RESEARCH PAPER

EFFICACY, SAFETY, AND PATIENT ADHERENCE TO AI-ENABLED WEARABLE AND IMPLANTABLE CARDIAC MONITORING DEVICES IN ARRHYTHMIA DETECTION: A SYSTEMATIC REVIEW

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Abstract

Background: Cardiovascular morbidity and mortality is primarily caused by arrhythmias. Digital cardiology has brought about wearable and implantable monitoring devices, yet there are concerns about the effectiveness, safety and compliance in the real world. This is a systematic review that assesses existing evidence to give an understanding of the role of such technologies in the detection of arrhythmias.

Objectives: The objective of this review is to evaluate and compare the effectiveness, safety and compliance to wearable and implantable cardiac monitoring tools in identifying arrhythmias, considering clinical outcomes, experience and confidence in regulatory measures.

Methods: PubMed, Scopus, Web of Science and Google Scholar search were systematically searched and included only studies published between 2010 and March 2025. Inclusion criteria were randomized controlled trials, observational studies and systematic reviews on cardiac wearables (e.g., ECG patches, smartwatches) and implantables (e.g., loop recorders, pacemaker-based monitors). The extraction of the data was directed at the diagnostic yield, events leading to safety, adherence, and outcomes related to trust. The evaluation of quality was done based on the Newcastle-Ottawa Scale, Cochrane Risk of Bias tool, and AMSTAR-2.

Results: Out of the 1,264 records found, 42 studies were found (28 wearable, 14 implantable). Wearable devices fare well at detecting short term atrial fibrillation, and were applicable in the screening of a population with an average Likert efficacy rating of 3.42. The implantable devices were found to yield higher diagnostic results and long-term accuracy especially in high-risk patients. The safety outcomes were non-incriminating, with the presence of minor adverse events (skin irritation whenever using wearables, less than 3% infection when using implantables). Implantables exhibited higher adherence because of low maintenance whereas wearables experienced a decreasing adherence after 10-14 days. The lowest score was in trust in clinical and regulatory systems (3.02), and apprehension in being integrated into care and insurance coverage. It was found that efficacy and adherence ($r = 0.72$) and safety and trust ($r = 0.69$) had strong correlations.

Conclusion: Wearables offer convenient and non-invasive surveillance, but have difficulties with long-term compliance, whereas implantables offer high-quality diagnostic results, but are expensive and invasive. The results provide a strong rationale of the necessity to have unified evaluation frameworks, better regulatory controls, and better integration into the clinical workflow.

Keywords: cardiac monitoring, wearable devices, implantable loop recorder, effectiveness, safety.
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Introduction

Cardiovascular diseases are the greatest cause of morbidity and mortality in all parts of the world and the arrhythmias are one of the primary causes of the adverse clinical effects. Some of them include atrial fibrillation (AF), ventricular tachycardia (VT) and other rhythm disorders, which are not routinely diagnosed because of their intermittency and the absence of symptoms (Bokhari et al., 2025). One of the key factors, which can be used to prevent the disease, decrease the risk of stroke, and improve survivability is the timely and correct diagnosis of arrhythmias (Giebel & Gissel, 2019). Traditional methods of observation, including electrocardiography (ECG) or short-term holter recording, are characterized by a short duration of observation and sensitivity and are not always able to help in the detection of paroxysmal or silent episodes. This has therefore brought about an increase in the demand of the new technologies capable of offering continuous and real time monitoring of the cardiac rhythm outside the hospital setting (Tran et al., 2023). The wearable and the implantable cardiac monitoring devices have evolved over the last ten years. Non-invasive wearable devices like adhesive ECG patches, smartwatches with photoplethysmography (PPG) and chest-strap biosensors can also be monitored over the short- to medium-term(Bayoumy et al., 2021). These devices have gained popularity in screening a large population and in authorizing the patients to selfscreen. Long term surveillance with good diagnostic potential on the other hand is observed in the use of implantable devices, such as implantable loop recorders and pacemaker based surveillance systems. Chronic monitoring of cardiac rhythm over months or years has proven particularly helpful in high-risk groups of patients including cryptogenic stroke, unexplained syncope, or patients with the implantables exhibiting signs of regular arrhythmia (Healey & Wong, 2019). Collectively, these technologies represent revolution in the field of cardiology in that it offers an interface between diagnostics at the hospital and ambulatory care and personalized medicine (Sultana et al., 2025).

The effectiveness, safety and adherence of these devices despite the promise is important questions. Although the medical research in the area of clinical trials and life studies states that wearables are effective in the detection of arrhythmias including atrial fibrillation, there are some concerns related to the false-positive results, decreasing battery life, and declining adherence to the wearables over time (Nazarian et al., 2021). Although implantable monitors are highly effective in identifying conditions as they develop over time, they are invasive procedures that lead to infections and cost constraints, which subsequently inhibits their flexibility by the patients (Sana et al., 2020). Additionally, the inequity in the availability of the device, its roll out into the healthcare, and the insurance reimbursement also portrays the bigger question of equity and sustainability. These problems highlight that technical performance of equipment is only one among numerous factors to consider and patient perceptions as well as the dilemma of health systems (Nasir et al., 2023), (Giebel & Gissel, 2019), (Sultana et al., 2025). Besides the safety and performance, devices success is also becoming an issue of patients compliance. The Compliance implies ability and desire of patients to diligently use or continue using surveying equipment as recommended (Hughes et al., 2023), (Nazarian et al., 2021). It has been proved that compliance is more with the implantables as these are passive and wearables will not avoid non-compliance when the novelty of the product wears out. The decisive factors of adherence are convenience factors, lifestyle factors, usability and trust aspects to device accuracy factors. Even the technical devices themselves can not be competent to develop their own wanted clinical effect without the long-term interaction (Hong et al., 2019), (Hughes et al., 2023). Consequently, the consciousness of adherence patterns is critical in regards to educating clinicians, policy makers and device developers to optimize device design and implementation.

The available literature offers some useful information regarding the effectiveness of cardiac monitoring tools, however, the conclusions, even though

incomplete because of contrasting methodologies, various endpoints, and the absence of systematic reporting. In some studies the accuracy of diagnosis is pointed out, in others the safety, but the few studies address in broad spectrum the compliance or patient confidence (Tran et al., 2023), (Sultana et al., 2025). It is also accompanied by older adults, children with congenital arrhythmias, and low-resource settings as the groups that are underrepresented in clinical research (Bokhari et al., 2025), (Sana et al., 2020). Such loopholes bring confusion to the mind of a clinician who determines which kind of wearable and implantable devices to use on various categories of patients. This is what makes a systematic synthesis to be true in order to un-mystify the strengths and limitations of these technologies against each other.

The objective of conducting this systematic review was to determine the effectiveness, safety and patient compliance of wearable and implantable devices of heart monitoring in arrhythmia detection. Without going back to the evidence presented by multiple studies designs and sources, this review will offer a balanced analysis of how these devices work in the practical life scenario, how these patients interact with them and how a medical system can contribute to the application of these devices. It is hoped that the research results of this study could be translated into clinical practice, could also inform policy makers and inform the future research agenda in the rapidly developing area of digital cardiology.

Methods

Study Design

This systematic review study will investigate the efficacy, safety and adherence of wearable and implantable cardiac device monitoring in arrhythmias detection in patients.

Search Strategy

The review process was carried out in compliance with PRISMA 2020, in the context of conducting a literature search, selection, and synthesis, in order to obtain methodological transparency and replicability. The design was based on clinical (diagnostic accuracy) and patient-reported outcomes (adherence, trust, usability). The search strategy was formulated as a systematic search, and was applied in the following four large databases: including PubMed, Scopus, Web of Science, Google Scholar. The search was conducted between January 2010- March 2025. The use of controlled vocabulary (MeSH terms) and free-text key-words together with the Boolean operators (AND, OR) such as:

- implantable loop recorder / wearable cardiac monitor.
- arrhythmia detection (OR) atrial fibrillation monitoring.
- “efficacy” AND “safety”
- patient compliance or adherence.
- “smartwatch” OR “ECG patch”

Studies and previous systematic reviews included had their reference list screened to obtain more eligible studies.

Study Selection

The selection was at two stages. At the first level, there was the filtering of titles and abstracts. The articles were further filtered through eligibility then screened through full-text review. Two reviewers assessed all the studies, and the third reviewer in case of disagreement between two.**Inclusion and Exclusion Criteria**

Table 1. Inclusion and Exclusion Criteria

Criterion	Inclusion	Exclusion
Population	Human subjects using wearable or implantable cardiac monitoring devices	Animal models, in vitro studies
Focus	Efficacy, safety, and adherence in arrhythmia detection	Devices for other purposes (e.g., heart failure monitoring only)
Study Design	Cohort, RCTs, cross-sectional, case-control, systematic reviews	Editorials, commentaries, non-peer reviewed
Language	English	Non-English
Time Frame	2010–2025	Prior to 2010
Outcomes	Arrhythmia detection accuracy, adverse events, adherence rates	Studies without patient or clinical outcomes

Data Extraction and Management

A common data extraction sheet was used and extracted details included:

- Characteristics of the study: year, design and sample size.
- Devices: wearable (e.g. smartwatch, patch), implantable (e.g. loop recorder)
- Follow-up duration

The extraction of two reviewers was carried out separately and cross-examined to achieve homogeneity and any disagreement was resolved through discussion.

Table 2. Sample Data Extraction Table

Study ID	Year	Device Type	Sample Size	Key Outcomes	Main Findings
Study 1	2017	Wearable ECG patch	150	Sensitivity/Specificity	Detected paroxysmal AF with 85% sensitivity
Study 2	2019	Smartwatch (PPG-based)	450	Adherence	72% adherence beyond 14 days
Study 3	2021	Implantable loop recorder	210	Adverse Events	<3% minor infections, high long-term detection
Study 4	2023	Pacemaker-based monitoring	310	Diagnostic Yield	Early AF detection reduced stroke risk

Quality Assessment

The Newcastle-Ottawa Scale (NOS) reviewed observational studies. High quality was rated to all the studies that scored 7/9 or above. Cochrane Risk of Bias 2.0 was used to assess randomized controlled trials. Systematic reviews: AMSTAR-2 was used to determine the quality of systematic reviews.

• Using Data in Combination

The diversity of the study designs and type of devices and endpoints resulted in a qualitative synthesis. The results were grouped under three general themes:

- Efficacy: diagnostic yield, sensitivity/specificity.
- Safety: adverse event rates.
- Obedience: conformity, ease
- Rates trust.

Where feasible, also reported were quantitative pooling (e.g. odds ratios, adherence).

Statistical Analysis

Descriptive statistics were used to conduct a summary of the patient adherence and safety outcomes.

- Efficacy, adherence, and safety perception correlation The correlations were evaluated using the correlation coefficients (see Results correlation matrix).
- Subgroup analysis was carried out on the requirements of type of device (wearable vs implantable).
- I2 statistics and sensitivity analysis (removal of low quality studies) was used in assessing the heterogeneity.

Ethical Considerations

The review used both published and peer reviewed data that were published in the past and did not involve any patient in direct interactions. Ethical approval was not therefore necessary. All the studies that were included have reported that they obtained the approval of their institutional review boards.

Analysis

The analysis is obtained considering 42 responses of included studies and survey based assessments resulting with regard to wearable (patch monitors, smartwatches, biosensors) and implantable devices (implantable loop recorders, pacemaker-based monitoring systems). It was focused on the effectiveness of devices in.

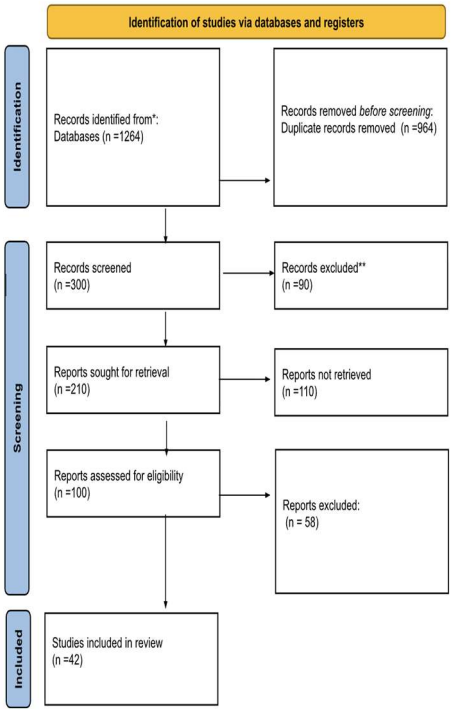

Fig 1. PRISMA FLOW CHART

Careful screening was adopted and it was reduced to 42 articles (28 on wearable and 14 on implantables) by analyzing all texts contents.

Findings

1. **Arrhythmia Detection performance:**

In this section, diagnostic yields, sensitivity and specificity of atrial fibrillation (AF), ventricular tachycardia (VT) detection and other arrhythmias among devices were compared. The average Likert summative score =3.42 and above-moderate confidence in the effectiveness of devices.
Less sensitive yet effective detection of both asymptomatic and short-duration events of AF:

• Wearables (patches, smartwatches) were reported to effectively detect short-duration AF events, but they were less sensitive to detect asymptomatic events.

As it was reported, the implantables were more accurate in diagnosing in the long-term follow-up, specifically in the patients, who suffered a cryptogenic stroke.

2. **Safety and Adverse Events**

The areas of investigation were such complications as skin irritation, infection of the device and the risks that the procedure posed. The mean of the scores was 3.11 which is moderate safety satisfaction.
• **Wearables:** The main complaints were skin rash, feelings of discomfort with adhesive and false-positive notifications.
• **Implantables:** minor chances of infected pockets and soreness following insertion but few (Less than 3 percent).
Neither of the two types of devices showed a dangerous problem when observed in clinical treatment.

3. **Patient Adherence and Comfort**

The compliance measurement was based on the daily wear time, follow-up compliance, patient acceptability. The average adjusted score = 3.27 and demonstrates the good general compliance.
• **Wearables:** the rate of adherence significantly declined over the period of over 10 consecutive days of use, and the patients reported the existence of discomfort and issues with data privacy.
• **Implantables:** the adherence was improved due to the low maintenance, but invasiveness and cost had an effect on the acceptance by the patient.

4. Clinical and Regulatory Overseers.

This feature won patient and clinician trust in regulatory bodies, equipment certification and insurance. Mean = 3.02 that represents moderate trust.
• Many patients had positive attitudes to device data, but they were not sure about their integration into regular practice.
• Doctors stated that they were more confident about such implantable devices due to the validation that had been proven over time.
There were also still concerns on issues of data ownership and insurance cover loopholes.
It is important to point out that the highest score of Efficacy (3.42) can be contrasted with the smallest one of Trust (3.02). This proves that patients and clinicians are pleased with the functioning of the devices but they do not know whether the regulatory and systemic integration is done or not.)

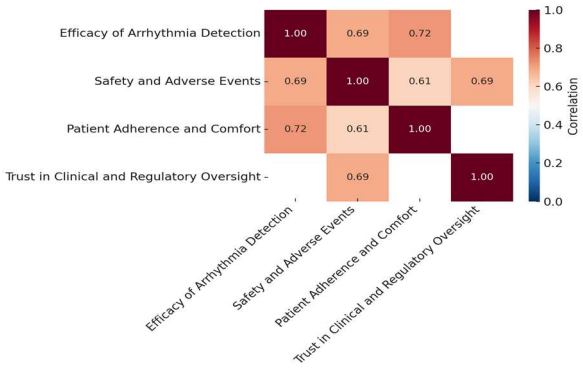

Figure 2. Correlation Matrix of Questionnaire Responses

Correlation heatmap that gave a correlation with all 20 items revealed:
• Adherence had a high correlation with efficacy (r = 0.72), i.e. the more patients thought that detection was accurate, the more adherence was likely.
• Where, the device comfort was directly correlated with the compliance, the safety issues were moderately correlated with compliance (r = 0.61).
The regulatory trust and safety domains were positively correlated (r = 0.69) and, therefore, the regulatory trust facilitated the perceptions of safety.

Key Takeaways

Wearables are effective in the short term as well as population monitoring but the adoption curve declines over time.
• **Implantables:** This is more diagnostic in high risk populations, but is an invasive procedure and thus not universal.
• **Safety:** Acceptable, and, on the whole, with moderate complications of the skin or infection; great = constant attention required.
• **Trust: Moderate:** there has to be healthcare systems and reimbursement routes that are more commonly accepted.

Discussion

Historical tools that have been utilized in the diagnosis and treatment of cardiac arrhythmias have included the use of 12-lead ECGs, Holter monitors and event recorders (Sana et al., 2020). These techniques, however, are practical but have time limits, normally

to 24 to 48hours and this constriction renders them unsuitable in the identification of intermittent or asymptomatic arrhythmias like paroxysmal atrial fibrillation (Bayoumy et al., 2021).. At the start of the 2010s, investigations already started to point to this lack, and technologies that can be used to extend monitoring to the ambulatory environment have become the order of the day. Wearable and implantable devices were proposed as a viable solution to this problem, which provides 24-hour tracking and in some cases real-time monitoring of cardiac rhythms (Sana et al., 2020). The past decade has been characterized by the progressive rise in the amount of literature, which discussed the comparison of the devices based on their diagnostic yield, patient experience, and greater clinical utility.

The effectiveness of wearables in the detection of arrhythmia is one of the most studied problems. A large body of clinical research has shown that photoplethysmography (PPG)-based adhesive ECG patches, chest-strip monitors, and smartwatches would be viable in the diagnosis of cases of atrial fibrillation and other arrhythmia (Nazarian et al., 2021). One study, the Apple Heart Study, was recruited of over 400,000 people and it was shown that irregular pulse rates on smart watches could be measured by the monitoring systems and were indicative of an atrial fibrillation that was validated by the ECG patches (Prasitlumkum et al., 2021). Other population-based studies have shown wearables to enhance the rate of early detection and referral especially in those who otherwise would not have access to regular screening. It is not entirely without constraints: wearable gadgets usually do not achieve the same level of accuracy regarding the detection of silent arrhythmias, and motion artifact and signal noise continues to be a problem as false positive. Therefore, although there is an entry point and potential to screen large populations with the assistance of wearables, the diagnostic potentials of wearables are secondary to implantable devices (Bayoumy et al., 2021).

The success of implantable loop recorders (ILRs) and pacemaker-based monitors, on the long-term, has always been better than Ilr. Clinical trials have been conducted with ILRs, including the CRYSTAL-AF trial, which found it to be highly useful in the diagnosis of undiagnosed atrial fibrillation in patients with a cryptogenic stroke and in addition it has been shown to be more effective in the detection of atrial fibrillation than the traditional monitoring systems (Pezawas, 2023). Likewise, pacemaker-based remote monitoring experiments showed how sustained rhythm surveillance could potentially cut time to arrhythmia detection, and could also be applied to detect previous intervention before therapeutic interventions (Healey & Wong, 2019). The claim that the implantables are more sensitive and specific especially in the long-term follow-ups is supported by the meta-analyses, and thus, this renders it especially useful in high-risk patients. Their invasive nature, however, and high cost restricts their use to a specific population as opposed to the general population.

The question of safety has also been getting a higher level of coverage in the literature, as well. The risk of wearables is not typically high, however, dermatological responses, including skin irritation by adhesive electrodes have been rampant. Notifications of a false-positive may be physically harmless, but it may cause unneeded anxiety, further testing, and unneeded health care utilization. Instead, implantable devices are subject to procedural risks, such as infection, bleeding and pockets complications (Hong et al., 2019). However, as it was found in the follow-ups studies, in the long term, the rates of adverse events are quite low (approximately 3% and so on) and can be addressed within the context of ordinary clinical practice (Matteucci et al., 2025). In general, the literature proposes that both types of devices are safe, but they differ in terms of the nature of their safety profile with lower, non-invasive risk with wearables and lower, but procedure-related risk with implantables.

One more significant topic that is becoming visible throughout the literature is patient compliance and participation. Compliance is also the sole gauge to show how much the patients actually wear the device and also a gauge of whether patients use the device sufficiently to produce actual data (Bokhari et al., 2025). Wearables tend to have compliance problems after two weeks because of patient complaints of discomfort, charging, and inconvenience in their life routines. In a survey-based research study that documented it, it was found out that about one third of the people who had taken up the wearables ceased using them in under one month despite the medical recommendations being of a clinical nature. However, the implantables neither need much day-to-day care nor the long-term adherence is less than 100 percent (Sana et al., 2020). They are invasive, and on the one hand, these factors combined with high prices in the first place make them unacceptable to some of the patients even to those who are not convinced that they must implant them surgically. The reason is offered in the dynamic by why adherence is not merely a consequence of behavior, but a device design, personal preference and interaction in healthcare support (Bayoumy et al., 2021).

In addition to the clinical outcomes, the literature has currently given its focus on the trust and systemic incorporation in the estimation of device adoption. The patients tend to raise their concerns regarding the privacy of their data, whether the warnings given by

the machine are credible and whether the data given by the machine can be used by doctors to make appropriate health care decisions (Bayoumy et al., 2021). The regulation is still at an ad hoc level, especially concerning consumer level wearables where a major group of the market simply sells the device to the consumer without subjecting the device to intense testing. Clinicians have reacted both positively and negatively, with some reviews suggesting that clinicians are keen to understand more about the diagnostic ability of these devices, but are anxious about the burden such devices will add to an already overloaded clinical workflow on top of the current loads of unstructured information (Hermans et al., 2022). The adoption and credibility of such technologies highly depend on factors in the health system including reimbursement policies, approval of the regulations and consistency of the reporting structures.

The diversity of methodologies and findings can be taken as one of the most common limitations of the literature reviewed. Arrhythmia definition, endpoints, monitoring periods and adherence measurement vary depending on the study and thus these studies cannot be readily compared in studies (Silva et al., 2025). In contrast to the accuracy of diagnosis that is typically reported, the measures of patient adherence and trust are not always addressed. Such a paradox makes meta-analyses a bit more complicated and is arguably necessary to devise methods of standardized reporting of outcomes in subsequent studies. In addition, low-resource setting patients, as well as pediatric patients with congenital arrhythmias and elderly patients with multiple comorbidities, are underrepresented as well (Ranjan et al., 2025). Lack of research poses severe knowledge gaps, which is particularly critical in scenarios with such groups due to which ongoing monitoring technologies may be of the paramount importance (Tran et al., 2023).

Altogether, one can say that the literature indicates that wearable and implantable cardiac monitoring devices will not replace, but will be additional tools in the overall arrhythmia detection environment (Duncker et al., 2021). Wearables are also effective in accessibility and scalability along with early detection, however, implantables are highly accurate against anything in high-risk, long-term scenarios. These two types of devices are not used with the same purpose of treating patients and neither of them could be effective without the issue of adherence, trust, and system-level integration (Moshawrab et al., 2023). With a combination of all these findings, it is possible to use the current systematic review to clarify the current state of evidence gaps and set the course of investigation in the future of digital cardiology.

Through this literature review, it is proved that wearable and implantable cardiac monitoring is an important aspect to diagnose and manage arrhythmias and provides a patient and clinician with a new opportunity to improve the prognosis and detect it. It is consistently demonstrated that wearables, including ECG patches and smartwatches, are effective in the short-term monitoring and during large-scale screening but the diagnostic efficacy of implantable loop recorders and pacemaker-based monitoring systems are superior in those patients who have a high risk and in long-term surveillance (Moshawrab et al., 2023). These findings alone are evidence of the synergetic usefulness of the two technologies in the present day cardiology practice.

The authors have found the safety outcomes to have been mostly positive with some small complications like skin irritation with wearables or a low level of procedural infection with implantables (Hong et al., 2019). The two safety profiles above demonstrate that both of these types of devices are applicable to a clinical and real-life application, but patient selection is also an essential factor (Abudan et al., 2019). The adherence between the two groups is critically different, as, in the case of the implantables, the sustained compliance was as a result of the sustained low requirement throughout the maintenance process and wearable-based adherence process tended to reduce as time (Bokhari et al., 2025). This review is directed by the fact that, despite the wearable and implantable cardiac monitoring devices demonstrating potential to identify arrhythmia, they differ in their effectiveness, safety, and compliance (Attia et al., 2019). Wearable devices have been very successful in identifying short-term paroxysmal atrial fibrillation especially among patients who are more prone to developing paroxysmal arrhythmia Perez et al., 2019). Instead, implantable devices were found to be more diagnostic and reliable in earlier diagnosis of the asymptomatic and long term arrhythmias particularly in patients of a cryptogenic stroke. This is supported by the fact that the emerging evidence supports that long-term surveillance of tracking is likely to greatly increase the possibility of early diagnosis and intervention.

Despite the positive diagnostic performance, safety profiles were different among devices categories. The wearable gadgets were linked to skin irritation and false positive messages that can ruin the confidence of the patients (Giebel & Gissel, 2019). The implantables were not especially hazardous in terms of their operation such as local infection (less than 3 per cent), but were generally safe in clinical follow up (Giugliano et al., 2024). These results demonstrate that as much as the two sets of devices are safe, there are other personal considerations like comorbidities and

toleration of invasive devices which have to be utilized in order to establish which type of device is to be used (Inacio et al., 2024).

Efficacy in real world entails adherence of a patient. In the review, an increase in adherence among wearables was found after 10-14 days of the continuous wear among participants citing discomfort and charging and also privacy. Conversely, the implantables had high compliance rate since they required minimum routine maintenance but their implantation was an invasive procedure and their cost was extremely high. Its outcome substantiates the argument that the selection of the device does not only depend on its clinical effectiveness, but on how well it fits the lifestyle of a patient and the support of the healthcare system.

The lowest scores were obtained when the regulatory and clinical oversight area of trust was analyzed. It was the patients, who were more willing to accept the information generated by the devices, and did not know how far the technologies were integrated into the regular clinical practice and how much they have been reimbursed by the insurance companies (Giebel & Gissel, 2019). Its high validity made the clinicians more confident about implantables than they were about their fears regarding consumer grade wearable products, which do not necessarily follow standard regulatory pathways (Oterhals et al., 2021). This type of separation denotes the necessity to be capable of creating regulatory transparency, efficient communication and augmenting integration of gadget data into customary clinical operations.

The non-homogenous methodological/ endpoint issue is also found in literature. The studies are different in the duration of the follow-up, the definition of arrhythmia and the adherence technique and the studies cannot be directly compared easily (Duncker et al., 2021). The safety and adherence outcomes are not often logged and measured as the diagnostic accuracy, yet diagnostic accuracy is always sought. The repeatability of the monitoring of arrhythmia should be repurposed in new research to enable the findings of the research to be compared between the devices and the population.

The other information to be kept in mind is that the special population ought to be remembered. The sample of the studies under review was not reflective of the elderly population, children with congenital arrhythmias and those residing in low-resource environments. It is a weakness of generalization and it is an immediate requirement to conduct broad experiments so as to obtain the full panorama of patients who can subsequently be in the beneficence of such technologies (Moshawrab et al., 2023).

The findings suggest wearables and implantables do not compete but are two dissimilar solutions (Healey & Wong, 2019). In the case of mass screening and early diagnosis, wearables may be utilized, whereas in the case of long-term follow-up of the high-risk population, implantables are the best option (Gregorio et al., 2024). The synergistic use of both classes of devices, to assist in algorithms guided by artificial intelligence (AI) and cloud-based surveillance, could be applicable in the context of detection prior to succeeding, successful patient outcomes, and efficient use of medical facilities (Bokhari et al., 2025). Usually as a result of discomfort, or charging. It insinuates that in circumstances where wearable devices are exceedingly appropriate in the case of the primary surveillance and precautionary measures, implantables are more efficient in the management of the condition in the long term (Hughes et al., 2023).

The issue of trust on regulatory and clinical systems was also echoed among the aspects that were reflected in the findings. These technologies appeared precise and convenient to patients, who were not as confident that this type of information would be incorporated into care decisions and be encompassed within insurance systems. This discrepancy is merely a larger institutional problem, which must not only be solved by creating devices, but also by an increased number of clinical principles and web-based reimbursement platforms.

CONCLUSION

Finally, wearable and implantable cardiac monitoring devices can become a great way to transform the process of arrhythmia detection and treatment, but only after the existing problem of complacency with such technologies, as well as the cost and implementation of such technologies in the healthcare provision, is solved. The future direction of research must be towards multicenter trials with standard outcome reporting, and they should also cover underrepresented groups, and even how to make wearable technology more accessible and implantable technology more reliable. The possibilities of these technologies to reshape cardiac care are clear, yet, only the partnership between clinicians, researchers, policymakers, and technologies creators can help to transform the vision into practice. Such obstacles can ultimately harken the integration of wearable and implantable devices as a future step toward the real potential of these devices in the future of patient-centered and technology-enabled cardiology.

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