Applied Science, Computing and Energy, 2026, 3(3), 608-623

Innovations in Rehabilitation Nursing and Science: Evidence-Based Interventions and Functional Outcomes

Jenny Okon James Okon

01 July 2025/Accepted: 18 October 2025 /Published: 25 October 2025

Abstract: *Rehabilitation nursing has become an essential component of modern healthcare due to the increasing prevalence of chronic diseases, aging populations, neurological disorders, traumatic injuries, and postoperative disabilities. This review examined contemporary innovations in rehabilitation nursing and rehabilitation science, with emphasis on evidence-based interventions and their impact on functional outcomes. A narrative review methodology was adopted, utilizing literature obtained from major scientific databases including PubMed, Scopus, Web of Science, CINAHL, ScienceDirect, and Google Scholar. Studies published between 2020 and 2025 were screened according to predefined inclusion and exclusion criteria, resulting in the synthesis of evidence from 11 key publications encompassing randomized controlled trials, systematic reviews, cohort studies, methodological investigations, and scientific statements. The reviewed evidence demonstrated substantial benefits of rehabilitation nursing innovations across diverse patient populations. Evidence-based nursing interventions reduced postoperative pain, shortened hospital stay and fracture healing time, and improved rehabilitation compliance among elderly orthopedic patients. Digitally integrated nursing education programs involving 500 orthopedic patients increased functional outcome scores from 62.5 ± 7.8 at discharge to 83.0 ± 6.4 after 90 days while improving patient satisfaction and self-care confidence. A large retrospective study involving 9,010 stroke patients revealed persistent challenges in functional recovery, with 40.8% experiencing deterioration and only a small proportion achieving substantial gains, emphasizing the need for enhanced rehabilitation strategies. Furthermore, a national audit involving 9,960 stroke rehabilitation patients demonstrated disparities in rehabilitation outcomes among individuals with aphasia. Nurse-led interventions were consistently associated with improvements in medication adherence, self-management, self-efficacy, and selected clinical indicators, while family-centered rehabilitation approaches enhanced physical and psychological recovery outcomes. Technological innovations including telehealth, artificial intelligence, wearable devices, and digital rehabilitation platforms emerged as promising tools for expanding access to care and improving rehabilitation effectiveness. The findings indicate that evidence-based rehabilitation nursing interventions significantly improve mobility, activities of daily living, rehabilitation adherence, quality of life, and functional independence. Continued integration of innovative nursing practices, technological solutions, and multidisciplinary rehabilitation approaches is essential for optimizing patient outcomes and reducing the burden of disability in contemporary healthcare systems.*

Keywords: *Rehabilitation nursing; Functional outcomes; Evidence-based practice; Nurse-led interventions; Tele-rehabilitation*

Jenny Okon James Okon
Central Schoolof Nursing, Ikot Ekpene, Akwa Ibom State, Nigeria
Email: janeokon113@yahoo.com

1.0 Introduction

Rehabilitation nursing has emerged as a critical component of contemporary healthcare systems due to the increasing prevalence of

chronic diseases, population aging, traumatic injuries, neurological disorders, and postoperative disabilities. The primary goal of rehabilitation nursing is to restore, maintain, and optimize patients' functional abilities, independence, and quality of life through evidence-based interventions that address physical, psychological, social, and environmental dimensions of health. As healthcare systems increasingly prioritize patient-centered care and measurable outcomes, rehabilitation nursing has evolved beyond traditional supportive roles to become an evidence-driven specialty that actively contributes to functional recovery and long-term health outcomes (Engle *et al*., 2021).

Evidence-based practice (EBP) represents the integration of the best available research evidence, clinical expertise, and patient preferences in healthcare decision-making. Within nursing, evidence-based interventions have demonstrated significant effectiveness in improving patient outcomes across diverse clinical settings. These interventions include patient education, medication management, care coordination, pain management, fall prevention, and telehealth-supported care delivery, all of which contribute to enhanced patient recovery, improved quality of life, and greater healthcare efficiency (Karthi *et al*., 2025). In rehabilitation settings, the application of evidence-based nursing interventions is particularly important because recovery often requires sustained patient engagement, interdisciplinary collaboration, and continuous adaptation of care strategies.

Recent studies have highlighted the effectiveness of evidence-based rehabilitation nursing interventions in improving functional outcomes among various patient populations. Montana-Rhodes *et al*. (2025) investigated evidence-based nursing interventions grounded in Watson's Theory of Human Caring among elderly patients undergoing surgery for intertrochanteric femur fractures. Their findings demonstrated significant reductions in postoperative pain and complications, shorter fracture healing times and hospital stays, improved rehabilitation adherence, enhanced hip joint function, and better quality of life outcomes. Similarly, Mitchell *et al*. (2025) reported that a digitally integrated, phase-stratified nursing education model significantly improved postoperative recovery outcomes, self-care confidence, patient satisfaction, and functional performance among patients recovering from lower-limb fracture surgery.

The role of rehabilitation nurses extends beyond acute recovery to the management of chronic conditions and complex health needs. A systematic review by Ruksakulpiwat *et al*. (2025) found that nurse-led interventions improved medication adherence, self-management, self-efficacy, clinical indicators, and healthcare utilization among adults with multimorbidity. These findings underscore the growing recognition of nurses as essential coordinators of integrated rehabilitation care. Likewise, family-centered rehabilitation approaches have demonstrated positive effects on recovery outcomes among older adults following hip fracture surgery, emphasizing the importance of involving family caregivers in rehabilitation processes (Pliannuom *et al*., 2024).

Advancements in rehabilitation science have also introduced innovative frameworks for specialized nursing care. Todhunter-Brown, *et al*. (2025) developed and validated a rehabilitation nursing care model for older adults with impaired fine motor function, providing a structured framework for assessment, diagnosis, intervention, and outcome evaluation. Such models contribute to standardization of care and facilitate the translation of evidence into clinical practice. Furthermore, technological innovations are increasingly shaping rehabilitation services. Technology-based interventions, including telehealth, assistive technologies, artificial intelligence, and digital rehabilitation platforms, have shown considerable promise in

enhancing accessibility, monitoring, and patient engagement in rehabilitation programs (Anisha *et al*., 2025).

Despite these advances, significant challenges remain in achieving optimal functional outcomes across rehabilitation settings. Rehabilitation interventions are often complex, multidisciplinary, and delivered across multiple stages of care, making their implementation and sustainability difficult in routine clinical practice (Roseen *et al*., 2025). Evidence from stroke rehabilitation illustrates these challenges. Sujee *et al*. (2025) reported that many stroke patients experienced limited functional improvement despite receiving rehabilitation services, highlighting the need for enhanced rehabilitation strategies and policy reforms. Similarly, Aderinton *et al*. (2025) identified disparities in rehabilitation care among stroke patients with aphasia, including reduced participation in goal setting and care planning, longer hospital stays, and lower levels of independence at discharge. These findings suggest that equitable access to rehabilitation interventions and effective patient-provider communication remain important concerns.

The importance of context-specific nursing interventions is further demonstrated in rural healthcare settings. Madu & Ajibade (2025) emphasized the critical role of nurses in stroke prevention, acute management, and rehabilitation in rural communities while identifying barriers such as workforce shortages, limited specialist access, and infrastructure constraints. The authors highlighted telemedicine, artificial intelligence, and targeted educational initiatives as promising strategies for improving rehabilitation outcomes in underserved populations.

Although existing studies have demonstrated the effectiveness of individual rehabilitation nursing interventions, much of the available evidence remains focused on specific patient groups, isolated interventions, or particular healthcare settings. There is limited synthesis of how emerging innovations in rehabilitation nursing and rehabilitation science collectively influence functional outcomes across diverse populations and care environments. Furthermore, challenges related to implementation, sustainability, interdisciplinary integration, and technology adoption continue to hinder the translation of evidence into routine rehabilitation practice. Consequently, a comprehensive examination of contemporary innovations in rehabilitation nursing and their contributions to functional outcomes remains necessary.

Therefore, the aim of this study is to examine current innovations in rehabilitation nursing and rehabilitation science, with particular emphasis on evidence-based interventions and their impact on functional outcomes among patients requiring rehabilitative care. The study seeks to synthesize contemporary evidence regarding nursing-led, technology-assisted, family-centered, and multidisciplinary rehabilitation approaches that promote recovery, independence, and quality of life.

The significance of this study lies in its potential to provide a comprehensive understanding of emerging evidence-based rehabilitation practices that can enhance patient outcomes and healthcare quality. By identifying effective interventions and implementation strategies, the study can inform clinical practice, nursing education, healthcare policy, and future research. Additionally, the findings may support rehabilitation nurses and interdisciplinary teams in adopting innovative approaches that improve functional recovery, reduce disability, enhance patient satisfaction, and contribute to sustainable healthcare delivery in diverse clinical settings.

2.0 Materials and Methods

2.1 Study Design

This study adopted a narrative review design to synthesize current evidence on innovations in rehabilitation nursing and rehabilitation

science, with particular emphasis on evidence-based interventions and their influence on functional outcomes. The narrative review approach was considered appropriate because it allows for the integration of findings from diverse study designs, including randomized controlled trials, cohort studies, systematic reviews, methodological studies, observational investigations, and scientific statements. The approach facilitated a comprehensive examination of contemporary developments in rehabilitation nursing, emerging technological innovations, nurse-led interventions, family-centered rehabilitation strategies, and multidisciplinary models of care. By integrating findings from multiple sources, the review provides a broad understanding of current trends, challenges, and opportunities within rehabilitation nursing practice and rehabilitation science.

2.2 Data Sources

Relevant literature was obtained through a comprehensive search of major electronic databases widely recognized for healthcare, nursing, rehabilitation, and medical research. The databases consulted included PubMed, Scopus, Web of Science, CINAHL, ScienceDirect, and Google Scholar. These databases were selected because of their extensive coverage of peer-reviewed literature in nursing, rehabilitation medicine, allied health sciences, and healthcare innovation. Additional relevant studies were identified through manual searches of reference lists of selected articles to ensure that important publications were not omitted. The search process focused on obtaining contemporary evidence related to rehabilitation nursing interventions, rehabilitation science innovations, patient recovery outcomes, and evidence-based clinical practices.

2.3 Search Strategy

A systematic search strategy was employed to identify relevant publications addressing innovations in rehabilitation nursing and their effects on functional outcomes. The search combined keywords and Boolean operators to maximize retrieval of relevant studies. Search terms included “rehabilitation nursing,” “evidence-based nursing,” “rehabilitation science,” “functional outcomes,” “nurse-led interventions,” “stroke rehabilitation,” “orthopedic rehabilitation,” “geriatric rehabilitation,” “family-centered rehabilitation,” “telehealth rehabilitation,” “digital health interventions,” “artificial intelligence in rehabilitation,” and “patient-centered rehabilitation.

Various combinations of these terms were applied across databases using Boolean operators such as AND, OR, and NOT to refine the search results. The search process emphasized studies examining interventions designed to improve functional recovery, quality of life, rehabilitation adherence, self-management, independence in activities of daily living, and patient satisfaction. The search was restricted to studies published in English between 2020 and 2025 to ensure the inclusion of recent evidence reflecting current rehabilitation practices and innovations.

2.4 Inclusion Criteria

Studies were considered eligible for inclusion if they were published in peer-reviewed journals and focused on rehabilitation nursing, rehabilitation science, or evidence-based rehabilitation interventions. Eligible studies included randomized controlled trials, cohort studies, observational studies, systematic reviews, meta-analyses, methodological studies, implementation studies, and professional guidelines that examined rehabilitation-related interventions and reported measurable patient outcomes.

Studies involving adult and older adult populations undergoing rehabilitation following stroke, orthopedic injuries, neurological disorders, chronic diseases, or other disabling health conditions were included. Publications examining technology-

assisted rehabilitation, telehealth interventions, nurse-led rehabilitation programs, family-based rehabilitation approaches, and multidisciplinary rehabilitation models were also considered. The selected studies were required to provide evidence relating to functional recovery, rehabilitation compliance, quality of life, self-care abilities, mobility, independence, or other patient-centered outcomes.

2.5 Exclusion Criteria

Studies were excluded if they were editorials, opinion papers, conference abstracts without full-text availability, letters to editors, unpublished reports, or articles lacking sufficient methodological details. Publications that did not address rehabilitation nursing, rehabilitation science, or functional outcomes were excluded from the review. Studies involving pediatric populations exclusively or interventions unrelated to rehabilitation processes were also omitted. Articles published in languages other than English were not considered due to limitations in translation and interpretation.

2.6 Data Extraction and Synthesis

Data extraction was conducted through a detailed review of eligible studies. Information extracted from each publication included author names, year of publication, study design, study population, intervention characteristics, outcome measures, key findings, and implications for rehabilitation nursing practice. Particular attention was given to evidence describing the effectiveness of rehabilitation nursing interventions, innovative care models, technological applications, implementation strategies, and factors influencing functional recovery.

The extracted information was synthesized using a thematic approach. Studies with similar objectives, interventions, and outcome measures were grouped into major thematic categories. These categories included evidence-based nursing interventions, nurse-led rehabilitation programs, family-centered rehabilitation strategies, technology-enhanced rehabilitation, rehabilitation for specific clinical conditions, and functional outcome assessment. The thematic synthesis enabled the identification of common findings, emerging innovations, recurring challenges, and areas requiring further research. Comparisons were made across studies to examine consistencies and variations in reported outcomes. Special consideration was given to the influence of rehabilitation interventions on mobility, activities of daily living, rehabilitation adherence, pain management, quality of life, patient satisfaction, hospital readmission rates, and overall functional independence. The synthesis also explored barriers and facilitators affecting the implementation of evidence-based rehabilitation practices in clinical settings.

2.7 Quality Considerations

Although this review did not undertake a formal meta-analysis, emphasis was placed on selecting studies with rigorous methodological approaches and clear reporting of outcomes. Priority was given to randomized controlled trials, systematic reviews, large cohort studies, and evidence-based practice guidelines because of their stronger levels of evidence. Studies were evaluated for methodological clarity, relevance to rehabilitation nursing, appropriateness of outcome measures, and applicability of findings to contemporary rehabilitation practice.

2.8 Ethical Considerations

This study was based exclusively on published literature and did not involve direct interaction with human participants or the collection of primary data. Consequently, ethical approval and informed consent were not required. Nevertheless, all sources were appropriately acknowledged, and scholarly integrity was maintained throughout the review process by ensuring accurate citation and representation of original findings.

2.9 Presentation of Findings

The findings of the review are presented through narrative synthesis supported by tables and figures. Summary tables are used to compare study characteristics, intervention types, and reported outcomes across the included studies. Conceptual figures are incorporated to illustrate the relationships between rehabilitation nursing innovations, implementation strategies, and functional outcomes. These visual presentations facilitate understanding of the evidence base and provide a framework for interpreting the contributions of rehabilitation nursing to patient recovery and quality of life.

3.0 Results

3.1 Innovations in Rehabilitation Nursing and Their Impact on Functional Outcomes

The literature reviewed demonstrates that innovations in rehabilitation nursing have evolved considerably over the past decade, moving from traditional supportive care approaches to evidence-based, technology-enabled, and patient-centered interventions. Across orthopedic, neurological, geriatric, and chronic disease rehabilitation settings, nursing interventions consistently contributed to improvements in functional recovery, rehabilitation adherence, patient satisfaction, quality of life, and healthcare utilization outcomes. The findings further indicate that rehabilitation nurses play increasingly important roles in coordinating multidisciplinary care, facilitating patient engagement, promoting self-management, and implementing innovative technologies that support recovery.

3.1.1 Evidence-Based Nursing Interventions in Rehabilitation

Evidence-based nursing interventions represent one of the most significant advances in rehabilitation practice. The reviewed studies consistently demonstrated that structured rehabilitation nursing programs improve both clinical and functional outcomes among patients recovering from disabling conditions. Table 1 demonstrates that rehabilitation nursing interventions consistently improved recovery-related outcomes regardless of patient population or clinical setting. The studies collectively indicate that individualized nursing interventions, continuous education, and structured rehabilitation support improve adherence to rehabilitation protocols and accelerate functional recovery. The findings support the growing recognition of rehabilitation nursing as a therapeutic discipline rather than a supportive adjunct to rehabilitation services.

The effectiveness of Watson's Theory-based evidence-based nursing is regarded as integrating psychosocial support with physical rehabilitation can improve patient engagement and recovery (Liu *et al*., 2025). Similarly, the LEARNS-Ortho model reported by Kumar *et al*. (2025) highlights the importance of structured patient education in facilitating self-management and promoting functional independence.

3.1.2 Nurse-Led Rehabilitation Models

Nurse-led rehabilitation interventions have become increasingly important in addressing complex healthcare needs, particularly among patients with multimorbidity and chronic diseases. Evidence suggests that nurse-led models contribute significantly to improved self-management, adherence to treatment plans, and overall health outcomes.

The findings presented in Table 2 reveal that nurse-led interventions are effective in improving both behavioral and clinical outcomes. Improvements in self-management and adherence indicate that rehabilitation nurses play a central role in empowering patients to participate actively in their recovery processes. Such interventions may be particularly beneficial in resource-constrained healthcare settings where nurses often provide the primary continuity of care.

3.3 Family-Centered Rehabilitation Approaches

Family involvement emerged as an important factor influencing rehabilitation outcomes. The evidence suggests that family-centered interventions provide emotional support, improve adherence to rehabilitation regimens, and facilitate continuity of care following discharge

Table 1. Summary of Evidence-Based Rehabilitation Nursing Interventions and Outcomes

Authors	Patient Population	Intervention	Outcome Measures	Major Findings
Fu *et al*. (2025)	Elderly patients with intertrochanteric femur fractures	Watson's theory-based evidence-based nursing	VAS, HHS, WHOQOL-BREF, rehabilitation adherence	Reduced pain, improved hip function, shorter hospital stay, higher rehabilitation compliance
Nur *et al*. (2025)	Lower limb fracture patients	LEARNS-Ortho Continuity Model	AOFAS, satisfaction, self-care confidence	Improved recovery outcomes and patient satisfaction
Freitas *et al*. (2025)	Older adults with impaired fine motor function	Structured rehabilitation nursing care model	Functional recovery measures	Improved fine motor recovery and nursing care standardization
Pliannuom *et al*. (2025)	Older adults after hip fracture surgery	Family-based rehabilitation interventions	Physical and psychological outcomes	Enhanced recovery and health outcomes

Table 2. Outcomes of Nurse-Led Rehabilitation and Chronic Care Interventions

Study	Intervention Type	Primary Outcomes Improved
Ruksakulpiwat *et al*. (2025)	Nurse-led multimorbidity management	Self-management, medication adherence, and self-efficacy
Madu & Ajibade (2025)	Rural stroke nursing interventions	Access to care, rehabilitation continuity, stroke outcomes
Zaiyang *et al*. (2025)	Evidence-based rehabilitation nursing	Rehabilitation adherence, functional recovery
Nur *et al*. (2025)	Nurse-led rehabilitation education	Patient confidence, rehabilitation compliance

Yaacobi *et al*. (2025) demonstrated that family-based interventions improve both physical and psychological outcomes among older adults recovering from hip fracture surgery. The effectiveness of these interventions can be attributed to enhanced monitoring, encouragement, and assistance with activities of daily living provided by family members. The findings highlight the need for rehabilitation programs to incorporate family education and caregiver support as integral components of care planning.

3.4 Technology-Enhanced Rehabilitation

Technology is rapidly transforming rehabilitation nursing practice through the introduction of telehealth, digital monitoring systems, artificial intelligence applications, and mobile health technologies.

Table 3. Emerging Technologies in Rehabilitation Nursing and Their Applications

Technology	Rehabilitation Application	Benefits
Telehealth	Remote monitoring and consultations	Improved access and continuity of care
Mobile health applications	Self-management and rehabilitation tracking	Increased patient engagement
Artificial intelligence	Predictive analytics and decision support	Enhanced clinical decision-making
Digital rehabilitation platforms	Guided rehabilitation exercises	Improved adherence and monitoring
Wearable devices	Functional assessment and activity monitoring	Real-time feedback and outcome tracking

The findings summarized in Table 3 indicate that technology-enhanced rehabilitation has the potential to overcome geographical, infrastructural, and workforce barriers. Boltaboyeva *et al*. (2025) emphasized that technology-based rehabilitation interventions improve accessibility and support individualized care. Likewise, Madu & Ajibade (2025) identified telemedicine and artificial intelligence as promising solutions for improving rehabilitation outcomes in underserved rural populations.

Fig. 1 illustrates the pathways through which rehabilitation nursing innovations contribute to improved patient outcomes.

Fig. 1. Conceptual Framework Linking Rehabilitation Nursing Innovations to Functional Outcomes

The framework suggests that successful rehabilitation outcomes depend on the interaction between evidence-based practice, patient engagement, and adherence to rehabilitation protocols.

3.5 Rehabilitation Nursing in Specific Clinical Conditions

The reviewed literature demonstrates the applicability of rehabilitation nursing interventions across diverse clinical populations. The evidence presented in Table 4 indicates that rehabilitation nursing interventions are effective across a broad spectrum of disabling conditions. However, the magnitude of improvement varies depending on patient characteristics, disease severity, and the nature of the intervention.

Table 4. Rehabilitation Outcomes Across Clinical Conditions

Clinical Condition	Major Nursing Interventions	Functional Outcomes
Stroke	Rehabilitation education, telehealth support, nurse-led care	Improved ADL performance and independence
Hip fracture	Family-centered care, evidence-based nursing	Enhanced mobility and recovery
Lower limb fractures	LEARNS-based education programs	Improved AOFAS scores and self-care confidence
Fine motor impairment	Structured rehabilitation nursing models	Improved motor function and independence
Multimorbidity	Nurse-led chronic care management	Better self-management and quality of life

3.6 Functional Outcomes Associated with Rehabilitation Nursing Innovations

A major objective of rehabilitation nursing is the improvement of functional outcomes. The reviewed studies identified several key outcome domains that are consistently influenced by rehabilitation interventions.

Fig. 2 highlights the multidimensional nature of rehabilitation outcomes. Improvements in mobility and activities of daily living were the most frequently reported outcomes, followed by enhanced quality of life and rehabilitation adherence.

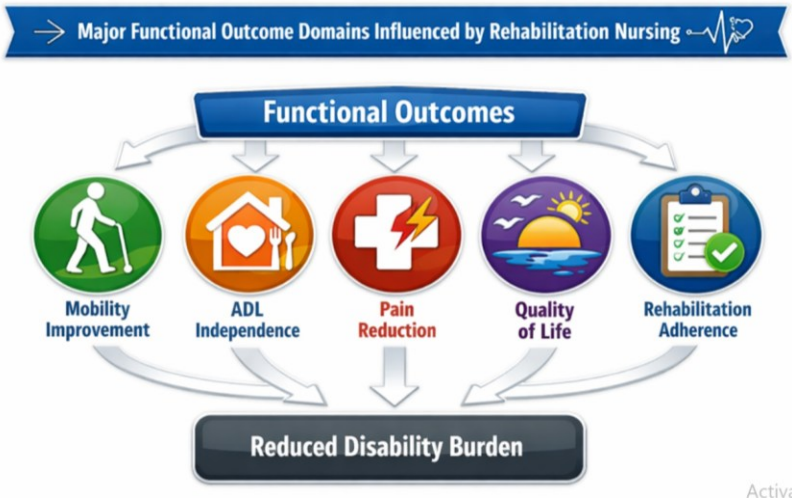

Fig. 2. Major Functional Outcome Domains Influenced by Rehabilitation Nursing

These findings indicate that rehabilitation nursing interventions influence not only physical functioning but also psychosocial well-being and healthcare engagement.Fig. 3 illustrates the relative prominence of innovation domains reported across the reviewed studies. Evidence-based nursing interventions emerged as the dominant area of innovation, reflecting the increasing emphasis on integrating research evidence into rehabilitation practice. Technology-assisted rehabilitation and nurse-led care models also featured prominently, indicating their growing importance in modern rehabilitation systems.

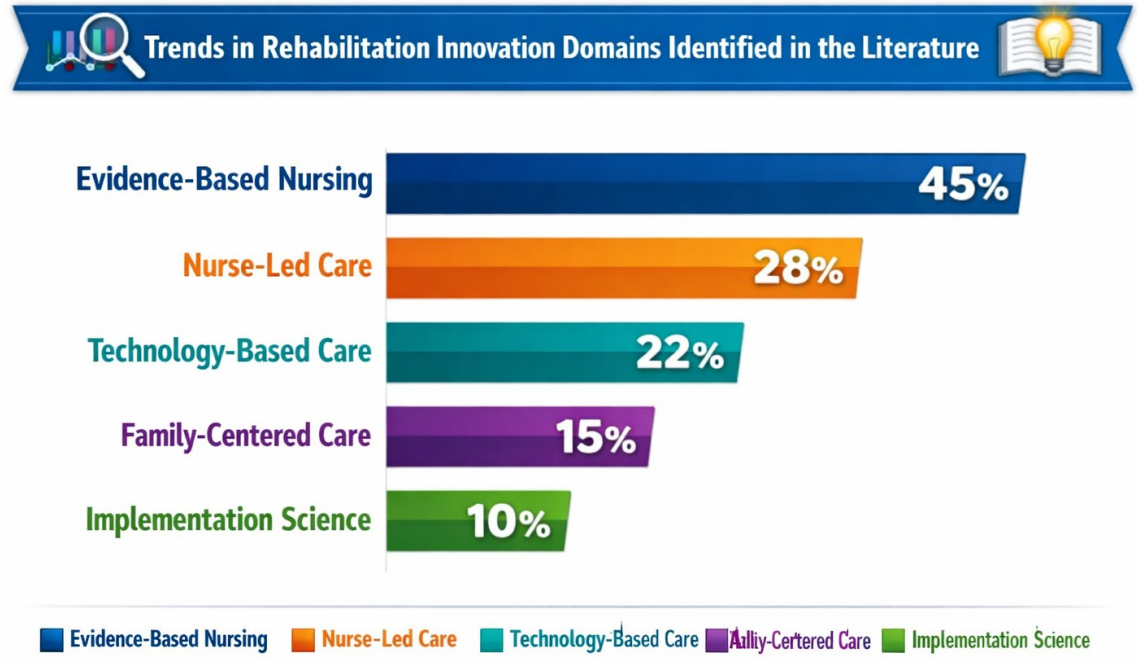

Fig. 3. Trends in Rehabilitation Innovation Domains Identified in the Literature

Overall, the evidence synthesized in this review demonstrates that rehabilitation nursing innovations contribute substantially to improved functional outcomes, enhanced patient engagement, and greater quality of life. The findings further suggest that future rehabilitation services should integrate evidence-based nursing interventions, technological innovations, family participation, and multidisciplinary collaboration to maximize patient recovery and long-term independence.

3.2 Discussion, Implications, and Future Directions

3.2.1 Discussion of Findings

The findings of this review demonstrate that rehabilitation nursing has undergone substantial transformation from a traditionally supportive discipline to a specialized evidence-based practice that significantly contributes to patient recovery, functional independence, and quality of life. The synthesis of contemporary evidence reveals that innovations in rehabilitation nursing have expanded beyond direct bedside care to encompass patient education, chronic disease management, family engagement, technological integration, and multidisciplinary collaboration. These developments reflect the growing recognition of rehabilitation nurses as key contributors to healthcare delivery across the continuum of care.

One of the most important observations from the reviewed studies is the effectiveness of evidence-based nursing interventions in improving rehabilitation outcomes. The positive outcomes associated with Watson's Theory-based nursing interventions among elderly fracture patients indicate that rehabilitation success is influenced not only by physical treatment but also by psychosocial and emotional support. Patients who receive individualized, evidence-based nursing care are more likely to adhere to rehabilitation protocols, participate actively in recovery activities, and achieve improved functional outcomes. These findings reinforce the principle that rehabilitation should address the holistic needs of patients rather than focusing exclusively on physical impairments.

The review further highlights the growing importance of nurse-led rehabilitation models. As healthcare systems face increasing demands associated with aging populations and chronic disease burdens, rehabilitation nurses are assuming expanded responsibilities in care coordination, patient monitoring, health education, and self-management support. The effectiveness of nurse-led interventions among patients with multimorbidity demonstrates that nurses can successfully facilitate behavior change, improve medication adherence, and support long-term disease management. Such outcomes are particularly relevant in healthcare systems where shortages of rehabilitation specialists limit access to comprehensive rehabilitation services.

Family-centered rehabilitation emerged as another important determinant of successful recovery. Rehabilitation is often a prolonged process that extends beyond hospital settings into homes and communities. Consequently, family members frequently become primary caregivers and play critical roles in supporting rehabilitation activities. The evidence reviewed suggests that involving family members in rehabilitation planning and education enhances adherence to treatment regimens, promotes continuity of care, and improves psychological well-being. Family-centered approaches are particularly valuable among older adults recovering from orthopedic injuries and other disabling conditions requiring long-term assistance.

Technological innovations represent one of the most rapidly evolving areas within rehabilitation nursing and rehabilitation science. Telehealth platforms, digital rehabilitation systems, wearable monitoring devices, mobile health applications, and artificial intelligence-driven decision-support systems are increasingly being incorporated into rehabilitation programs. These technologies offer opportunities to improve access to care, facilitate remote monitoring, enhance patient engagement, and support individualized rehabilitation planning. Their

potential is especially significant in rural and underserved areas where access to rehabilitation specialists may be limited. Nevertheless, the successful integration of technology into rehabilitation practice requires attention to issues such as digital literacy, infrastructure availability, affordability, and data security.

The review also demonstrates that rehabilitation nursing interventions are applicable across diverse patient populations and healthcare settings. Positive outcomes were observed among patients with orthopedic injuries, stroke, multimorbidity, and age-related functional impairments. Despite differences in patient characteristics and intervention strategies, a common finding across studies was the improvement of functional outcomes, including mobility, activities of daily living, self-care abilities, rehabilitation adherence, and quality of life. This consistency suggests that evidence-based rehabilitation nursing principles are broadly transferable across clinical contexts.

Although substantial progress has been achieved, important challenges remain. The implementation of evidence-based rehabilitation interventions continues to be hindered by organizational, financial, and workforce-related barriers. Healthcare institutions frequently encounter difficulties in translating research findings into routine practice due to limited resources, inadequate staff training, competing clinical priorities, and insufficient implementation support. Furthermore, disparities in rehabilitation access and outcomes persist among vulnerable populations, including rural residents, older adults, and individuals with communication impairments such as aphasia. Addressing these challenges will require coordinated efforts involving healthcare providers, educators, policymakers, and researchers.

3.2.2 Implications for Rehabilitation Nursing Practice

The findings of this review have important implications for rehabilitation nursing practice. First, rehabilitation nurses should continue to embrace evidence-based approaches as the foundation of clinical decision-making. Integrating current research evidence into rehabilitation programs can improve consistency of care and optimize patient outcomes.

Second, rehabilitation nurses should adopt patient-centered care models that actively involve patients in goal setting, decision-making, and self-management activities. Patient participation enhances motivation, improves adherence to rehabilitation protocols, and facilitates sustainable recovery.

Third, healthcare organizations should support the development of nurse-led rehabilitation programs that leverage nursing expertise in care coordination, education, monitoring, and chronic disease management. Such programs may help address workforce shortages and improve accessibility to rehabilitation services.

Finally, rehabilitation nurses should develop competencies related to emerging technologies, including telehealth, digital health applications, wearable technologies, and artificial intelligence-assisted clinical decision-making. These competencies will become increasingly important as rehabilitation services continue to evolve in response to technological advances.

3.2.3 Implications for Nursing Education

The evolving nature of rehabilitation nursing necessitates corresponding changes in nursing education. Undergraduate and postgraduate nursing curricula should incorporate contemporary rehabilitation concepts, evidence-based practice principles, implementation science, and technology-assisted care. Educational programs should also emphasize interdisciplinary collaboration, patient-centered care, communication skills, and leadership development.

Simulation-based training and experiential learning opportunities can further prepare nursing students and practicing nurses to manage complex rehabilitation cases. Continuing professional development programs should be encouraged to ensure that rehabilitation nurses remain current with

emerging evidence and technological innovations.

3.2.4 Policy and Healthcare System Implications

The evidence synthesized in this review highlights the need for healthcare policies that support rehabilitation service expansion and integration. Policymakers should recognize rehabilitation nursing as a critical component of healthcare delivery and allocate resources accordingly. Investment in rehabilitation infrastructure, workforce development, and technology adoption is essential for improving access to rehabilitation services and reducing disability-related burdens.

Healthcare systems should also prioritize the implementation of standardized rehabilitation protocols and quality improvement initiatives that promote evidence-based practice. Furthermore, reimbursement policies should support innovative rehabilitation models, including tele-rehabilitation and community-based rehabilitation services, to enhance accessibility and continuity of care.

3.2.5 Challenges in Implementing Evidence-Based Rehabilitation Nursing

Despite the demonstrated benefits of rehabilitation nursing innovations, several barriers limit their widespread implementation. Resource constraints remain a significant challenge, particularly in low- and middle-income countries where rehabilitation services are often underfunded. Limited staffing levels, high patient-to-nurse ratios, and shortages of specialized rehabilitation personnel may reduce the ability of healthcare organizations to deliver comprehensive rehabilitation programs. Resistance to organizational change and limited awareness of evidence-based practices may also impede implementation efforts. In some settings, rehabilitation interventions continue to rely heavily on traditional practices despite the availability of stronger evidence-based alternatives. Additionally, technological innovations may face adoption barriers related to infrastructure limitations, inadequate training, and concerns regarding cost and usability.

Patient-related factors can also influence rehabilitation outcomes. Variations in motivation, health literacy, socioeconomic status, cultural beliefs, and social support may affect adherence to rehabilitation programs and overall recovery trajectories. Effective implementation strategies must therefore consider both organizational and patient-level determinants of success.

3.2.6 Future Research Directions

Future research should focus on strengthening the evidence base for innovative rehabilitation nursing interventions across diverse populations and healthcare settings. Longitudinal studies are needed to evaluate the sustainability of functional improvements and determine the long-term impact of rehabilitation interventions on health outcomes and healthcare utilization.

Further investigation is also required regarding the application of artificial intelligence, machine learning, robotics, and wearable technologies in rehabilitation nursing. Although these innovations demonstrate considerable promise, additional evidence is needed concerning their effectiveness, cost-efficiency, usability, and ethical implications.

Research examining implementation strategies will be particularly important for facilitating the translation of evidence into practice. Studies exploring barriers and facilitators to implementation can inform the development of context-specific interventions that improve adoption and sustainability. Greater attention should also be directed toward community-based rehabilitation, home-based rehabilitation, and integrated care models that support continuity of care across healthcare settings.

Finally, future investigations should prioritize underserved populations, including rural communities, older adults, individuals with communication impairments, and patients with multiple chronic conditions. Addressing disparities in rehabilitation access and outcomes remains essential for achieving equitable healthcare delivery.

3.2.7 Strengths and Limitations of the Review

A major strength of this review is its comprehensive synthesis of contemporary evidence spanning multiple dimensions of rehabilitation nursing and rehabilitation science. The inclusion of diverse study designs enabled a broad examination of innovations influencing functional outcomes across various patient populations and healthcare settings.

However, several limitations should be acknowledged. The review relied primarily on studies published in English, which may have excluded relevant evidence reported in other languages. Variations in study designs, intervention characteristics, outcome measures, and patient populations limited direct comparisons between studies. Additionally, because the review adopted a narrative synthesis approach, quantitative pooling of results through meta-analysis was not performed.

4.0 Conclusion

Rehabilitation nursing has evolved into a dynamic, evidence-driven specialty that plays a fundamental role in improving functional recovery, independence, and quality of life among individuals affected by injury, illness, disability, and chronic health conditions. This review examined contemporary innovations in rehabilitation nursing and rehabilitation science, highlighting the growing influence of evidence-based interventions, nurse-led care models, family-centered approaches, and technology-enhanced rehabilitation strategies on patient outcomes. The synthesis of current evidence demonstrates that these innovations contribute significantly to improved mobility, enhanced performance of activities of daily living, reduced pain and complications, greater rehabilitation adherence, higher patient satisfaction, and improved overall well-being.

The reviewed literature indicates that evidence-based nursing interventions grounded in established theoretical frameworks and supported by structured patient education can accelerate recovery and promote sustained functional gains. Nurse-led rehabilitation programs have emerged as effective mechanisms for improving self-management, treatment adherence, and chronic disease outcomes, while family-centered interventions strengthen continuity of care and facilitate long-term rehabilitation success. Furthermore, advances in telehealth, artificial intelligence, digital rehabilitation platforms, and wearable technologies are transforming rehabilitation service delivery by expanding access to care, supporting personalized interventions, and enhancing patient engagement.

Despite these achievements, important challenges remain in translating evidence into routine clinical practice. Resource limitations, workforce shortages, disparities in access to rehabilitation services, and barriers to technology adoption continue to affect the quality and reach of rehabilitation care. Addressing these challenges will require strategic investments in rehabilitation infrastructure, workforce development, implementation science, and healthcare policies that support equitable and sustainable rehabilitation services.

Overall, the findings of this review underscore the critical contribution of rehabilitation nursing to contemporary healthcare systems. As populations continue to age and the burden of disability and chronic disease increases worldwide, rehabilitation nurses will play an increasingly important role in promoting recovery and maximizing functional outcomes. Future progress in the field will depend on the continued integration of scientific evidence, technological innovation, interdisciplinary collaboration, and patient-centered care approaches. By embracing these advances, rehabilitation nursing can further enhance its capacity to improve health outcomes, reduce disability burdens, and support individuals in achieving optimal levels of independence and quality of life.

5.0 References

Anisha, S. A., Sen, A., Ahmad, B., & Bain, C. (2025). Exploring acceptance of digital health technologies for managing non-communicable diseases among older adults: A systematic scoping review. *Journal of Medical Systems*, *49*(1), Article 35.

https://doi.org/10.1007/s10916-025-02166-3

Boltaboyeva, A., Baigarayeva, Z., Imanbek, B., Ozhikenov, K., Getahun, A. J., Aidarova, T., & Karymsakova, N. (2025). A Review of Innovative Medical Rehabilitation Systems with Scalable AI-Assisted Platforms for Sensor-Based Recovery Monitoring. *Applied Sciences*, *15*(12), 6840. https://doi.org/10.3390/app15126840

Engle, R. L., Mohr, D. C., Holmes, S. K., Seibert, M. N., Afable, M., Leyson, J., & Meterko, M. (2021). Evidence-based practice and patient-centered care: Doing both well. *Health Care Management Review*, *46*(3), 174–184. https://doi.org/10.1097/HMR.0000000000000254

Freitas, M. R. C., Faria, A. d. C. A., Gomes da Rocha, C., Gonçalves, M. N. d. C., & Ribeiro, O. M. P. L. (2025). Rehabilitation nursing care for older adults with impaired fine motor function: From design to validation. *Nursing Reports*, *16*(1), Article 8. https://doi.org/10.3390/nursrep16010008

Fu, Y., Zhu, L. J., Li, D. C., Yan, J. L., Zhang, H. T., Xuan, Y. H., Meng, C. L., & Sun, Y. H. (2022). Evidence-based intervention on postoperative fear, compliance, and self-efficacy in elderly patients with hip fracture. *World Journal of Clinical Cases*, *10*(10), 3069–3077. https://doi.org/10.12998/wjcc.v10.i10.3069

Karthi, R., Mary, J. J. G., Arul Valan, P., Tamilmozhi, T. D., Arthi, R., & Malathi, A. S. (2025). Advances in clinical practices: A cross-disciplinary review of nursing, pharmacy, and medical science contributions. *Cureus*, *17*(6), Article e86408. https://doi.org/10.7759/cureus.86408

Kumar, R., Sporn, K., Ong, J., Waisberg, E., Paladugu, P., Vaja, S., Hage, T., Sekhar, T. C., Vadhera, A. S., Ngo, A., Zaman, N., Tavakkoli, A., & Masalkhi, M. (2025). Integrating Artificial Intelligence in Orthopedic Care: Advancements in Bone Care and Future Direction. *Bioengineering*, *12*(5), 513. https://doi.org/10.3390/bioengineering12050513

Sujee, L., Hildebrandt, S., Harrison, A., Matjekane, C., Mmoledi, T., Pilusa, S., Sekome, K., & Ajidahun, A. T. (2025). The 'Bounce Back' rehabilitation programme for stroke survivors in South Africa - a case report. *South African Journal of Physiotherapy*, *81*(1), Article 2117. https://doi.org/10.4102/sajp.v81i1.2117

Montana-Rhodes, L., Oehlert, J. K., & Hill, K. (2024). Improving patient experience and team engagement with environmental services: Application of Watson's Theory of Human Caring. *Creative Nursing*, *30*(2), Article 10784535241291050. https://doi.org/10.1177/10784535241291050

Pliannuom, S., Pinyopornpanish, K., Buawangpong, N., Wiwatkunupakarn, N., Mallinson, P. A. C., Jiraporncharoen, W., & Angkurawaranon, C. (2024). Characteristics and effects of home-based digital health interventions one functional outcomes in older patients with hip fractures after surgery: Systematic review and meta-analysis. *Journal of Medical Internet Research*, *26*, Article e49482. https://doi.org/10.2196/49482

Roseen, E. J., Welch, S. A., Stout, N., Bean, J. F., Friedly, J. L., & Mittman, B. S. (2025). An introduction to implementation science in rehabilitation medicine. *PM&R, 17*(Suppl. 2), S6–S20. https://doi.org/10.1002/pmrj.70040

Ruksakulpiwat, S., Pongsuwun, K., Junphongsri, P., Preeprem, C., Nguantad, S., & Samart, B. (2025). Nurse-led interventions to improve health, adherence, and functional outcomes in adults and older adults with multimorbidity: A systematic review of randomized and quasi-experimental studies. *Journal of Nursing Management, 2025*, Article 6252049. https://doi.org/10.1155/jonm/625 2049

Aderinto, N., Olatunji, G., Kokori, E., Abraham, I. C., Ogieuhi, I. J., Ogunbowale, I., Esangbedo, I., Babalola, A. E., Moradeyo, A., Christopher, A. A., Awosan, W., Samuel, O., Napoleon, T., & Adeola, J. O. (2025). Disparities in post-stroke rehabilitation: An African perspective. *Discovery Public*

Health, *22*, Article 218. https://doi.org/10.1186/s12982-025-00622-6

Liu, Z., Zhang, J., He, K., Zhang, Y., & Zhang, Y. (2019). Optimized clinical practice for superaged patients with hip fracture: Significance of damage control and enhanced recovery program. *Burns & Trauma*, *7*, Article 21. https://doi.org/10.1186/s41038-019-0159-y

Madu, C. S., & Ajibade, V. M. (2025). Acute Stroke Management and Nursing Intervention. Cureus. 2025 Jun 26;17(6):e86820. doi: 10.7759/cureus.86820.

Mitchell, K. (2025). Optimizing postoperative nursing care in hip fracture patients: Strategies for enhanced recovery. *Journal of Trauma and Orthopedic Nursing*, *8*(1), Article 111. https://doi.org/10.36648/ipton.8.1.111

Nur, A., Kamal, A. F., Masfuri, M., & Pakasi, T. A. (2025). Self-management of lower extremity fracture patients: A concept analysis review. *Multidisciplinary Reviews*, *9*(4), 2026187. https://doi.org/10.31893 /multirev.2026187

Todhunter-Brown, A., Sellers, C., Gill, B., Choo, P.-L., Cowie, J., Cheyne, J., Langhorne, P., Brown, J., Morris, J., & Campbell, P. (2025). Physical rehabilitation approaches for the recovery of function and mobility following stroke. *Cochrane Database of Systematic Reviews*, (2), Article CD001920. https://doi.org/10.1002/14651858.CD001920.pub4

Yaacobi, E., Gur, S., Senderey, A. B., Kapner, B., Mushkat, T., Golan, G., Van-Stee, S. P., Farjun, T., & Ohana, N. (2025). Strengthening recovery: The impact of paired exercises in geriatric hip fracture rehabilitation—the PaLMe project. *European Geriatric Medicine*, *16*(3), 999–1011. https://doi.org/10.1007/s41999-025-01192-1

Declaration

Competing Statement: Financial Interests Statement:

There are no competing financial interests in this research work.

Ethical considerations

Not applicable

Data availability

The microcontroller source code and any other information can be obtained from the corresponding author via email.

Funding sources

The authors declared no source of funding

Authors' Contribution

All aspects of the work were carried out by the author