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Educational and Supportive Interventions for Improving Self-Care Behaviors and Quality of Life Among Patients with Permanent Pacemakers: A Narrative Review

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Patients with permanent pacemakers face significant physical, psychological, and social challenges that can impair self-care behaviors and health-related quality of life. These challenges include wound care, activity restrictions, fear of device malfunction, body image concerns, and the need for lifelong follow-up, which often persist even after successful implantation. This narrative review examines the effectiveness of educational and supportive interventions on self-care behaviors, self-efficacy, and health-related quality of life among adult patients with permanent pacemakers. This review synthesizes findings from 12 published studies (2013–2025) examining educational, nurse-led, peer-support, family-centered, and multimodal interventions. Structured educational programs and nurse-led supportive interventions were generally associated with improvements in patients' knowledge, self-care practices, self-efficacy, and selected domains of health-related quality of life. Multimodal and family-involving approaches also showed favorable outcomes for adherence, psychological adaptation, and daily functioning, although the strength and consistency of effects varied across studies. Early delivery after implantation with continued reinforcement was commonly described as beneficial. Educational and supportive interventions appear promising for supporting self-care and quality of life after permanent pacemaker implantation and may be considered within post-implantation care pathways. Further rigorous research is needed to confirm the most effective components and delivery models.

Keywords: Permanent pacemaker; Self-care; Quality of life; Educational intervention; Supportive care; Nurse-led intervention

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Introduction

Cardiovascular diseases continue to impose a substantial burden of morbidity and mortality globally. Among various cardiac conditions, disorders of the cardiac conduction system—particularly sinus node dysfunction and atrioventricular blocks—frequently necessitate permanent pacemaker (PPM)

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implantation. This intervention has proven highly effective in alleviating the symptoms of bradyarrhythmias, preventing syncope, enhancing functional capacity, and improving survival. Technological advancements in cardiac implantable electronic devices (CIEDs) have led to a steady increase in the number of patients living with pacemakers. However, the ultimate success of this therapy depends not only on the device's technical reliability but also on patients' ability to adapt to life with the implant and actively participate in related self-care [1,2]. Despite being a life-saving procedure, pacemaker implantation often represents a challenging life transition for many patients. Following hospital discharge, individuals commonly face practical and emotional difficulties, including wound care, temporary activity restrictions, fear of lead dislodgement, concerns about device malfunction, risk of pocket infection, electromagnetic interference, and the necessity of lifelong follow-up. Moreover, the permanent presence of a foreign device can profoundly affect body image, sense of autonomy, and social roles. Studies indicate that even when cardiac symptoms improve, a considerable proportion of patients experience persistent psychological distress, diminished self-confidence, and reduced health-related quality of life (HRQoL) [3,4].

Central to successful long-term adaptation is the development of effective self-care behaviors. In the context of chronic illness, self-care encompasses the knowledge, skills, and confidence required to maintain health, monitor symptoms, manage complications, and integrate treatment recommendations into daily life (5). For patients with permanent pacemakers, this includes proper care of the implantation site, appropriate levels of physical activity, recognition of warning signs, adherence to follow-up schedules, and safe navigation of environmental hazards. Inadequate self-care has been linked to heightened anxiety, poorer perceived control, increased healthcare utilization, and suboptimal clinical outcomes [6].

The quality-of-life following pacemaker implantation is a complex, multidimensional construct influenced by physiological recovery, psychological adjustment, and social reintegration. While the device often improves objective cardiac function, patients' subjective experience is shaped by their ability to cope with the device, maintain independence, and receive adequate support. Growing evidence suggests that self-efficacy and active self-care participation are critical mediators of HRQoL in this population [3,7].

Educational and supportive interventions have emerged as key nursing strategies to empower patients. Structured pre- and post-discharge education can address knowledge gaps, correct misconceptions, and build self-care confidence. Complementary supportive approaches—such as nurse-led telephone follow-ups, individualized counselling, peer support, and technology-assisted programs—help maintain continuity of care, facilitate early problem detection, and mitigate psychological burden [8,9].

Although several studies have evaluated educational interventions for patients with CIEDs and reported improvements in knowledge, self-management, and certain aspects of QoL, the evidence remains heterogeneous. Differences in intervention design, duration, delivery methods, and outcome measures have made it difficult to identify the most effective strategy. Moreover, many existing programs continue to prioritize technical device management over the broader educational, psychological, and social needs of patients, an imbalance that is especially pronounced in resource-limited settings [1,10].

The comparative value of different intervention approaches (structured education alone versus nurse-led peer support, motivational interviewing, or family-involving programs), the durability of any observed benefits beyond the early post-implantation period, and the extent to which findings from predominantly single-center quasi-experimental studies can be generalised are less clear. A focused synthesis of the available evidence is therefore needed to clarify patterns of effect, highlight methodological limitations, and identify priorities for future research and practice.

Given the growing population of pacemaker recipients and the pivotal role of self-care in long-term success, a synthesis of current evidence on educational and supportive interventions is both timely and necessary. This narrative review aims to critically examine the available literature on such interventions, evaluate their impact on self-care behaviors and quality of life, and highlight the gaps that warrant further investigation. The findings are expected to inform the development of more comprehensive

patient-centred care pathways for individuals living with permanent pacemakers.

Material and Methods

The present study was designed as a narrative review to identify, evaluate, and synthesize the existing literature on educational and supportive interventions for enhancing self-care behaviors and health-related quality of life in patients with permanent pacemakers.

A targeted literature search was performed between January 2013 and April 2025. Peer-reviewed articles were retrieved from the following electronic databases: PubMed/MEDLINE, Scopus, Web of Science, CINAHL, and Google Scholar. Citation tracking of key papers was also used to identify additional relevant studies.

Although this is a narrative rather than a systematic review, the main search terms and Boolean combinations employed across databases are summarized in Table 2 to enhance transparency.

Eligible studies were original research articles (quantitative, qualitative, or mixed-methods) published in English that involved adult patients (≥18 years) with permanent pacemakers and evaluated any form of educational, psychosocial, nurse-led, peer-support, or technology-assisted interventions. Only full-text articles were included. When the full text was not freely available, the corresponding authors were contacted by email to request a copy; studies for which the full text could not be obtained were excluded to minimize selection bias. Studies were considered for inclusion if they reported at least one outcome related to self-care behaviors, knowledge, self-efficacy, psychological adaptation, or health-related quality of life. Studies were excluded if they: (a) focused exclusively on implantable cardioverter-defibrillators (ICDs) or cardiac resynchronization therapy (CRT) devices without separate findings for pacemaker patients; (b) addressed only technical or procedural aspects of device implantation and programming; (c) were review articles, editorials, conference abstracts, or dissertations; or (d) lacked sufficient methodological detail or outcome data.

All retrieved citations were imported into EndNote reference management software for duplicate removal and subsequent screening. Titles and abstracts were screened first, followed by full-text assessment of potentially eligible papers. From an initial pool of records identified across the databases and citation tracking (approximately 280–320 after duplicate removal), the majority were excluded after title/abstract screening because they did not address educational or supportive interventions, focused solely on technical device issues, or involved mixed CIED populations without separate pacemaker data. After full-text review, twelve studies met the inclusion criteria and were retained for synthesis.

The final set of included studies was read in full and thematically categorized according to the primary nature of the intervention: [1] structured educational programs focused mainly on knowledge and self-care instruction; [2] nurse-led supportive or peer-support interventions emphasizing ongoing contact and emotional support; [3] interventions that explicitly involved family members or combined education with social support; and [4] descriptive or theory-based studies that provided foundational insights rather than testing a discrete intervention package. As this narrative review did not follow a systematic review methodology, no PRISMA flow diagram, dual independent screening, or formal methodological quality appraisal was conducted; this is acknowledged as a limitation. Due to heterogeneity across studies, a narrative synthesis approach was adopted.

Table 1. Search strategy and Boolean term combinations

Database	Search terms / Boolean combination
PubMed / MEDLINE	("permanent pacemaker" OR "cardiac pacemaker" OR PPM OR "pacemaker implantation") AND ("self-care" OR "self management" OR education OR "nurse-led" OR "peer support" OR "quality of life" OR self-efficacy)
Scopus	TITLE-ABS-KEY (("permanent pacemaker" OR "cardiac pacemaker") AND ("self-care" OR education OR "quality of life" OR "nurse-led" OR "motivational interviewing"))
Web of Science	TS=(("permanent pacemaker" OR PPM) AND ("self-care" OR "educational intervention" OR "peer support" OR "quality of life"))
CINAHL	("permanent pacemaker" OR "pacemaker") AND ("self care" OR education OR "nursing intervention" OR "quality of life")
Google Scholar	permanent pacemaker self-care education OR "nurse-led" OR "quality of life" (first 200 results screened by relevance)

Results

Twelve original research studies fully satisfied the inclusion criteria. These studies, published between 2013 and 2025. Most were conducted in Egypt, Iran, China, Thailand, and Nepal, with sample sizes ranging from 44 to approximately 100 adult patients living with permanent pacemakers.Due to heterogeneity in intervention types, delivery methods, and outcome measures, a narrative synthesis was performed. Key patterns are presented thematically below, with individual study details summarized in Table 1.

1. Structured Educational Programs

Four quasi-experimental studies evaluated relatively structured educational or instructional programs delivered primarily by nurses. Across these studies, participants showed gains in knowledge of device-related self-care, adherence to recommended practices (wound care, activity restrictions, follow-up attendance), and selected domains of HRQoL, particularly mobility, self-care ability, and anxiety-related scores [2,9–11].

The programs typically consisted of face-to-face sessions, sometimes supplemented by written materials, and were delivered during the early post-implantation period. While the direction of effect was consistently positive, the magnitude of change and the specific domains improved varied, and none of the studies included long-term follow-up beyond a few months or objective clinical endpoints.

Table 2. Summary of the 12 Included Studies

Author (Year)	Design/ Sample	Setting	Intervention (brief description)	Main findings (key outcomes)
Ibrahim et al. (2024)	Quasi-exp. n=45	Egypt	Structured educational sessions on coping, device care, and lifestyle	Significant gains in coping, self-efficacy, and multiple HRQoL domains
Elsaka et al. (2024)	Quasi-exp. n=94	Egypt	Self-care management program (education + practice guidance)	Improved adherence to care practices and activities of daily living
Jassam & Hassan (2021)	Quasi-exp. n=50	Iraq	Self-care instructional program focusing on daily living and symptom monitoring	Improvements in mobility, self-care, pain, and anxiety domains of HRQoL
Shen et al. (2019)	RCT n=76	China	Nurse-led telephone peer-support program after discharge	Better self-care, lower anxiety/depression, higher follow-up compliance
Khedr et al. (2024)	RCT n=70	Egypt	Motivational interviewing sessions targeting adherence and emotional factors	Improved adherence, emotional intelligence, and dispositional optimism
Pensri & Ua-Kit (2019)	Quasi-exp. n=44	Thailand	Education combined with social-support sessions involving family	Significant improvement in health behaviors versus control
Yan et al. (2025)	Evidence synthesis	China	Best-evidence summary for home-based self-management (7 domains)	35 graded recommendations covering complications, EMI, activity, follow-up, role & emotion
Rayamajhi et al. (2021)	Descriptive n=98	Nepal	Cross-sectional assessment of knowledge and practice (no intervention)	Identified substantial gaps in self-care knowledge and practice
El-Sayed et al. (2019)	Quasi-exp. n=50	Egypt	Implementation of self-care guidelines within nursing care pathway	Positive changes in nursing-sensitive patient outcomes
Ali et al. (2021)	Quasi-exp. ~100	Egypt	Health-education nursing intervention on care practices and daily activities	Improved adherence to recommended care practices
Mohamed et al. (2025)	Quasi-exp.	Egypt	Learning instructional program aimed at quality of life	Reported improvement in overall quality of life scores
Rakhshan et al. (2013)	Pre-post n=51	Iran	Education based on Leventhal's self-regulatory model of illness perception	Improved illness perception and psychological adaptation

2. Nurse-Led Supportive and Peer Interventions

Three studies examined nurse-led approaches that placed greater emphasis on ongoing support, motivational techniques, or peer contact rather than one-time education alone. A randomized telephone peer-support program improved self-care behaviors, reduced anxiety and depression scores, and increased follow-up compliance [12]. Motivational interviewing was associated with better adherence and emotional outcomes in another trial [13]. A nursing health-education intervention reported improved adherence to care practices [14]. These interventions appeared to address psychological adaptation more directly than pure educational sessions; however, the sample sizes remained modest and follow-up periods were limited.

3. Family-Involving and Combined Education–Support Approaches

Two quasi-experimental studies explicitly incorporated family members or social support with education. One program that combined education with social support produced significant improvements in health behaviors [15). Another study that applied self-care guidelines within a nursing framework reported positive changes in nursing-sensitive outcomes [16]. An evidence-summary paper synthesized recommendations for home-based self-management across seven domains (complication management, electromagnetic interference, activity, limb care, follow-up, role, and emotional management) [17]. These approaches highlight the potential value of involving the patient's social network, although the relative contribution of the family component versus education itself cannot be isolated from the available study designs.

4. Descriptive and Theory-Based Insights

A descriptive study from Nepal documented substantial gaps in patients' knowledge and self-care practices, underscoring the need for targeted education [18]. An earlier pre-post study grounded in Leventhal's self-regulatory model showed that education improved illness perception and adaptation [19]. These papers provide useful contextual information but do not test multi-component interventions.

Overall pattern. Taken together, the reviewed studies point in a favorable direction: educational and supportive interventions were associated with better self-care knowledge and behaviors, higher self-efficacy, and improvements in selected HRQoL domains. Psychological outcomes (anxiety, depression, and emotional adaptation) appeared more responsive when interventions included ongoing contact or motivational elements. However, the evidence base is characterized by small samples, predominantly quasi-experimental designs, short follow-up, reliance on self-report measures, and limited geographic. diversity. Direct head-to-head comparisons of intervention types are lacking, and the durability of benefits remains uncertain.

Discussion

The available studies suggest that educational and supportive interventions can help patients adapt to life with a permanent pacemaker, particularly with respect to knowledge, self-care behaviors, and selected psychological and quality-of-life outcomes. Structured educational programs have produced consistent, albeit modest, gains in knowledge and adherence [2,9–11]. Interventions that included ongoing nurse contact, peer support, or motivational interviewing appeared to have a more noticeable influence on anxiety, depression, and emotional outcomes [12,13]. Approaches that involved family members or combined education with social support also yielded favorable changes in health behaviors [15,16]. An evidence summary further organizes practical recommendations for home-based self-management [17].

These patterns should be interpreted cautiously. Most primary studies were single-centre quasi-experimental designs with sample sizes under 100 and follow-ups limited to a few months. Outcome assessment relied heavily on self-report instruments, and objective indicators such as device interrogation data, infection rates, or long-term healthcare utilization were rarely reported. Only two studies used a randomized controlled design, and none provided head-to-head comparisons of the different intervention packages. The geographic concentration of a limited number of countries further restricts generalizability. Consequently, while the direction of the effect is encouraging, claims of consistent or strong effectiveness cannot yet be made with high confidence.

From a theoretical perspective, the interventions align with the Self-Care of Chronic Illness Theory and social-cognitive concepts of self-efficacy [20,21]. The work grounded in Leventhal's model [19] illustrates how altering illness perceptions may facilitate adaptation. In practice, programs delivered early after implantation and reinforced through continued contact appear more promising than single-session education alone; this observation, however, remains largely interpretive rather than definitively tested.

A comparison with the broader CIED literature is limited because many previous reviews have focused primarily on implantable cardioverter-defibrillators or mixed device populations. Therefore, the present synthesis adds value by restricting attention to permanent pacemakers, yet it underscores the scarcity of high-quality, pacemaker-specific evidence. Technology-assisted or hybrid digital interventions were almost entirely absent, leaving open questions about scalability in diverse resource settings.

In summary, educational and supportive interventions show potential benefits; however, the current evidence base is still preliminary. Future work should prioritize larger multicentre trials, longer follow-up, standardized outcome sets that include both patient-reported and clinical endpoints, and clearer reporting of intervention components so that effective elements can be identified and replicated.

Limitations

his review has several limitations. Most included studies were single-center with small samples and quasi-experimental designs, which limited generalizability and increased the risk of bias. Outcome measures relied heavily on self-reports, with few studies using objective data, such as device interrogation or long-term clinical outcomes. Follow-up periods were generally short, and research was concentrated in a limited number of countries. Technology-assisted interventions remain underrepresented. As a narrative review, formal quality appraisal of all studies and a systematic search protocol with dual independent screening were not conducted; the approximate screening numbers provided are therefore indicative rather than exact.

Conclusion

This narrative review indicates that educational and supportive interventions are associated with favorable changes in self-care behaviors, self-efficacy, and selected aspects of health-related quality of life among patients with permanent pacemakers. Structured education, nurse-led peer support, motivational interviewing, and family involving approaches appear to offer potential benefits, although the strength of evidence varies and methodological limitations are common.

Integrating well-designed educational and supportive components into post-implantation care pathways may help patients adapt more successfully to life with a pacemaker. Nurses, who frequently lead patient education and follow-up, are well positioned to contribute to such efforts. At the same time, the current literature is not robust enough to prescribe specific program formats with certainty. Hospital administrators and policymakers may wish to support further evaluation and local adaptation of these approaches rather than adopt them uncritically.

Future research should prioritize larger multicentre randomized trials with longer follow-up periods, standardized outcome measures that combine patient-reported and clinical endpoints, and hybrid (in-person plus digital) delivery models. Such work will be essential to determine which intervention elements are most effective, for whom, and under what conditions, thereby allowing the full therapeutic potential of pacemaker therapy to be realized through better support for patients.

Authorship contribution statement

All authors have reviewed and approved the final version of the manuscript. Y, C & W conducted the study and collected the data; C & W performed the data analysis and interpretation.

Ethical Considerations

The review analyzed publicly available literature and did not involve human participants, identifiable private information, clinical records, or new patient contact. Institutional ethics approval and informed consent were therefore not required.

Conflict of interest statement

No conflict of interest has been declared

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Data Availability

This study is a narrative review and does not include any new, primary data. All data supporting the findings of this study are derived from previously published articles and sources, which are cited within the manuscript. Therefore, no additional data are available.

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Declaration of Generative AI

The authors declare that they have not used any type of generative artificial intelligence for the writing of this manuscript, nor for the creation of tables, or their corresponding captions.

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