiring Permanent Pacemaker Implantation

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## Abstract

**BACKGROUND:** Symptomatic bradycardia, commonly attributed to sinus node dysfunction/sick sinus syndrome, or atrioventricular (AV) blocks or conduction disorders from chronic fascicular blocks, is treated by implantation of a permanent pacemaker. Despite it being a class 1 recommendation, there is a perception based on informal surveys that permanent pacemaker implantation (PPI) is underutilized. The Philippines showed slow growth in the volume of implantation from 1049 in 2015 to 1225 in 2016. The Philippine pacemaker data after 2016 are incomplete and unreliable because of the lack of a national registry. It is the aim of this study to ascertain the prevalence of cardiac arrhythmias requiring PPI and the volume of its utilization in the Philippines.

**OBJECTIVES:** The aims of this study were to (1) to determine the prevalence of hospitalization claims in 2017 and 2018 for cardiac arrhythmias requiring PPI, (2) to determine the regional distribution of arrhythmias requiring PPI, (3) to determine the regional distribution of hospitalization claims for PPI, (4) to determine the number of hospitalization claims for specific cases requiring PPI and the corresponding mortality rate, (5) to determine the number of hospitalization claims for PPI and the corresponding mortality rate, and (6) to describe the demographic profile of patients with indications and with claims for PPI, as well as the duration of hospitalization and type of facilities where the hospital claims were filed.

**METHODS:** This is a descriptive study of Filipino patients 19 years or older, admitted for cardiac arrhythmias requiring PPI in the Philippine Health Insurance Corporation (PhilHealth)-accredited hospitals in 2017 and 2018. The data for disease prevalence were gathered from the database of PhilHealth using the *International Statistical Classification of Diseases and Related Health Problems, Tenth Revision (ICD-10)* of the World Health Organization. The procedures that the patients underwent were determined using the latest PhilHealth Relative Value Scale (RVS) codes. Other variables gathered were the demographic data, diagnosis, region, duration of hospital stay, type of facility on admission, and the status on discharge. Qualitative data were tabulated and presented as frequency and percent distribution. Quantitative data were reported as median with corresponding quartiles (Q1 and Q3).

**RESULTS:** Based on the 2017 and 2018 database of PhilHealth, out of the nationwide total medical admissions, there were 958 total claims for arrhythmias requiring pacemaker implantation in 2017 and 1144 total claims in 2018. The prevalence in both years was similar (0.04%). There were 549 and 683 total claims for PPI, in 2017 and 2018, respectively, and preponderantly done in the National Capital Region. Sick sinus syndrome/tachycardia-bradycardia syndrome had the greatest number of total claims for both years. More than half of the patients who had PPI were females. The median age was similar (67 and 68 years old for both years and 73 and 75 years old in 2017 and 2018, based on *ICD-10* and RVS codes, respectively). The duration of hospitalization was a median of 4 days (*ICD-10* codes) and 5 to 6 days (RVS codes). Most of the hospital claims for cardiac arrhythmias (76%–79%) requiring PPI were filed in private facilities. Mortality among those diagnosed was 3.6% for complete atrioventricular block and 0.3% for sick sinus syndrome but was low among those who underwent PPI (0.8%–2.2%).

**CONCLUSION:** The prevalence of hospitalization claims for arrhythmias requiring PPI was 0.04%, both in 2017 and 2018. There is a big gap between the number of cases requiring a permanent pacemaker and the number that underwent the procedure. Hospitalization claims, based on *ICD-10* codes and RVS codes, were centralized in the National Capital Region and private hospitals. The mortality rate among those who had the procedure was low.

**KEYWORDS:** arrhythmia, permanent pacemaker insertion or implantation, prevalence, hospitalization, PhilHealth

## INTRODUCTION

Cardiovascular diseases remain the number one cause of mortality in the Philippines.<sup>1</sup> Cardiac arrhythmias are commonly encountered but underreported. Cardiac arrhythmias have different types, etiologies, presentations, and management approaches.

Implantation or insertion of a permanent pacemaker is the only proven therapy for symptomatic bradycardia attributed to sinus node dysfunction or atrioventricular (AV) blocks or cardiac conduction delay. The 2018 American College of Cardiology/American Heart Association/Heart Rhythm Society<sup>2</sup> Guideline on the Evaluation and Management of Patients With Bradycardia and Cardiac Conduction Delay lists the following as class 1 recommendations for PPI: (1) sinus node dysfunction (with accompanying symptoms), (2) AV block, and (3) conduction disorders from chronic fascicular blocks (eg, patients with syncope and alternating bundle-branch block). Among the major indications for implantation of a cardiac pacemaker were high-degree AV block and sick sinus syndrome (SSS).<sup>3</sup>

In the first nationwide data on pacemaker implantation obtained from a population-based survey in the United States of 47,485 households with an estimate of 456,482 noninstitutionalized adults with pacemakers,<sup>4</sup> the prevalence was 2.6 per 1000. The prevalence was higher among those 75 years or older (26 per 1000) compared with persons aged 18 to 64 years (0.4 per 1000).

The Asia Pacific Heart Rhythm Society has collated data on pacemaker implantation and replacements annually since 2013.<sup>5</sup> Data from 19 countries and regions were reported. All the 19 countries showed an increasing trend in the rate of pacemaker implantation in 2018 as compared in 2017. The highest implantation rate was in New Zealand and Japan. However, not all patients in the Asia Pacific region who were recommended to have pacemaker implantation received the devices.<sup>6</sup> The Philippines showed slow growth in the volume of implantation from 1049 in 2015 to 1225 in 2016.<sup>5</sup> Philippine pacemaker data after 2016 are incomplete and unreliable because of the lack of a national registry and refusal of device companies to release data because of privacy issues.

The Philippine Health Insurance Corporation (PhilHealth) is the agency mandated to provide health insurance coverage

for Filipinos through the National Health Insurance Program. It has a nationwide database of patients admitted to PhilHealth-accredited hospitals. Approximately 93%<sup>7</sup> and 98%<sup>8</sup> of the population had been covered by the National Health Insurance Program. Part of its program is the “expanded Z packages for heart surgeries, particularly for coronary artery bypass graft, surgery for total correction of tetralogy of Fallot), and patch repair of ventricular septal defect.” These packages apply to PhilHealth members and dependents who would pass the selection criteria.<sup>9</sup> However, other standards of care such as permanent pacemakers have yet to be covered by the program.

Because of lack of registry, it is the aim of this study to ascertain the number of cardiac arrhythmias requiring permanent pacemaker implantation (PPI) and the volume of its utilization both on the national and regional levels.

### *Research Question*

Among patients 19 years or older who were admitted in PhilHealth-accredited hospitals in 2017 and 2018 for cardiac arrhythmias, what is the prevalence of cardiac arrhythmias requiring PPI?

### *General Objectives*

- (1) To determine the annual nationwide (overall) and per-region prevalence of hospitalization claims (first admission and readmissions) of cardiac arrhythmia-related illnesses that required pacemaker implantation among adult patients 19 years or older who were admitted in PhilHealth-accredited hospitals in 2017 and 2018.
- (2) To determine the number of permanent pacemakers implanted among the patients hospitalized for cardiac arrhythmias that required them (objective 1).

### *Specific Objectives*

- (1) To determine the prevalence of hospitalization claims (first admission and readmissions) in 2017 and 2018 for cardiac arrhythmias requiring PPI.
- (2) To determine the regional distribution of arrhythmias requiring PPI in 2017 and 2018.
- (3) To determine the regional distribution of hospitalization claims for PPI.
- (4) To determine the number of hospitalization claims for specific cases requiring PPI and the corresponding mortality rate.

- (5) To determine the number of hospitalization claims of PPI and the corresponding mortality rate.
- (6) To describe the demographic profile of patients with indications and with claims for PPI, as well as the duration of hospitalization and type of facilities (government or private) where the hospital claims were filed.

## METHODOLOGY

The authors of the Cardiac Arrhythmias and Devices Study Group embarked on a relatively big prevalence study by the development of a Cardiac Arrhythmias and Devices Study “mother” protocol. The mother protocol investigated the prevalence of the different cardiac arrhythmias and the number of cases requiring three different procedures (depending on indications) based on hospital claims in 2017 and 2018 using PhilHealth data, namely, permanent pacemaker implantation (PPI), implantable cardioverter-defibrillator, and radiofrequency ablation. It contained seven specific objectives; hence, it was intended that there would be substudies, resulting in three separate prevalence studies. This article focuses on the prevalence of cardiac arrhythmias requiring PPI.

### *Study Design and Participants*

This is a retrospective descriptive study of patients 19 years or older, admitted for cardiac arrhythmias requiring PPI in the PhilHealth-accredited hospitals in 2017 and 2018.

### *Source of Data*

The data for disease prevalence were gathered from the database of PhilHealth using the *International Statistical Classification of Diseases and Related Health Problems, Tenth Revision (ICD-10)* of the World Health Organization derived from the latest PhilHealth Medical Case Rates table<sup>10</sup> (Appendix Table 1). The treatment received by the patients was collected using the latest PhilHealth Relative Value Scale (RVS) codes/procedures<sup>11</sup> (Appendix Table 2).

### *Ethical Considerations*

All data from the PhilHealth computer database were obtained in anonymity. Only the number of cases and pertinent values were documented in the final data encoding and the reporting of the results. This study is part of the main mother protocol, which was reviewed and approved by the Independent Ethics Committee of De La Salle Medical and Health Sciences Institute, Dasmariñas, Cavite.

### *Data Analysis*

Data were encoded using Microsoft Excel 2016 (Microsoft Corp, Redmond, Washington). Qualitative data were tabulated and presented as frequency and percent distribution. The age of admission was tabulated as median with the corresponding range. The duration of hospitalization was reported as median with the corresponding quartiles (Q1, Q3).

## RESULTS

### *Prevalence of Diseases Requiring PPI*

Based on the 2017 and 2018 PhilHealth database, the total

PhilHealth claims for medical conditions were 2,675,097 and 2,715,491 (2017 and 2018, respectively) for those 19 years or older.

Among these PHIC claims, 958 (2017) and 1144 (2018) were hospitalization claims (either for first admission and readmissions) for arrhythmias requiring pacemaker implantation with a prevalence rate of 0.04% hospital claims in both years.

### *Regional Distribution of Arrhythmias Requiring PPI*

Claims for admissions for arrhythmias requiring permanent pacemaker vary among the 17 regions in the country (Table 1). In 2017, the National Capital Region (NCR) had the highest number of admissions (22.4%), followed by Northern Mindanao (Region X) 10.9%. The Autonomous Region of Muslim Mindanao (ARMM) and Caraga (Region XIII) had the least number of admissions, 1.5% and 1.8%, respectively. In 2018, both NCR (16.2%) and Region X (14.1%) again had the greatest number of admissions. Zamboanga Peninsula (Region IX) and ARMM (1.1% and 1.5%, respectively) had the least number of admissions.

### *Regional Distribution of Claims for PPI*

In 2017 (Table 2), 549 claims for pacemaker implantations were made. In 2018, 683 claims were filed. Half of these pacemaker implantations were done in NCR in both years (288 and 346 in 2017 and 2018, respectively). These numbers are higher than the claims for hospital admissions in the region. This pattern was also seen in Davao Region (Region XI), where the number of procedures exceeded the number of reported admissions both in 2017 and 2018.

On the other hand, in 2017 and 2018, there were 53 and 67 hospitalizations claims in Cagayan Valley, 17 and 24 hospitalization claims in Caraga (Region XIII), and 14 and 17 hospitalization claims in ARMM of patients for arrhythmias requiring implantation, yet no PPIs were performed.

### *Indications Cited in Claims for PPI*

Table 3 shows the number of specific cases of cardiac arrhythmias requiring pacemaker implantation in 2017 and 2018 based on ICD-10 codes and the corresponding percentage of mortality. Both in 2017 and 2018, SSS and tachycardia-bradycardia syndrome had the greatest number of total claims, which were 539 and 599, respectively. On the other hand, complete AV block had a total claim of 218 and 250 in 2017 and 2018, respectively. Unspecified conduction system disorder had total claims of 201 in 2017 and increased to 295 in 2018. There were no claims for AV block, second degree (may include Mobitz 1 and 2), and trifascicular block.

### *Mortality Among Cases With Indications and With PPI*

In terms of mortality rate, in 2017, there were five readmissions for SSS and one readmission each for complete AV block and unspecified conduction system disorder. Given the possible readmissions, the actual numbers (as denominators) for the determination of mortality rates were 534 (SSS), 217 (AV block, complete), and 200 (conduction system disorder, unspecified).

The in-hospital mortality rate among the total claims was highest in cases with complete AV block (3.7%). Likewise, in 2018, total claims with complete AV block had the highest mortality rate of 3.6%. Sick sinus syndrome had the lowest mortality rate of 0.2% to 0.3%, closely followed by unspecified conduction system disorder (0.3%–0.5%).

#### Mortality Among Cases With Claims for PPI

Table 4 shows the number of procedures related to cardiac arrhythmias requiring pacemaker implantation in 2017 and 2018 based on RVS codes and the corresponding percentage of mortality. RVS code 33208 (insertion or replacement of permanent pacemaker with transvenous electrode(s), atrial and ventricular) had the highest number of procedures both in 2017 and 2018, followed by RVS code 33207 (insertion or replacement of permanent pacemaker with transvenous electrode(s), ventricular), whereas RVS code 71090 (insertion pacemaker, fluoroscopy and radiography, radiological supervision and interpretation) had the lowest number of procedures in both years. Mortality rates were low with ranges from 0.2% to 2.2%. The 2.2% pertained to one death out of the 45 total claims in 2018 under the RVS code 33206 (insertion

or replacement of permanent pacemaker with transvenous electrode(s), atrial).

#### Demographics of Patients With Indications and With Claims for PPI

More than half of the patients (Table 5) with pacemaker insertion were females (60.7% in 2017 and 58.0% in 2018). The median age was almost the same (67 and 68 years old) in both years. Based on *ICD-10* codes, most of the patients (46% in 2017 and 45.4% in 2018) who underwent pacemaker insertion belonged to the age range 59 to 78 years, followed by the age group 79 to 98 years.

In terms of procedures done based on RVS codes, females made up more than half of the total number of claims in both years. The median age is 73 and 75 years in 2017 and 2018, respectively.

Duration of hospitalization (Table 6) was a mean of 3 days and a median of 4 days both in 2017 and 2018 based on *ICD-10* codes. Based on RVS codes, the duration of hospitalization was between a mean of 4 days and a median of between 5 and 6 days.

**Table 1.** Regional Distribution of Hospitalization (First Admission and Readmissions) for Arrhythmias Requiring Pacemaker Implantation in the Philippines

Region	n (%) 2017	n (%) 2018
Philippines	958	1144
Ilocos Region (Region I)	77 (8.0)	90 (7.9)
Cagayan Valley (Region II)	53 (5.5)	67 (5.9)
CAR	18 (1.9)	33 (2.9)
Central Luzon (Region III)	74 (7.7)	85 (7.4)
NCR	215 (22.4)	185 (16.2)
Calabarzon (Region IV-A)	38 (4.0)	59 (5.2)
MIMAROPA (Region IV-B) <sup>a</sup>	34 (3.5)	37 (3.2)
Bicol Region (Region V)	20 (2.1)	32 (2.8)
Western Visayas (Region VI)	62 (6.5)	58 (5.1)
Central Visayas (Region VII)	95 (9.9)	93 (8.1)
Eastern Visayas (Region VIII)	48 (5.0)	44 (3.8)
Zamboanga Peninsula (Region IX)	18 (1.9)	13 (1.1)
Northern Mindanao (Region X)	104 (10.9)	161 (14.1)
Davao Region (Region XI)	20 (2.1)	21 (1.8)
SOCCSKSARGEN (Region XII)	51 (5.3)	125 (10.9)
Caraga (Region XIII)	17 (1.8)	24 (2.1)
ARMM	14 (1.5)	17 (1.5)

CAR=Cordillera Administrative Region; NCR=National Capital Region; CALABARZON=Cavite, Laguna, Rizal, Quezon; MIMAROPA=Mindoro, Marinduque, Romblon, Palawan (Batangas, included in IV-B as per PhilHealth office); SOCCSKSARGEN=South Cotabato, Cotabato, Sultan Kudarat, Sarangani, General Santos; ARMM=Autonomous Region of Muslim Mindanao.

In 2017 and 2018, based on ICD-10 codes and RVS codes (Table 6), most of the hospital claims for cardiac arrhythmias (76%–79%) requiring pacemaker implantation were admitted in private facilities or hospitals.

## DISCUSSION

The prevalence of cardiac arrhythmia requiring pacemaker implantation was 0.04% both in 2017 and 2018. This is comparable to the population-based estimate of 0.03% to

**Table 2.** Regional Distribution of Pacemaker Implantation in the Philippines

Region	n (%) 2017	n (%) 2018
Philippines	549	683
Ilocos Region (Region I)	12 (2.2)	11 (1.6)
Cagayan Valley (Region II)	0	1 (0.1)
CAR	23 (4.2)	30 (4.4)
Central Luzon (Region III)	44 (8.0)	44 (6.4)
NCR	288 (52.4)	346 (50.7)
Calabarzon (Region IV-A)	3 (0.5)	10 (1.5)
MIMAROPA (Region IV-B) <sup>a</sup>	7 (1.3)	12 (1.8)
Bicol Region (Region V)	7 (1.3)	4 (0.6)
Western Visayas (Region VI)	47 (8.6)	52 (7.6)
Central Visayas (Region VII)	52 (9.5)	71 (10.4)
Eastern Visayas (Region VIII)	1 (0.2)	2 (0.3)
Zamboanga Peninsula (Region IX)	1 (0.2)	3 (0.4)
Northern Mindanao (Region X)	20 (3.6)	21 (3.1)
Davao Region (Region XI)	41 (7.5)	69 (10.1)
SOCCSKSARGEN (Region XII)	3 (0.5)	7 (1.0)
Caraga (Region XIII)	0	0
ARMM	0	0

CAR=Cordillera Administrative Region; NCR=National Capital Region; CALABARZON=Cavite, Laguna, Rizal, Quezon; MIMAROPA=Mindoro, Marinduque, Romblon, Palawan (Batangas, included in IV-B as per PhilHealth office); SOCCSKSARGEN=South Cotabato, Cotabato, Sultan Kudarat, Sarangani, General Santos; ARMM=Autonomous Region of Muslim Mindanao.

**Table 3.** Number of Specific Cases of Cardiac Arrhythmias Requiring Pacemaker Implantation and Corresponding Mortality Rate

ICD-10 Codes	Description	Total Claims, 2017	Mortality, 2017 n (%)	Total Claims, 2018	Mortality, 2018 n (%)
I49.5	Sick sinus syndrome; tachycardia-bradycardia syndrome	539 (56.3%)	1 (0.2)	599 (52.3%)	2 (0.3)
I44.1	AV block, second degree (may include Mobitz 1 and 2)	0		0	0
I44.2	AV block, complete	218 (22.6%)	8 (3.7)	250 (21.8%)	9 (3.6)
I45.3	Trifascicular block	0		0	0
I45.9	Conduction system disorder, unspecified	201 (21%)	1 (0.5)	295(25.8%)	1 (0.3)
	<b>Total claims</b>	<b>958<sup>a</sup></b>	<b>10 (1.0)</b>	<b>1144</b>	<b>12 (1.05)</b>

<sup>a</sup>951 after removal of readmissions.

AV=atrioventricular; ICD-10=International Statistical Classification of Diseases and Related Health Problems, Tenth Revision.

0.05% found in Western Australia.<sup>12</sup> However, the reported local prevalence is just an estimation of the true prevalence as the numerator used was a combination of the hospital claims based on *ICD-10* codes and RVS codes and not as unique patients.

The volume of procedures performed was small. Only 549 and 683 procedures were performed in 2017 and 2018, which seemed to represent slightly more than half of the cases with an indication for it. This may be explained by several factors: (1) lack of education regarding the favorable benefit versus risk profile of the procedure; (2) the limited PhilHealth coverage for a procedure (one example is that the case rate for RVS code 33208 is only 21,400 Philippine pesos.<sup>13</sup> which covers only 10% of the total cost of the procedure coupled with the inability of the patient to supplement this out-of-pocket payment); and (3) lack of facilities and healthcare providers capable of performing the recommended procedures in a particular region. As seen in some regions (NCR and Davao Region) where disparities of the higher number of implantations compared with the number of admissions may be due to the possibility that many patients who were initially admitted in hospitals in their respective regions were eventually referred to another region, particularly in NCR where facilities are more equipped for the pacemaker implantation, this leads to a bias in the distribution of hospital type where procedures are performed, with 80% of procedures were performed in private hospitals compared with only 20% in government hospitals. More comprehensive coverage will likely tilt the distribution more equally.

Comparing our results with the Asia Pacific Heart Rhythm Society, we reported 683 claims in 2018 compared with 1037 from the Asia Pacific Heart Rhythm Society (APHRS) census.<sup>5</sup> This discrepancy may be explained by the following: (1) incomplete or nonfiling of claims, (2) not all patients reported by the APHRS were PhilHealth members (either foreigner or Filipino nonmember), (2) erroneous encoding of the RVS code, and (4) the claim was filed for a concomitant procedure with a higher benefit package, for example, coronary artery bypass graft.

In other Southeast Asian countries, such as Vietnam and Indonesia, the rapid growth of pacemaker implantation cases could be observed.<sup>5</sup> Vietnam showed an increase from 2722 implantations in 2015 to 3242 in 2018. In Indonesia, there had been a doubling of cases from 700 in 2015 to 1400 in 2018. This rapid rise in numbers is attributable to government subsidy of pacemaker implantations. In Vietnam, the government pays up to US \$2000 per procedure. This illustrates that when there is government support, there is growth in healthcare utilization.

The distribution of pacemaker implantations reflects the economic and political strength of the geographical region. Many of the procedures were performed in the country's capital, NCR (50%), followed by Central Visayas (10%) and Davao Region (10%). These regions have the highest number of tertiary hospitals with teaching and training (level 4).<sup>14</sup> Such numbers reflect the developmental bias in the Philippines.

**Table 4.** Number of Procedures Related to Cardiac Arrhythmias Requiring Pacemaker Implantation and Corresponding Mortality Rate

RVS Codes	Description	Total Claims, 2017	Mortality, 2017 n (%)	Total Claims, 2018	Mortality, 2018 n (%)
33212	Insertion or replacement of pacemaker pulse generator only, single chamber	64 (11.6%)	0	73 (10.7%)	1 (1.4)
33213	Insertion or replacement of pacemaker pulse generator only, dual chamber	49 (8.9%)	0	71 (10.4%)	0
33206	Insertion or replacement of permanent pacemaker with transvenous electrode(s), atrial	33 (6%)	0	45 (6.6%)	1 (2.2)
33207	Insertion or replacement of permanent pacemaker with transvenous electrode(s), ventricular	172 (31.3%)	1 (0.6)	222 (32.5%)	3 (1.4)
33208	Insertion or replacement of permanent pacemaker with transvenous electrode(s), atrial and ventricular	223 (40.6%)	0	266 (38.9%)	0
71090	Insertion pacemaker, fluoroscopy and radiography, radiological supervision and interpretation	8 (1.5%)	0	6 (0.9%)	0
	<b>Total claims</b>	<b>549</b>	<b>1 (0.2)</b>	<b>683</b>	<b>5 (0.7)</b>

RVS=Relative Value Scale.

**Table 5.** Demographics of Patients Requiring and Underwent Pacemaker Implantation in 2017 and 2018

Variables	ICD-10 Codes	
	2017	2018
No. of males	376	480
No. of females	582	664
Median age (Q1, Q3), y	68 (55, 78)	67 (53, 77)
	ICD-10 Codes Only	
	2017	2018
Age range		
19–38 y	101 (10.5%)	116 (10.1%)
39–58 y	181 (18.9%)	252 (22.0%)
59–78 y	441 (46.0%)	520 (45.4%)
79–98 y	234 (24.4%)	254 (22.2%)
≥99 y	1 (0.1%)	2 (0.2%)
Total	958	1144
	RVS Codes	
	2017	2018
No. of males	223	289
No. of females	327	394
Median age (Q1, Q3), y	73 (65, 81)	75 (66,82)
Total	550	683

ICD-10=International Statistical Classification of Diseases and Related Health Problems, Tenth Revision; Q1=first quartile; Q3=third quartile; RVS=Relative Value Scale.

Moreover, it is a dismal fact that there are regions in the Philippines that did not have procedural claims for PPI (Caraga and ARMM) and only one claim in Region II, Cagayan Valley. In these regions, there is an absence or shortage of implanters, as well as implanting facilities. The geographic makeup of the Philippines, being an archipelago, may be a deterrent in its development and in the movement of patients to a facility where the procedure can be done.

In a study done by Pestaño et al<sup>14</sup> in 2014, the total number of cardiologists practicing in the Philippines was 1204 (9.0%), and 58% of them were in NCR and 7.8% in Central Visayas (Region VII). This finding further highlights the concentration of cardiologists in NCR. In the APHRS census, published in 2019 (5), there were 72 implanting centers and 76 implanting physicians in 2018, attending to 1144 total claims in 2018, translating into a ratio of one implanting physician for every 18 claims in 2017 and one for every 15 claims in 2018. This ratio is misleading because there remains a maldistribution of resources and an underreporting of cases with indications for pacemakers.

The majority of patients admitted with cardiac arrhythmias requiring PPI are in the age range of 59 to 78 years, followed by the age range of 79 to 98 years (both in 2017 and 2018), reflecting the degenerative nature of the disease. In the study done by Bradshaw et al,<sup>12</sup> a population-based retrospective cohort study, in Western Australia from 1995 to 2009, the rates of implantation and prevalence of permanent pacemaker had a sustained increase with the aging population. The mean age at implantation increased from 73.8 (SD, 11.7) years in 1995 to 1999 to 75.3 (SD, 11.7) years in 2005 ( $p \leq 0.001$ ). The increase in prevalence could be attributed to the association of aging with increases in arrhythmias and conduction abnormalities.<sup>15</sup>

**Table 6.** Duration of Hospitalization in Days and Types of Facilities/Hospitals According to ICD-10 and RVS Codes

	2017	2018
	Duration of Hospitalization in Days	
ICD-10 codes	Median = 3 (2, 4) Mean = 4.03	Median = 3 (2, 4) Mean = 3.52
RVS codes	Median = 4 (2, 6) Mean = 5.42	Median = 4 (3, 7) Mean = 5.93
	Type of Facility/Hospital	
ICD-10 codes	Government = 212 (22.13%) Private = 746 (77.87%)  Total: 958	Government = 267 (23.34%) Private = 877 (76.66%)  Total: 1144
RVS codes	Government = 113 (20.58%) Private = 434 (79.05%) Not mentioned = 2 (0.36%)  Total: 549	Government = 166 (24.30%) Private = 516 (75.55%) Not mentioned = 1 (0.15%)  Total: 683

ICD-10=International Statistical Classification of Diseases and Related Health Problems, Tenth Revision; RVS=Relative Value Scale.

The claims for arrhythmias requiring PPI in both years were evenly divided between SSS and AV block/conduction system disorders. However, the mortality rate is generally higher for AV block (3.7%) than SSS (0.3%). As previously observed, half of these patients did not receive the pacemaker for reasons previously cited. However, it is generally low for cases that underwent pacemaker implantations. Based on RVS codes, the mortality rates were 0.2% in 2017 and 0.7% in 2018. The marked difference in mortality rates among the group with indications for pacemakers (based on *ICD-10* code) and those who underwent the procedure (based on RVS code) seemingly suggests a hypothetical improvement in survival after the procedure is done. Compared with other countries, in a study done by Speedie et al,<sup>15</sup> a 10-year retrospective period (2002–2012) and a 2-year (2012–2014) prospective observational study done in a hospital in India, the mortality rate during the entire study period was 7.1%.

The low mortality rate based on RVS may be attributed to the minimally invasive nature of the procedure with low risk for complications. The procedure once recommended is straightforward and entails only a short duration of hospitalization (median, 4 days).

Overall, the balance of good results and the straightforward nature of PPI make the requirements for a benefit program predictable.

## LIMITATIONS OF THE STUDY

The actual number of readmissions could not be perfectly ascertained. To maintain patients' anonymity, the name as a unique patient identifier was removed from the file. Cross-checking of the data for possible readmissions was done by looking at the patient's date of birth, the same *ICD-10* codes, and the same name of hospital or region where the hospital was located. The demographics of the study were limited to age, gender, and length of hospitalization. The comorbid conditions or complications could not be gathered from the PhilHealth databases as these specifics were not documented.

## RECOMMENDATIONS

A registry of all patients who are admitted for cardiac arrhythmias, as well who have undergone the procedures, can be done at national and regional levels. Gathering other necessary data can provide an in-depth analysis of the characteristics of the patients, the healthcare provider, and the healthcare facility available from the regional and national perspectives. Correct inscription of the *ICD-10* codes and RVS codes by the attending and implanting physicians can help provide a more accurate prevalence of the conditions and rate of implantation. Almost half of the required pacemaker procedure was not done; this might be ameliorated if the cost of the procedure and hospitalization can be shouldered by the government through higher PhilHealth coverage.

## CONCLUSION

The prevalence of cardiac arrhythmia requiring pacemaker implantation was 0.04% both in 2017 and 2018. The volume of the procedures was low. There was a geographic and economic bias of procedures performed favoring NCR and private hospitals. The mortality rates were higher for AV block in the combined group of treated and untreated patients but low for all those who underwent the procedure. More comprehensive coverage from PhilHealth, improvement of healthcare facilities in the regions with claims/cases but procedures not being done, and the deployment of expert physicians in regions other than NCR can improve the utilization rate of the procedure, especially when highly recommended.

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The authors' contributions are as follows: Although all the study members were coauthors of all these articles, B.A.T.-M. and V.L.M. were the lead authors of the article, "Economic Burden of Hospitalizations for Cardiac Arrhythmias Requiring Cardiac Implantable Electronic Devices (CIED) and Radiofrequency Ablation Among Adults Aged  $\geq 19$  Years Old in the Philippines." The other investigators were the lead authors for the other articles, namely, (1) "Prevalence of Cardiac Arrhythmias Requiring Cardiac Implantable Electronic Devices" (F.E.R.P. and E.C.F.), (2) "Prevalence of Cardiac Arrhythmias Requiring Radiofrequency Ablation" (A.A.A.B.-D.S. and M.J.F.A.), and this article, (3) Prevalence of Cardiac Arrhythmias Requiring Permanent Pacemaker Implantation" (G.G.G. and N.S.P.). The primary proponents of this article were involved in the article's conceptualization, collection and analysis of data, and writing and revising of the manuscript and assumed responsibility for the accuracy and completeness of the article.

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## APPENDIX

**Table 1.** Cardiac Arrhythmia Codes Based on WHO ICD-10

ICD-10 Code	Description
I44.1	Av block, second degree (may include Mobitz 1 and 2)
I44.2	AV block, complete
I45.3	Trifascicular block
I45.9	Conduction system disorder, unspecified
I49.5	Sick sinus syndrome; tachycardia–bradycardia syndrome

AV=atrioventricular; ICD-10=International Statistical Classification of Diseases and Related Health Problems, Tenth Revision.

**Table 2.** Treatment Received by Patients With Cardiac Arrhythmias Based on the 2016 PhilHealth RVS Codes/Procedures

RVS Code	Description
33206	Insertion or replacement of permanent pacemaker with transvenous electrodes, atrial
33207	Insertion or replacement of permanent pacemaker with transvenous electrodes, ventricular
33208	Insertion or replacement of permanent pacemaker with transvenous electrodes, atrial and ventricular
33212	Insertion or replacement of pacemaker generator only, single chamber
33213	Insertion or replacement of pacemaker generator only, dual chamber
71090	Insertion pacemaker, fluoroscopy and radiography, radiological supervision and interpretation

RVS=Relative Value Scale.