

Incidence and Types of Cardiac Arrhythmias Detected by Telemetry Monitoring in Hospitalized Patients at a Tertiary Care Hospital

Sopita Areerob¹ , Urasri Imsomboon^{1*} , Rungaroon Phuengyaem¹ , Krissada Meemook¹ ,
Naline Niyomthai¹ , Chaiwat Wanchuay¹ 

¹ Nursing Services Division, Faculty of Medicine Ramathibodi Hospital, Mahidol University, Bangkok, Thailand

Abstract

Background: Cardiac arrhythmia constitutes a significant clinical complication among hospitalized patients, with elevated prevalence in individuals presenting with underlying cardiovascular pathology. Continuous telemetry monitoring provides real-time electrocardiographic surveillance, facilitating prompt arrhythmia detection and therapeutic intervention. Despite widespread clinical implementation globally, Thailand lacks standardized hospital guidelines governing telemetry monitoring utilization.

Objective: To determine the incidence, classification, and morphological characteristics of cardiac arrhythmias in patients subjected to continuous telemetry surveillance at a tertiary medical hospital in Thailand.

Methods: A cross-sectional study was conducted at Ramathibodi Hospital. The study comprised 331 hospitalized patients aged 18 years or older who received telemetry monitoring between June 2022 and December 2022. Clinical data were systematically extracted from electronic health records and subjected to descriptive statistical analysis.

Results: Among 331 monitored patients, cardiac arrhythmias were documented in 212 patients (64.05%). According to the American Heart Association classification criteria, most patients were categorized as class II (118 of 212 patients, 55.60%). Out of the 387 detected episodes, premature ventricular contractions constituted the most frequently observed arrhythmic pattern (34.37%), followed by premature atrial contraction (19.90%) and atrial fibrillation (15.76%). Conservative clinical observation represented the predominant management approach (41.69%). Hospital discharge constituted the primary indication for telemetry monitoring discontinuation (59.21%).

Conclusions: This study demonstrated a substantial incidence of cardiac arrhythmias under continuous telemetry surveillance, with premature ventricular contractions representing the most prevalent finding. These findings underscore the clinical utility of telemetry monitoring in hospitalized patients and support the development of standardized monitoring protocols in Thai healthcare hospitals.

Keywords: Arrhythmias, Cardiac, Telemetry, Incidence, Electrocardiography, Hospitalization

Citation: Areerob S, Imsomboon U, Phuengyaem R, Meemook K, Niyomthai N, Wanchuay C. Incidence and types of cardiac arrhythmias detected by telemetry monitoring in hospitalized patients at a tertiary care hospital. *Res Med J.* 2026;49(3):e275781. doi:10.33165/rmj.2026.e275781

* **Corresponding Author:**
urasri.ims@mahidol.ac.th

Received: 2 June 2025

Revised: 1 September 2025

Accepted: 4 September 2025

Published Online:

26 January 2026



Copyright © 2026
by the Author(s).

Licensee RMJ. This article is licensed
under the Creative Commons
Attribution (CC BY) License.

Introduction

Cardiovascular diseases constitute a predominant global health burden, representing the leading cause of mortality worldwide. According to the World Health Organization (WHO) statistics from 2019, cardiovascular pathologies accounted for approximately 17.9 million deaths, constituting 32.1% of global mortality.¹ In Thailand, the Division of Non Communicable

Disease Control under the Ministry of Public Health documented an incidence of 554.8 cardiovascular disease cases per 100 000 population in 2022.² Cardiac pathophysiology may arise from structural cardiac abnormalities, myocardial ischemia, or compromised ventricular contractility, all of which can disrupt the cardiac electrical conduction system and precipitate arrhythmic events.³

Cardiac arrhythmias are defined as abnormalities in cardiac rhythm resulting from aberrant electrical conduction manifesting as excessively rapid or delayed impulse propagation, ultimately producing irregular cardiac rhythm patterns. Clinical presentations commonly include palpitations, perceived skipped cardiac beats, bradycardic or tachycardic episodes, chest discomfort, presyncope, or transient loss of consciousness.⁴

Contemporary technological advances and evolving medical knowledge have facilitated the development of diverse monitoring modalities of the electrocardiography (ECG) beyond conventional 12-lead ECG, which remains the gold standard for detecting cardiac electrical abnormalities in hospitalized patients. Ambulatory ECG monitoring enables continuous rhythm surveillance while preserving patients' normal daily activities, thereby facilitating detection of intermittent arrhythmias not observable during hospitalization or routine ambulatory encounters. These technologies encompass continuous 24-48-hour Holter monitoring and intermittent recording devices, including patient-activated event recorders and loop recorders, which provide targeted arrhythmia capture capabilities.⁵⁻⁸

In critical care and intermediate care units, continuous bedside cardiac monitoring provides round-the-clock rhythm surveillance. Additionally, telemetry monitoring — a mobile ECG system utilizing radiofrequency signal transmission to central receivers — offers enhanced patient mobility while maintaining continuous cardiac surveillance. Telemetry devices are compact monitoring systems typically employed for patients who no longer require intensive care but necessitate ongoing arrhythmia surveillance, enabling ambulatory activities within the transmission range while providing continuous ECG data acquisition.

However, optimal ECG monitoring modality selection depends upon specific clinical indications and physician clinical judgment. Consequently, telemetry monitoring implementation generally follows 2 operational models: specialized step-down cardiovascular units providing comprehensive telemetry surveillance for all admitted patients with real-time monitoring of vital signs, cardiac rhythm, and oxygen saturation; or distributed patient care across general wards with centralized ECG monitoring, where abnormality alerts are communicated to ward nursing staff or attending physicians for timely clinical intervention.⁹⁻¹²

The American College of Cardiology has established clinical practice guidelines for ECG monitoring of hospitalized patients at risk for cardiac arrhythmias requiring diagnostic surveillance. The 2004 guideline first established standardized criteria for inpatient ECG monitoring using telemetry, categorized by clinical indications and disease classifications to minimize inappropriate utilization and reduce healthcare expenditures. The guidelines classify patients into 3 risk categories: class I encompasses high-risk patients requiring mandatory continuous ECG monitoring due to life-threatening arrhythmia potential; class II includes moderate-risk patients for whom telemetry monitoring may provide clinical benefit in selected cases; and class III comprises low-risk patients for whom telemetry is generally contraindicated but may be considered in specific clinical contexts.^{8, 12-14} In resource-constrained healthcare environments, particularly in developing nations like Thailand, the implementation of comprehensive telemetry monitoring systems presents significant challenges. These systems require substantial capital investment in sophisticated

equipment and necessitate specialized personnel with expertise in cardiac rhythm interpretation and device management. Consequently, the widespread adoption of telemetry monitoring remains limited, resulting in a paucity of research examining arrhythmia detection through these modalities in Thai healthcare settings. Thailand has not formally adopted these standardized criteria into routine clinical practice. Current decisions regarding initiation and discontinuation of inpatient cardiac telemetry monitoring remain predominantly dependent upon individual physician clinical judgment and hospital-specific protocols.

At Ramathibodi Hospital, a leading tertiary medical hospital in Thailand, the American College of Cardiology guideline remain unimplemented. Current practice involves monitoring some patients until discharge or device reallocation to higher-priority cases, potentially creating equipment shortages during the high-demand period. The absence of standardized telemetry protocol presents several challenges in the current clinical practice. These include potential overutilization of telemetry resources for low-risk patients, suboptimal resource allocation during the high-demand periods, and lack of evidence-based criteria for initiation and discontinuation of the ECG monitoring. Such practices may result in an inefficient healthcare resource utilization and potentially compromise optimal patient care delivery.

Ramathibodi Hospital operates 3 centralized telemetry monitoring centers, providing surveillance services for medical, surgical, and pediatric patients admitted to general wards requiring arrhythmia monitoring. Hospital utilization statistics demonstrate increasing trends in telemetry monitoring service demand, with 732, 814, and 809 patients utilizing these services in 2019, 2020, and 2021, respectively. In developed healthcare systems, data on telemetry monitoring, including detected arrhythmias, undergoes systematic analysis to develop evidence-based protocols for enhancing patient management accuracy and timeliness, facilitating appropriate therapeutic interventions and optimizing clinical outcomes.¹⁵⁻¹⁷ Currently, standardized protocols and criteria for initiation of telemetry monitoring remain absent from the hospital practice. Existing workflow requires cardiology consultation prior to the device discontinuation. Duration of the monitoring often extends until the patient discharge regardless of clinical necessity, with device discontinuation primarily driven by equipment demand for newly admitted patients rather than evidence-based clinical indication. ECG interpretation and clinical communication protocols are contingent upon the operational context of individual service units and the experiential competency of the nursing personnel.

However, limited research has examined the prevalence and characteristics of arrhythmias detected through telemetry monitoring in Thai healthcare settings. This knowledge gap is particularly significant given the resource-intensive nature of telemetry systems and the need for evidence-based utilization criteria in resource-limited environment. The absence of local data regarding arrhythmia incidence and patterns detected through telemetry surveillance impedes the development of appropriate clinical protocols and resource allocation strategies. Therefore, this study aimed to investigate the incidence and characteristics of cardiac arrhythmias detected through telemetry monitoring in hospitalized patients at a tertiary care medical hospital in Thailand. The findings will provide fundamental epidemiological data to support evidence-based development of service models, clinical protocols, and resource management strategies for telemetry monitoring systems, ultimately optimizing patient care delivery and organizational efficiency in resource-sensitive healthcare environments.

Methods

Participants

A cross-sectional study design was implemented at Ramathibodi Hospital, a tertiary care medical hospital. The study population comprised hospitalized patients receiving telemetry monitoring as prescribed by their attending physicians. Sample size determination was conducted utilizing the n4studies statistical software platform, with population data derived from hospital electronic health records spanning 2019 to 2021, revealing 2355 patients who underwent telemetry monitoring during this period. Employing a proportion of 0.50, a margin of error of 5%, and a significance level of .05, the requisite sample size was calculated to be 331 participants. Participant selection was executed through a purposive sampling method.

The inclusion criteria were patients aged 18 years or older. Patients who were prescribed telemetry monitoring between 1 June 2023 and 31 December 2023. Patients diagnosed with at least 1 type of cardiac arrhythmia, confirmed by a physician.

The exclusion criteria were patients with a history of confusion or dementia during hospitalization, rendering them unable to cooperate with telemetry monitoring, and severe skin lesions at the chest wall that prevented the proper placement of electrodes.

Data Collection

The data collection instrument comprised 3 distinct forms and was developed by the principal investigator through a systematic review of pertinent literature. Content validity was established using content validity index (CVI), assessed by 3 experts: a cardiologist, a critical care nursing specialist, and a cardiovascular nursing faculty member. The scale-CVI/average (S-CVI/Ave) was 0.80, meeting the acceptable criterion (≥ 0.80).

Section 1: personal information form – included demographic such as age, sex, marital status, educational level, healthcare entitlement, and clinical data including underlying diseases, smoking and alcohol consumption, cardiac surgeries or procedures, medications, and initial diagnosis.

Section 2: AHA classification form – that classified patients based on the American Heart Association (AHA) guideline for cardiac monitoring indications in hospitalized patients into 3 risk categories: class I, high risk for immediate life-threatening arrhythmias, requiring continuous telemetry; class II, moderate risk, for whom telemetry may be beneficial in selected cases; and class III, low risk, where telemetry is generally not indicated but may assist in clinical decisions.

Section 3: arrhythmia event recording form – included initial ECG findings, types of arrhythmias detected, time (in days) from telemetry initiation to detection, clinical management strategies, and reasons for discontinuing the telemetry monitoring.

Following an ethics approval, formal authorization was obtained from the director of Ramathibodi Hospital to access patient data via hospital's electronic medical record system. The principal investigator and research team executed data collection and documentation procedures utilizing Excel version 2019 (Microsoft Corp). Data access was restricted exclusively to designated members of the research team.

Statistical Analysis

Descriptive statistical analyses were performed using Excel version 2019. Categorical variables were presented as frequencies and percentages, while continuous variables were expressed as mean (SD).

Results

A total of 331 patients were included in the study, with a mean (SD) age of 63.67 (19.73) years (median [range], 64.5 [23-97] years). Most patients were male (55.29%), aged 70 years and over (58.31%) with government insurance coverage (61.33%). Educational levels included bachelor's degree or equivalent in 32.02%, primary education in 29.91%, and secondary education in 21.15%. Regarding occupation, most patients were retired or unemployed (62.13%), followed by government employees/civil servants (10.44%), company employees (6.96%), traders/business owners (17.30%), farmers (3.18%), and other occupations (32.50%). Most patients were nonsmokers (323 patients, 97.58%) and nondrinkers or former drinkers (98.79%). Preexisting comorbidities were present in 90.33%, predominantly hypertension (66.16%), dyslipidemia (53.17%), and coronary artery disease (22.66%). Diabetes mellitus, heart failure, and atrial fibrillation affected 33.53%, 12.69%, and 29.91%, respectively. Previous cardiac interventions occurred in 57.70%, mainly coronary angiography/percutaneous coronary intervention in 89.53%.

Most patients were on regular medications (92.75%). Among these patients, lipid-lowering agents were most frequently prescribed (72.31%), followed by proton pump inhibitors (61.24%), beta-blockers (57.0%), and antiplatelet agents (54.07%). Cardiovascular system-related medications were also prevalent, including anticoagulants (37.46%), diuretics (36.81%), angiotensin-converting enzyme inhibitors/angiotensin II receptor blockers (24.1%), and calcium channel blockers (21.82%). Antiarrhythmic agents included amiodarone (12.70%) and digoxin (4.56%). Additional medications comprised antianxiety agents (36.81%), hypoglycemic agents (25.08%), and antidepressants (9.45%).

Primary admission diagnoses included acute coronary syndrome (9.06%), cardiac arrhythmias (11.48%), and congestive heart failure (12.39%). Mean (SD) hospital length of stay was 19.46 (31.49) days (median [range], 35.5 [1-276] days), with mean (SD) duration of cardiac telemetry monitoring of 154.1 (166.8) hours (median [range], 336 [24-1656] hours). Time-to-detection data, the mean (SD) time from telemetry initiation to detection was 58.8 (67.2) hours (median [range], 24 [24-720] hours). Most events were identified early: 200 events (51.7%) within the first 24 hours and 315 events (81.4%) within the first 72 hours. Only 17 events (4.4%) required more than 168 hours for detection.

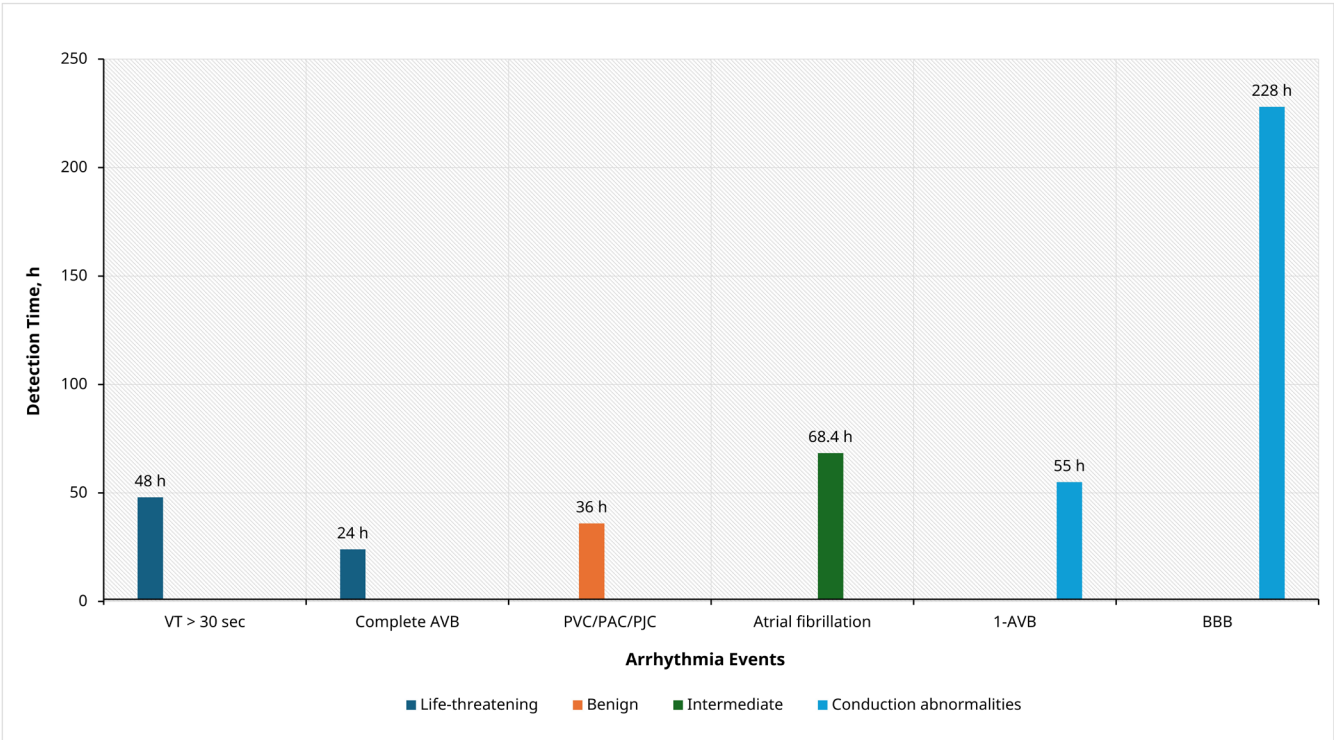
Life-threatening arrhythmias demonstrated early detection (complete atrioventricular block: 24 hours; ventricular tachycardia > 30 seconds: 48 hours). Benign arrhythmias were also detected relatively early, with 90% to 100% of premature contractions (premature ventricular contraction [PVC], premature atrial contraction [PAC], premature junctional contraction [PJC]) identified within 72 hours. Atrial fibrillation showed intermediate detection timing (mean [SD], 68.4 [50.4] hours), with 75.4% detected within 72 hours. Conduction abnormalities varied considerably, from first-degree atrioventricular block (mean [SD], 55.0 [45.6] hours) to bundle branch blocks requiring extended monitoring (mean [SD], 228 [153.6] hours). These findings suggest that 72-hour monitoring captures most clinically significant arrhythmic events (Figure 1).

Of the 331 patients undergoing cardiac telemetry monitoring, arrhythmias were detected in 212 patients (64.05%). Most arrhythmias were detected in AHA class II in 118 patients (55.60%), managed primarily through observation in 138 patients (65.09%) or medication adjustment in 36 patients (16.98%). Most patients were discharged home upon monitoring completion (196 patients, 59.21%) (Table 1).

A total of 387 abnormal ECG events were detected among 331 patients. The events were classified according to AHA risk levels for cardiac monitoring indications in

hospitalized patients. PVCs were the most frequent abnormality (34.37%), followed by PACs/nonconducted PACs (19.90%) and atrial fibrillation (15.76%). Nonsustained ventricular tachycardia occurred in 7.24%, while first-degree atrioventricular block was observed in (5.43%) (Table 2). The distribution across risk classes showed that class II events predominated, representing over half of all detected arrhythmias, while class III cases, which were categorized as low-risk, high-risk events were identified in approximately 10% of cases, accounting for 10% of all detected abnormalities (Figure 2).

Figure 1. Mean Detection Time From Telemetry Initiation to Arrhythmia Detection



Abbreviations: AVB, atrioventricular block; BBB, bundle branch block; PAC, premature atrial contraction; PJC, premature junctional contraction; PVC, premature ventricular contraction; VT, ventricular tachycardia.

Table 1. Incidence of Cardiac Arrhythmias Detected by Telemetry Monitoring and Classification by Severity	
Patient Information	No. (%)
Patients classified by ECG findings (n = 331)	
No arrhythmia detected	119 (35.95)
Arrhythmia detected (classified by AHA)	212 (64.05)
AHA class I	74 (35.00)
AHA class II	118 (55.60)
AHA class III	20 (9.40)

Table 1. Incidence of Cardiac Arrhythmias Detected by Telemetry Monitoring and Classification by Severity (Continued)

Patient Information	No. (%)
Clinical management in patients with detected arrhythmia (n = 212)	
Observation	138 (65.09)
Medication adjustment (initiation/titration)	36 (16.98)
Bedside cardioversion	2 (0.94)
Permanent pacemaker/ defibrillator (insertion/revise)	10 (4.72)
Coronary angioplasty/ stent placement	2 (0.94)
Transfer to ICU/CCU	13 (6.13)
Additional diagnostic tests	11 (5.19)
Reasons for telemetry discontinuation (n = 331)	
No further clinical indication	104 (31.42)
Discharge home	196 (59.21)
Transfer to ICU/CCU	31 (9.37)
Due to cardiac arrhythmia, No.	12
Due to respiratory problem, No.	3
Due to sepsis/septic shock, No.	4
Due to hemodynamic instability, No.	10
Other reasons, No.	2

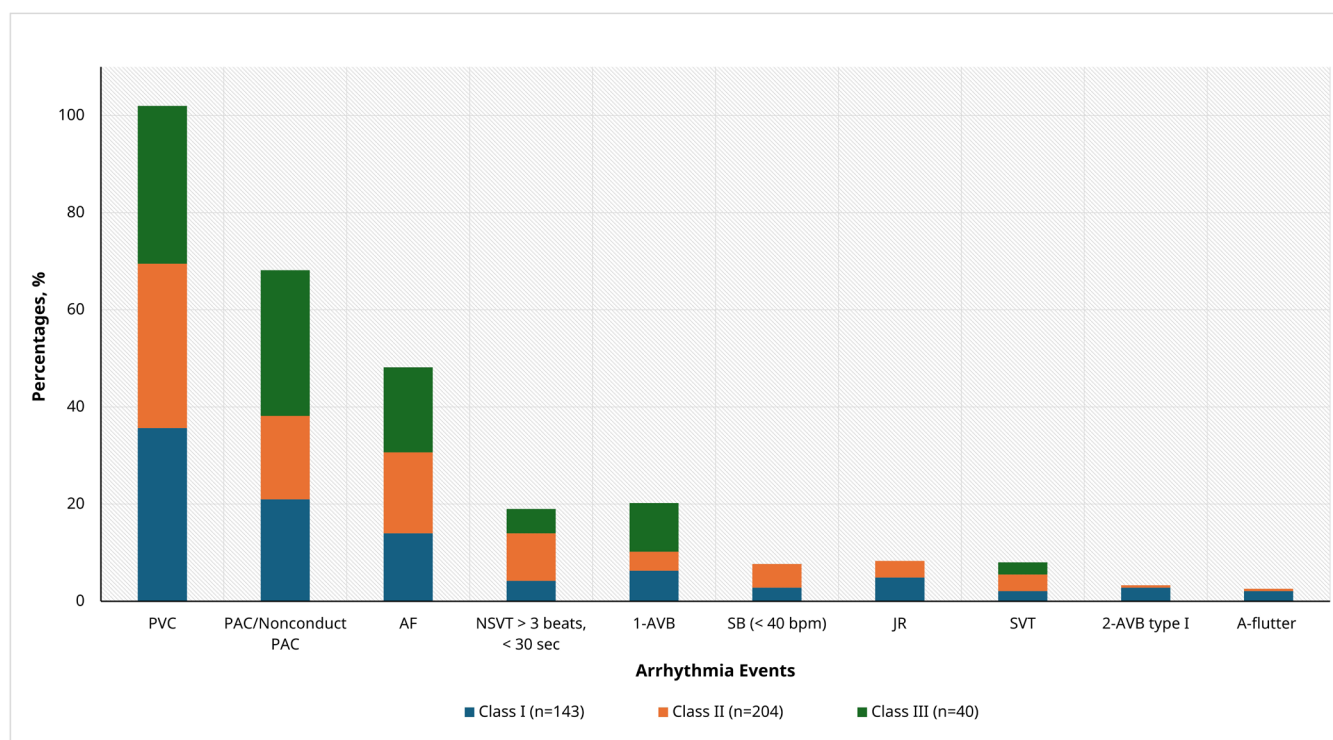
Abbreviations: AHA, American Heart Association; CCU, cardiac care unit; ECG, electrocardiogram; ICU, intensive care unit.

Table 2. Number of Abnormal Electrocardiogram Events Classified by the American Heart Association Indication Risk Levels

Type of Cardiac Arrhythmia*	Total Events (n = 387)	Class I (n = 143)	Class II (n = 204)	Class III (n = 40)
Ventricular tachycardia > 30 sec	1 (0.26)	0	1 (0.49)	0
Nonsustained ventricular tachycardia > 3 beats but < 30 sec	28 (7.24)	6 (4.20)	20 (9.80)	2 (5.00)
Supraventricular tachycardia	11 (2.84)	3 (2.10)	7 (3.43)	1 (2.50)
Atrial fibrillation	61 (15.76)	20 (13.99)	34 (16.67)	7 (17.50)
Atrial-flutter	4 (1.03)	3 (2.10)	1 (0.49)	0
Sinus bradycardia (heart rate < 40 bpm)	14 (3.62)	4 (2.80)	10 (4.90)	0
Pause > 3 sec	6 (1.55)	0	6 (2.94)	0
Junctional rhythm	14 (3.62)	7(4.90)	7 (3.43)	0
Third-degree atrioventricular block	1 (1.55)	1 (0.70)	0	0
Second-degree atrioventricular block type I	5 (1.29)	4 (2.80)	1 (0.49)	0
Second-degree atrioventricular block type II	3 (0.78)	2 (1.40)	1 (0.49)	0
First-degree atrioventricular block	21 (5.43)	9 (6.29)	8 (3.92)	4 (10.00)
Premature atrial contraction/nonconduct premature atrial contraction	77 (19.90)	30 (20.98)	35 (17.16)	12 (30.00)
Premature ventricular contraction	133 (34.37)	51 (35.66)	69 (33.82)	13 (32.50)
Premature junctional contraction	4 (1.03)	2 (1.40)	1 (0.49)	1 (2.50)
ST-segment change	2 (0.52)	1 (0.70)	1 (0.49)	0
Bundle branch blocks	2 (0.52)	0	2 (0.98)	0

* More than 1 arrhythmia type per patient was possible; the total number of events was 387, with 331 patients.

Figure 2. Percentages of Arrhythmia Types Among Patients Stratified by the American Heart Association Telemetry Indication Categories



Abbreviations: A-flutter, atrial-flutter; AF, atrial fibrillation; AVB, atrioventricular block; JR, junctional rhythm; NSVT, nonsustained ventricular tachycardia; PAC, premature atrial contraction; PVC, premature ventricular contraction; SB, sinus bradycardia; SVT, supraventricular tachycardia.

Discussion

This study demonstrated that arrhythmias were detected in 64.05% of patients undergoing telemetry monitoring, substantially exceeding previously reported rates in telemetry monitoring studies.^{12, 14} This discrepancy primarily reflects methodological differences in arrhythmia classification criteria. When excluding benign events (PVCs, PACs, PJs), the incidence was 35.3%, aligning with established literature and validating the reproducibility of clinically significant arrhythmia detection.^{11, 12, 14}

Among 387 abnormal ECG events were predominantly detected in AHA class II (55.60%) and class I (35%), representing largely benign arrhythmias managed conservatively through observation (65.09%). Only 3.77% required permanent pacemaker implantation and 5.66% needed coronary intervention or ICU transfer, indicating minimal immediate clinical impact for most detected events. The most frequent arrhythmias were PVCs (34.37%), PACs (19.90%), and atrial fibrillation (15.76%), reflecting the typical spectrum in hospitalized cardiac patients.^{8, 11, 12}

Clinical Implications and Resource Management

The predominance of benign arrhythmias requiring only observational management, combined with 81.4% of events detected within 72 hours (mean [SD], 58.8 [67.2] hours), indicates significant opportunities for optimizing telemetry resource allocation. Life-threatening

arrhythmias demonstrated early detection (24-48 hours), while benign arrhythmias were also identified early within 72 hours. Given the current mean (SD) monitoring duration of 154.1 (166.8) hours (approximately 6.4 days), these temporal patterns suggest that most clinically relevant events were detectable within a 72-hour period.^{8, 12}

Healthcare systems should consider implementing time-limited monitoring protocols, reducing duration for low-risk patients while prioritizing AHA class I patients for extended monitoring. System-level impacts include optimized bed occupancy, reduced nursing workload, and prevention of telemetry overuse, particularly given that only 4.4% of events required more than 7 days for detection.^{11, 12}

Standardized Notification Protocols

The absence of standardized protocols for arrhythmia notification presents a significant clinical practice gap. Currently, decisions regarding physician notification depend primarily on individual nursing experience and judgment, creating potential for both over-notification of benign events and under-notification of clinically significant arrhythmias. While no adverse incidents have been documented from current practices, the variability in notification approaches may lead to inefficient physician workload distribution and potential delays in appropriate clinical responses.

The development of evidence-based notification guidelines stratified by AHA classification and arrhythmia type could significantly reduce inappropriate alerts while ensuring timely communication of clinically significant events. Such protocols should delineate immediate notification criteria for life-threatening arrhythmias (sustained ventricular tachycardia, complete heart block), routine notification schedules for moderate-risk events (atrial fibrillation, nonsustained ventricular tachycardia), and documentation-only requirements for benign arrhythmias (isolated PVCs, PACs). Implementation of standardized notification protocols could optimize physician-nurse communication efficiency while maintaining patient safety standards.^{8, 12, 13}

Medication-Related and Postoperative Factors

The high prevalence of polypharmacy (92.75%), particularly diuretic administration, highlighting medication-related arrhythmia risk through electrolyte imbalances.^{18, 19} Proactive electrolyte monitoring and correction could reduce clinically insignificant events and optimize telemetry utilization. For patients with previous cardiac interventions (57.70%), standardized postoperative protocols with defined monitoring durations could improve efficiency while maintaining patient safety.^{18, 20-23} The current practice of continuous monitoring until discharge regardless of clinical necessity suggests potential for protocol refinement, such as routine (24-48 hour) telemetry after percutaneous coronary intervention for uncomplicated cases.^{21, 24}

Study Limitations

Key limitations include single-center design, purposive sampling methodology, and cross-sectional design, limiting generalizability and precluding causal inference.⁷ Additional constraints encompass lack of standardized telemetry criteria, absence of long-term outcome assessment, and missing content validity evaluation. These methodological limitations affect applicability to diverse healthcare settings with varying patient populations and monitoring protocols.

Future Research Directions

Prioritized research areas include multicenter validation of refined telemetry criteria, cost-effectiveness analyses of risk-stratified protocols, and prospective guideline implementation evaluations.^{12, 16} Development of predictive models for high-risk patient identification and integration of artificial intelligence for real-time arrhythmia classification represent opportunities for optimizing resource utilization.

Additionally, validation of standardized notification protocols for different arrhythmia types is needed to address current practice variability and optimize physician-nurse communication efficiency. Studies examining optimal monitoring durations for specific patient populations and post-procedural requirements would support more targeted telemetry utilization strategies.

These findings support development of protocols distinguishing patients requiring continuous surveillance from patients that can be managed with less intensive monitoring. Study limitations include single-center design, purposive sampling, and cross-sectional study limiting generalizability. Future research should focus on multicenter validation, predictive model development, and cost-effectiveness analyses to inform evidence-based guidelines for resource optimization of cardiac monitoring.^{12, 16}

Conclusions

This study identified arrhythmias in 64.05% of telemetry-monitored patients, with predominantly benign events (55.60% of AHA class II) and can be managed conservatively (65.09%). The high detection rate of clinically insignificant arrhythmias emphasizes the need for standardized, risk-stratified telemetry criteria to optimize resource utilization while maintaining patient safety.

Additional Information

Acknowledgments: We gratefully acknowledge Apinya Siripitayakunkit, cardiovascular disease instructor, and Teepatad Chintapanyakun, critical care nurse specialist, for their expert guidance throughout this research. We also extend our appreciation to the nursing staff of the Cardiac Care Unit and Telemetry Monitoring Center at Ramathibodi Hospital, Faculty of Medicine Ramathibodi Hospital, Mahidol University, for their invaluable support during data collection.

Ethics Approval: This study was approved by the Human Research Ethics Committee of the Faculty of Medicine, Ramathibodi Hospital, Mahidol University (MURA2023/154 on 3 March 2023). The study strictly adhered to ethical principles involving human participants. Patient confidentiality was protected by using anonymized ID codes instead of names, and the results were presented in aggregate form to ensure data privacy.

Clinical Trial Consideration: This study does not report on a clinical trial.

Financial Support: This study was supported by the Routine to Research (R2R) Program, Faculty of Medicine Ramathibodi Hospital, Mahidol University (WP66007, Sopita Areerob).

Conflict of Interest: None declared.

Author Contributions:

Conceptualization: Urasri Imsomboon, Krissada Meemook, Naline Niyomthai, Sopita Areerob, Rungaroon Phuengyaem

Formal Analysis: Chaiwat Wanchuay, Urasri Imsomboon

Funding Acquisition: Sopita Areerob

Investigation: Sopita Areerob, Urasri Imsomboon, Rungaroon Phuengyaem

Methodology: Urasri Imsomboon

Writing – Original Draft: Sopita Areerob, Urasri Imsomboon, Chaiwat Wanchuay

Writing – Review & Editing: Urasri Imsomboon, Krissada Meemook

References

1. World Health Organization. Cardiovascular diseases (CVDs). 31 July 2025. Accessed 1 September 2025. [https://www.who.int/news-room/fact-sheets/detail/cardiovascular-diseases-\(cvds\)](https://www.who.int/news-room/fact-sheets/detail/cardiovascular-diseases-(cvds))
2. Health Information System Development Office, Department of Disease Control, Ministry of Public Health. *National Plan for the Prevention and Control of Non-Communicable Diseases (2023–2077)*. Aksorn Graphic and Design, 2023. Accessed 1 September 2025. <https://ddc.moph.go.th/dncd/news.php?news=46335&deptcode>
3. American Heart Association. What is an Arrhythmia? 24 September 2024. Accessed 1 September 2025. <https://www.heart.org/en/health-topics/arrhythmia/about-arrhythmia>
4. The Heart Association of Thailand under the Royal Patronage of H.M. the King. Cardiac Examination. Accessed 1 September 2025. <https://shorturl.asia/iC3Qj>
5. Serhani MA, T El Kassabi H, Ismail H, Nujum Navaz A. ECG monitoring systems: review, architecture, processes, and key challenges. *Sensors*. 2020;20(6):1796. doi:10.3390/s20061796
6. Imsomboon U, Areerob S, Kongchauey K, Ngarmukos T. The incident of cardiac arrhythmia using trans-telephonic, portable ECG recorder in out-patients Faculty of Medicine Ramathibodi Hospital. *Mahidol R2R e-Journal*. 2018;5(1):61-75. doi:10.14456/jmu.2018.11

7. Yen KC, Chan YH, Wu CT, et al. Resuscitation outcomes of a wireless ECG telemonitoring system for cardiovascular ward patients experiencing in-hospital cardiac arrest. *J Formos Med Assoc.* 2021; 120(1 Pt 2):551-558. doi:10.1016/j.jfma.2020.07.004
8. Sandau KE, Funk M, Auerbach A, et al. Update to practice standards for electrocardiographic monitoring in hospital settings: a scientific statement from the American Heart Association. *Circulation.* 2017;136(19):e273-e344. doi:10.1161/CIR.0000000000000527
9. Cantillon DJ, Loy M, Burkle A, et al. Association between off-site central monitoring using standardized cardiac telemetry and clinical outcomes among non-critically ill patients. *JAMA.* 2016;316(5):519-524. doi:10.1001/jama.2016.10258
10. Sani A. Telemetry Unit: A Comprehensive Guide. Trusted. 3 June 2024. Accessed 1 September 2025. <https://www.trustedhealth.com/blog/what-is-a-telemetry-unit>
11. Dhillon SK, Tawil J, Goldstein B, et al. Effectiveness of telemetry guidelines in predicting clinically significant arrhythmias in hospitalized patients. *Cardiol Res.* 2012;3(1):16-22. doi:10.4021/cr129w
12. Steinberg JS, Varma N, Cygankiewicz I, et al. 2017 ISHNE-HRS expert consensus statement on ambulatory ECG and external cardiac monitoring/telemetry. *Heart Rhythm.* 2017;14(7):e55-e96. doi:10.1016/j.hrthm.2017.03.038
13. Al-Khatib SM, Stevenson WG, Ackerman MJ, et al. 2017 AHA/ACC/HRS guideline for management of patients with ventricular arrhythmias and the prevention of sudden cardiac death: a report of the American College of Cardiology/American Heart Association Task Force on Clinical Practice Guidelines and the Heart Rhythm Society. *Circulation.* 2018;138(13):e272-e391. doi:10.1161/CIR.0000000000000549
14. Maduke T, Qureshi B, Goite Y, et al. Monitoring the use of telemonitor: a resident-run quality improvement initiative decreases inappropriate use of telemonitor in a community hospital. *Cureus.* 2019;11(11):e6263. doi:10.7759/cureus.6263
15. Dillon JJ, DeSimone CV, Sapir Y, et al. Noninvasive potassium determination using a mathematically processed ECG: proof of concept for a novel "blood-less, blood test". *J Electrocardiol.* 2015;48(1):12-18. doi:10.1016/j.jelectrocard.2014.10.002
16. Raghunath S, Pfeifer JM, Ulloa-Cerna AE, et al. Deep neural networks can predict new-onset atrial fibrillation from the 12-lead ECG and help identify those at risk of atrial fibrillation-related stroke. *Circulation.* 2021;143(13):1287-1298. doi:10.1161/CIRCULATIONAHA.120.047829
17. Attia ZI, Noseworthy PA, Lopez-Jimenez F, et al. An artificial intelligence-enabled ECG algorithm for the identification of patients with atrial fibrillation during sinus rhythm: a retrospective analysis of outcome prediction. *Lancet.* 2019;394(10201):861-867. doi:10.1016/S0140-6736(19)31721-0
18. Greenberg JW, Lancaster TS, Schuessler RB, Melby SJ. Postoperative atrial fibrillation following cardiac surgery: a persistent complication. *Eur J Cardiothorac Surg.* 2017;52(4):665-672. doi:10.1093/ejcts/ezx039
19. Wiriatharakij T. Modified del Nido cardioplegia. *Thai J Hosp Pharm.* 2021;31(3):293-304.
20. Kusumoto FM, Schoenfeld MH, Barrett C, et al. 2018 ACC/AHA/HRS Guideline on the evaluation and management of patients with bradycardia and cardiac conduction delay: a report of the American College of Cardiology/American Heart Association Task Force on Clinical Practice Guidelines and the Heart Rhythm Society. *Circulation.* 2019;140(8):e382-e482. doi:10.1161/CIR.0000000000000628
21. Wongthida T. *Risk Score Prediction of Life-Threatening Arrhythmia After Primary Percutaneous Coronary Intervention in ST-Elevation Acute Coronary Syndrome Patients.* Master's thesis. Thammasat University; 2021. Accessed 1 September 2025. http://ethesisarchive.library.tu.ac.th/thesis/2021/U_2021_6011302053_13583_18760.pdf

22. January CT, Wann LS, Calkins H, et al. 2019 AHA/ACC/HRS focused update of the 2014 AHA/ACC/HRS guideline for the management of patients with atrial fibrillation: a report of the American College of Cardiology/American Heart Association Task Force on Clinical Practice Guidelines and the Heart Rhythm Society in collaboration with the Society of Thoracic Surgeons. *Circulation*. 2019;140(2): e125-e151. doi:10.1161/CIR.0000000000000665
23. Socie P, Nicot F, Baudinaud P, et al. Frequency of recovery from complete atrioventricular block after cardiac surgery. *Am J Cardiol*. 2017;120(10):1841-1846. doi:10.1016/j.amjcard.2017.07.090
24. Ibanez B, James S, Agewall S, et al. 2017 ESC Guidelines for the management of acute myocardial infarction in patients presenting with ST-segment elevation: the Task Force for the management of acute myocardial infarction in patients presenting with ST-segment elevation of the European Society of Cardiology (ESC). *Eur Heart J*. 2018;39(2):119-177. doi:10.1093/eurheartj/ehx393