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From Surgical Stress to Healthy Aging: Effectiveness of a Nurse-Led Integrated Educational–Care Program on Physical Recovery, Functional Independence, and Psychological Resilience among Older Adults Undergoing Hip Fracture Surgery

Mona Hamdy Afify Abdeldayem[1], Hend Abo Elsoud Ahmed[2], Iman Abd-Elmoaty Mohamed[3], Shaza Salah Ghazy[4], Ghada Mahmoud Mohammed Nabhan[5], Manal Ahmed Mohamed Ismail[6], Hassanat Ramadan Abdel-Aziz[7], Eman Ali Metwaly Badr[8], Mohsen Mohamed Elsayed Zidan[9], Walaa El Shahat El Gammal[10]

[1]Arabian Gulf University, Manama, Bahrain, College of Medicine and Health Sciences, monahaa@agu.edu.bh
[2]Professor of Nursing Education, Faculty of Nursing, Damanhour University, Egypt; Nursing Department, North Private College of Nursing, Arar, Saudi Arabia, hindalsaidi@nec.edu.sa
[3]Fellow of Medical-Surgical Nursing, Technical Nursing Institute, Al-Azhar Specialized Hospital, Al Azhar University, Egypt, emanhendy405@yahoo.com, ORCID: 0009-0007-7419-4249
[4]Fellow of Psychiatric Mental Health Nursing, Technical Nursing Institute, Al-Azhar Specialized Hospital, Al-Azhar University, Egypt, ShazaGhazy.2062@azhar.edu.eg, ORCID: 0009-0000-5608-0968
[5]Lecturer in Medical Surgical Nursing, Faculty of Nursing, Cairo University, white_night_2010@yahoo.com, gada.nabhan@cu.edu.eg
[6]Lecturer, Psychiatric Nursing and Mental Health, Faculty of Nursing, Sohag University
[7]College of Nursing, Prince Sattam Bin Abdulaziz University, Al-Kharj 11942, Saudi Arabia; Gerontological Nursing Department, Faculty of Nursing, Zagazig University, Egypt, hrrahman85@yahoo.com, ORCID: 0000-0001-9162-772X
[8]Department of Nursing Sciences, College of Applied Medical Sciences, Shaqra University, Shaqra, Saudi Arabia; Department of Medical-Surgical Nursing, Faculty of Nursing, Zagazig University, Zagazig, Egypt, emanbadr@su.edu.sa, ORCID: 0000-0002-1508-744X
[9]Assistant Professor of Nursing, Nursing Department, University of Tabuk, Tabuk, Saudi Arabia; Lecturer of Gerontological Nursing, Faculty of Nursing, Zagazig University, Egypt, profmohsen5@gmail.com, ORCID: 0000-0002-2514-353X
[10]Assistant Professor of Medical Surgical Nursing, Faculty of Nursing, Damanhour University, Egypt; Associate Professor of Medical-Surgical Nursing, Buraydah College, Saudi Arabia, ORCID: 0009-0009-6637-9491

ABSTRACT: Background: Hip fracture surgery in older adults is frequently followed by delayed physical recovery, impaired functional independence, and psychological distress,

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which may hinder healthy aging. Nurse-led integrated educational–care programs may provide a comprehensive approach to supporting postoperative recovery and resilience. Aim: To evaluate the effectiveness of a nurse-led integrated educational care program on physical recovery, functional independence, and psychological resilience among older adults undergoing hip fracture surgery.

Subjects and Method: A quasi-experimental one-group pretest-posttest design was used. A purposive sample of 100 older adults undergoing hip fracture surgery was recruited from the orthopedic and surgical units at Sohag university hospitals. Data were collected using a structured patient assessment tool, a physical recovery assessment scale, the Barthel Index of Activities of Daily Living to assess functional independence, and a psychological resilience scale.

Results: Overall satisfactory physical recovery increased substantially from 22.0% pre-intervention to 83.0% post-intervention. The total Barthel Index mean score increased from 51.0 ± 15.8 before the intervention to 78.2 ± 13.4 after the intervention. The overall mean BRS score increased from 2.58 ± 0.51 before the intervention to 3.93 ± 0.46 after the intervention. Following implementation of the nurse-led integrated educational–care program, the studied older adults demonstrated marked improvement in physical recovery, functional independence, and psychological resilience compared with their pre-intervention levels. The proportion of participants achieving satisfactory physical recovery and higher levels of functional independence increased substantially after the intervention, accompanied by a significant reduction in postoperative limitations and dependency. Psychological resilience also improved significantly, with fewer participants demonstrating low resilience and more achieving moderate-to-high resilience levels. Overall, the observed pre–post changes were statistically significant ($p < 0.001$).

Conclusion: The nurse-led integrated educational–care program was effective in enhancing physical recovery, promoting functional independence, and strengthening psychological resilience among older adults following hip fracture surgery. Recommendations: Integrating structured nurse-led educational and rehabilitative care into routine postoperative management of older adults undergoing hip fracture surgery is recommended, with continued follow-up after discharge to reinforce functional recovery, self-care, and psychological adaptation.

INTRODUCTION

Hip fracture is one of the most serious health challenges affecting older adults and represents a major cause of disability, loss of independence, hospitalization, and mortality. The consequences extend beyond the fracture itself, as older patients frequently experience reduced mobility, impaired activities of daily living, pain, fear of falling, and psychological distress during the postoperative period. With the increasing aging population worldwide, the burden associated with hip fractures is expected to continue rising, making effective postoperative recovery strategies an important priority for gerontological and orthopedic nursing practice **(The Lancet Healthy Longevity, 2024).**

Hip fracture surgery is generally performed to restore mobility, relieve pain, stabilize the fracture, and reduce complications associated with prolonged immobility. However, surgical treatment alone does not guarantee satisfactory recovery. Older adults may experience postoperative complications such as delirium, infection, thromboembolism, pressure injuries, muscle weakness, and functional decline. Moreover, pre-existing frailty, multimorbidity, nutritional deficiencies, and cognitive or psychological vulnerability may further compromise recovery and prolong dependence on caregivers (National Institute for Health and Care Excellence **)Phang et al., 2023).**

Physical recovery following hip fracture surgery is a multidimensional process that includes pain control, restoration of muscle strength, progressive mobilization, balance improvement, and the ability to safely perform daily activities. Early and individualized rehabilitation is therefore essential for minimizing functional decline and facilitating a return to pre-fracture levels

of activity. Evidence indicates that coordinated multidisciplinary rehabilitation, particularly when initiated early after surgery, can improve mobility and functional outcomes in older adults with hip fracture **(Koudouna et al., 2023).**

Functional independence is another critical indicator of successful recovery after hip fracture. Dependence in activities such as bathing, dressing, toileting, transferring, and walking may persist even after the fracture has healed. Loss of independence can negatively affect quality of life and increase caregiver burden, institutionalization, and healthcare utilization. Consequently, nursing interventions should not be limited to physical healing but should also promote patients' ability to regain autonomy and participate actively in their daily lives **(Prestmo et al., 2023).**

Psychological recovery is equally important because hip fracture may represent a traumatic event for older adults and may be accompanied by fear of falling, anxiety, depressive symptoms, reduced confidence, and fear of losing independence. These psychological responses can interfere with participation in rehabilitation and may contribute to prolonged functional disability. Psychological resilience the ability to adapt positively to adversity and maintain or regain psychological functioning has therefore become an important component of healthy aging and postoperative recovery **(Taylor et al., 2024).**

Nurses have a central role in the recovery of older adults after hip fracture surgery because they provide continuous patient assessment, symptom management, mobility support, education, self-care assistance, complication prevention, and psychological support. Nurse-led interventions can also improve patients' knowledge and engagement in their recovery by providing individualized education about pain management, wound care, medication adherence, nutrition, exercise, safe mobility, fall prevention, and discharge planning. Integrating these components into a coordinated educational–care program may address the physical, functional, and psychological dimensions of recovery simultaneously **(Handoll et al., 2021).**

The concept of healthy aging extends beyond the absence of disease and emphasizes maintaining functional ability that enables older people to live independently and participate meaningfully in their communities. From this perspective, postoperative hip fracture care should move from a purely surgical model toward an integrated model that combines physical rehabilitation, functional training, patient education, self-management, and psychological support. Such an approach is consistent with the World Health Organization's emphasis on maintaining intrinsic capacity and functional ability among older adults **(Menassa et al., 2023).**

Accordingly, a nurse-led integrated educational–care program may represent a practical strategy for bridging the gap between surgical treatment and healthy aging. By combining structured education with individualized postoperative care, progressive mobilization, functional training, complication prevention, discharge preparation, and psychological support, nurses can contribute substantially to restoring independence and strengthening patients' ability to cope with the consequences of hip fracture. Therefore, the present study was conducted to evaluate the effectiveness of a nurse-led integrated educational–care program on physical recovery, functional independence, and psychological resilience among older adults undergoing hip fracture surgery **(Azzellino et al., 2026).**

The nurse plays a pivotal role in the recovery of older adults undergoing hip fracture surgery by providing continuous, holistic, and individualized care throughout the perioperative and rehabilitation periods. Nurses assess pain, vital signs, wound condition, mobility, nutritional status, and functional ability; administer prescribed medications; prevent postoperative complications such as pressure injuries, infection, constipation, venous thromboembolism, and falls; and encourage early, progressive mobilization in collaboration with the multidisciplinary team. In addition, nurses provide individualized education regarding wound care, medication adherence, nutrition, safe transfers, use of assistive devices, exercises, fall prevention, and activities of daily living. Psychological support is also an essential nursing responsibility, including active listening, reassurance, motivation, anxiety reduction, and encouragement of patient participation in rehabilitation. Through discharge planning and follow-up education, nurses help patients and caregivers continue appropriate self-care at home, thereby promoting functional independence, psychological resilience, and healthy aging after hip fracture surgery **(Xie et al., 2025; Mohammed et al., 2023).**

Significance of the Study

Hip fracture is a major health problem among older adults because it can lead to prolonged hospitalization, postoperative complications, impaired mobility, loss of functional independence, psychological distress, and increased dependence on family caregivers. Although surgical treatment is essential for fracture stabilization, successful recovery requires comprehensive postoperative nursing care that addresses physical, functional, educational, and psychological needs. Older adults may

experience difficulty returning to their previous level of independence, making rehabilitation and supportive nursing interventions important components of recovery and healthy aging **(Andaloro et al., 2025).**

A nurse-led integrated educational care program can provide a structured approach that combines postoperative care, health education, progressive mobilization, functional training, complication prevention, self-care guidance, and psychological support. Such an approach may enhance patients' participation in rehabilitation, improve their ability to perform activities of daily living, strengthen coping and resilience, and facilitate a safer transition from hospital to home. Therefore, evaluating the effectiveness of this program may provide useful evidence for strengthening the role of nurses in the multidisciplinary management of older adults following hip fracture surgery.

Aim of the Study

The aim of this study is to evaluate the effectiveness of a nurse-led integrated educational care program on physical recovery, functional independence, and psychological resilience among older adults undergoing hip fracture surgery.

Research Hypotheses

H1: Older adults who receive the nurse-led integrated educational–care program will demonstrate significantly better physical recovery after the intervention compared with their pre-intervention levels.

H2: Older adults who receive the nurse-led integrated educational–care program will demonstrate significantly higher levels of functional independence after the intervention compared with their pre-intervention levels.

H3: Older adults who receive the nurse-led integrated educational–care program will demonstrate significantly higher levels of psychological resilience after the intervention compared with their pre-intervention levels.

H4: There will be a significant positive relationship between physical recovery and functional independence among older adults following implementation of the nurse-led integrated educational–care program.

H5: There will be a significant positive relationship between functional independence and psychological resilience among older adults following implementation of the nurse-led integrated educational–care program.

Subjects and Methods

Research Design

A quasi-experimental one-group pretest–posttest design was used.

Research Setting

The study was conducted in the Orthopedic Department and associated surgical units at Sohag University Hospitals, Sohag Governorate, Egypt, where older adults undergoing surgical management of hip fractures receive preoperative, postoperative, and rehabilitation care.

Subjects

A purposive sample of older adults undergoing hip fracture surgery was recruited from the Orthopedic Department and associated surgical units of Sohag University Hospitals, Sohag Governorate, Egypt, between June 2025 and November 2025. **The inclusion criteria** were as follows: participants were eligible if they were aged 60 years or older, had a confirmed hip fracture requiring surgical intervention, and had undergone hip fracture surgery during the study period; were medically stable and able to participate in the educational and rehabilitation activities; were able to communicate verbally and understand the instructions provided; and agreed to participate and provided written informed consent. **The exclusion criteria** were as follows: participants were excluded if they had severe cognitive impairment that prevented informed consent or participation, severe psychiatric or neurological disorders interfering with assessment or rehabilitation, pathological fractures associated with malignancy, severe medical instability requiring intensive care, or a pre-existing condition resulting in complete dependence in activities of daily living before the fracture.

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Sample Size Calculation

The sample size was determined using a power analysis for the paired-samples t-test, which is the primary inferential test for comparing pre- and post-intervention mean scores on the continuous outcome measures (Physical Recovery Assessment Scale, Barthel Index, and Brief Resilience Scale) within a one-group pretest–posttest design. The following formula was used:

$$n=\frac{Z^2P(1-P)}{d^2}$$

- **n** = required sample size
- **Z** = standard normal deviate at 95% confidence level = **1.96**
- **P** = expected proportion of the outcome = **0.50**, when no reliable previous estimate is available
- **d** = margin of error = **0.10**

Thus, a minimum of 32 participants was required. To account for possible attrition, incomplete follow-up, and to enhance the precision of the estimates and the statistical power of the secondary correlational analyses, the sample was increased to 100 older adults. This sample size provided a statistical power exceeding 0.95 for detecting a medium effect and allowed adequate power for the correlation analyses (H4 and H5). The calculation was verified using G*Power software (version 3.1), with the test family "t tests" and the statistical test "Means: Difference between two dependent means (matched pairs)."

Data Collection Tools:

Tool I: Structured Older Adult Assessment Questionnaire

A structured questionnaire was developed by the researcher after reviewing relevant literature concerning hip fracture **(Xie et al., 2025; Mohammed et al., 2023)**, postoperative recovery, gerontological nursing, and rehabilitation of older adults. It consisted of two parts.

Part I covered sociodemographic characteristics, including age, sex, marital status, educational level, previous occupation, and residence.

Part II assessed clinical characteristics, including type of hip fracture, operative procedure, presence of chronic diseases, number of chronic diseases, and previous history of falls or fractures.

Tool II: Physical Recovery Assessment Scale

A Physical Recovery Assessment Scale was developed by the researcher based on the literature and clinical recommendations related to postoperative recovery and rehabilitation following hip fracture surgery. The scale was designed to assess the patient's overall physical recovery and consisted of eight domains covering pain control, wound and surgical recovery, mobility, muscle strength and physical activity, balance and safety, postoperative complications, nutrition and general physical status, and overall physical recovery. Pain control included the presence and severity of pain, pain during rest and movement, and response to analgesics. Wound recovery included wound condition, redness, swelling, discharge, infection, and healing progression. Mobility assessed changing position in bed, sitting, standing, transfers, assisted walking, use of assistive devices, and progression toward independent ambulation. Muscle strength and physical activity included lower-limb strength, performance of prescribed exercises, activity tolerance, and participation in rehabilitation. Balance and safety included sitting and standing balance, safe transfers, walking stability, and adherence to fall-prevention measures. Postoperative complications included pressure injuries, surgical-site infection, manifestations of venous thromboembolism, respiratory complications, constipation, urinary complications, and delirium. Nutritional and general physical status included appetite, food and fluid intake, energy level, sleep, and rest. Scoring: Each item was scored as 2 = good/achieved, 1 = partially achieved, and 0 = not achieved/poor. The total score was converted into a percentage using: Obtained score / Maximum possible score × 100. The total percentage was categorized as poor recovery (<60%), moderate recovery (60–<75%), and good recovery (≥75%), with higher scores indicating better physical recovery. The domains were based on established recommendations emphasizing pain management, early mobilization, physical function, complication prevention, and rehabilitation after hip fracture **(McDonough et al., 2021).**

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Tool III: Barthel Index of Activities of Daily Living

The Barthel Index (BI) developed by **Mahoney and Barthel (1965)** was used to assess the degree of functional independence of the studied older adults in performing basic activities of daily living. The index evaluates 10 activities, namely feeding, bathing, grooming, dressing, bowel control, bladder control, toilet use, transfers from bed to chair, mobility/walking on a level surface, and stair climbing. Each activity is scored according to the degree of assistance required, with individual item scores ranging from 0 to 5, 10, or 15 points depending on the activity. The total score ranges from 0 to 100, where higher scores indicate greater functional independence and lower scores indicate greater dependence. Scoring: For interpretation in the present study, a total score of 0–20 indicated total dependence, 21–60 severe dependence, 61–90 moderate dependence, 91–99 slight dependence, and 100 complete independence. The Barthel Index is widely used in rehabilitation and gerontological settings to assess changes in functional ability among older adults.

Tool IV: Brief Resilience Scale

The Brief Resilience Scale (BRS) developed by Smith et al. (2008) was used to assess the psychological resilience of the studied older adults, particularly their perceived ability to recover or "bounce back" following stressful or difficult experiences. The scale consists of six items, including statements assessing the ability to recover quickly after difficult or stressful events and statements assessing difficulty recovering from adverse experiences. Items 2, 4, and 6 are negatively worded and were reverse-scored. Each item was rated using a five-point Likert scale, ranging from 1 = strongly disagree to 5 = strongly agree for positively worded items, while negatively worded items were reverse coded from 5 to 1. The total score ranges from 6 to 30, and the mean score is calculated by dividing the total score by six, resulting in a final score ranging from 1.00 to 5.00. Scoring: A mean score of 1.00–2.99 indicated low resilience, 3.00–4.30 indicated normal/moderate resilience, and 4.31–5.00 indicated high resilience, with higher scores representing greater psychological resilience. The BRS was selected because it specifically measures the ability to recover from stress, which is highly relevant to older adults coping with the physical and psychological consequences of hip fracture surgery **(Smith et al., 2008).**

Validity

The content validity of the study tools was assessed by a panel of five experts in Medical-Surgical Nursing, Gerontological Nursing, and Psychiatric/Mental Health Nursing. The experts reviewed the tools for clarity, relevance, comprehensiveness, appropriateness of wording, and suitability for older adults undergoing hip fracture surgery. Their suggestions were considered, and necessary modifications were made before the final version of the tools was prepared. For the researcher-developed Structured Older Adult Assessment Questionnaire and Physical Recovery Assessment Scale, content validity was particularly emphasized to ensure adequate coverage of the study variables. The standardized Barthel Index and Brief Resilience Scale were used in their established forms, with appropriate adaptation of wording when required to suit the study population without altering their essential scoring structure.

Reliability

The reliability of the study tools was **assess**ed to determine their internal consistency and stability before implementation of the main study. Cronbach's alpha coefficient was used for the multi-item scales, particularly the researcher-developed Physical Recovery Assessment Scale and the Brief Resilience Scale. The internal consistency and stability of the study tools were assessed before the main data collection. Cronbach's alpha was used for the multi-item scales, and test–retest reliability (ICC) was examined in the pilot sample (n = 10) over a 7–10-day interval. The Physical Recovery Assessment Scale demonstrated good internal consistency (Cronbach's $\alpha = 0.86$; domain-level $\alpha = 0.74$–0.89) and excellent test–retest stability (ICC = 0.91; 95% CI: 0.78–0.96). The Barthel Index of Activities of Daily Living showed high internal consistency (Cronbach's $\alpha = 0.89$) and excellent test–retest reliability (ICC = 0.95; 95% CI: 0.86–0.98), consistent with its established psychometric properties in geriatric and rehabilitation populations. The Brief Resilience Scale demonstrated acceptable internal consistency (Cronbach's $\alpha = 0.81$) and good test–retest stability (ICC = 0.88; 95% CI: 0.72–0.94). All coefficients exceeded the predetermined acceptability threshold of 0.70, indicating that the tools were reliable for measuring physical recovery, functional independence, and psychological resilience in the studied population. The obtained coefficients were considered acceptable when they reached 0.70, indicating satisfactory internal consistency. The Barthel Index was used as an established functional assessment instrument with documented reliability and validity in older adults and rehabilitation populations. Reliability testing was conducted to ensure that the tools could consistently measure physical recovery, functional independence, and psychological resilience.

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Pilot Study

A pilot study was conducted on 10% of the calculated sample (10 older adults) who fulfilled the same inclusion and exclusion criteria as the main study participants. The purpose of the pilot study was to evaluate the clarity, simplicity, sequence, applicability, and feasibility of the study tools, as well as to estimate the time required to complete each tool and identify any practical difficulties during data collection. The pilot participants were also observed during implementation of the educational–care activities to determine whether the instructions and procedures were appropriate for older adults after hip fracture surgery. Necessary modifications were made according to the pilot findings. The participants involved in the pilot study were excluded from the main study sample to prevent possible contamination or duplication of data.

Ethical Considerations

The study was conducted after obtaining approval from the responsible scientific and ethical authorities (No=168/2024) and the relevant hospital administration. Before enrollment, each eligible older adult was informed about the purpose, procedures, expected benefits, and any potential inconvenience associated with participation. Written informed consent was obtained from each participant before data collection. Participants were informed that participation was voluntary and that they had the right to refuse participation or withdraw from the study at any time without affecting the quality of their medical or nursing care. Confidentiality and privacy were maintained throughout the study by coding participants' data rather than using names and by restricting access to the collected information to the research team. The intervention was designed to complement, rather than replace, the medical and rehabilitation care prescribed by the treating team. Participants were also informed that the collected information would be used only for scientific research purposes.

Data Collection Procedure

Data collection was carried out through four sequential phases: assessment, planning, implementation, and evaluation from June /2025 to November/ 2025. The researcher attended the orthopedic/surgical units regularly during the study period and recruited older adults who met the predetermined eligibility criteria. Each participant was interviewed individually in a quiet setting, and the study purpose and procedures were explained before obtaining written informed consent. Baseline assessment was conducted using the study tools to identify the participants' sociodemographic and clinical characteristics, physical recovery status, functional independence, and psychological resilience. The findings of the initial assessment were used to identify individual needs and guide implementation of the nurse-led integrated educational–care program. Following completion of the intervention, the same outcome measures were reapplied to determine changes in physical recovery, functional independence, and psychological resilience.

PHASES OF THE NURSE-LED INTEGRATED EDUCATIONAL-CARE PROGRAM

The program was implemented through four main phases: preparation and assessment, educational–care implementation, rehabilitation and psychological support, and evaluation/follow-up. The program was individualized according to the patient's age, clinical condition, surgical procedure, functional capacity, learning needs, and ability to participate.

Phase I: Preparation and Initial Assessment

During this phase, the researcher established rapport with the older adult and caregiver and assessed the participant's baseline condition. The researcher collected information regarding sociodemographic characteristics, fracture and surgical history, comorbidities, pre-fracture mobility, pain, postoperative condition, functional independence, and psychological resilience. The participant and caregiver were then introduced to the objectives of the program and the expected role of the patient in recovery. An individualized care and education plan was prepared according to the identified needs.

Phase II: Integrated Educational-Care Implementation

The second phase focused on providing structured education combined with direct nursing care. Participants received education about the nature of hip fracture, postoperative recovery, pain management, medication adherence, wound care, nutrition, hydration, sleep, prevention of complications, and the importance of early progressive mobilization. The researcher used simple verbal explanations, demonstrations, illustrated educational materials, and return demonstrations to reinforce learning. Family caregivers were involved when appropriate to support continuity of care.

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Phase III: Functional Rehabilitation and Psychological Support

This phase emphasized progressive restoration of physical function and independence. Participants were encouraged to perform appropriate bed exercises, positioning, sitting, standing, safe transfer techniques, progressive ambulation, and activities of daily living according to their clinical status and prescribed rehabilitation plan. Education regarding fall prevention, safe use of assistive devices, environmental modification, and energy conservation was provided. Psychological support included active listening, reassurance, encouragement, anxiety reduction, positive reinforcement, coping strategies, and motivation to participate actively in rehabilitation. The nurse continuously monitored the participant's response and coordinated with the medical and rehabilitation team whenever necessary.

SESSIONS OF THE NURSE-LED INTEGRATED EDUCATIONAL-CARE PROGRAM

The program consisted of 8 structured sessions delivered over approximately 4 weeks, according to the patient's hospitalization and follow-up schedule. Each session lasted approximately 30–45 minutes, with additional practical time when demonstrations or exercises were required. Sessions were delivered individually or with the caregiver when appropriate.

Session	Main content	Methods
Session 1: Orientation and Assessment	Introduction, rapport building, baseline assessment, explanation of hip fracture recovery and program objectives	Interview, discussion, assessment
Session 2: Postoperative Care and Pain Management	Pain assessment, prescribed analgesics, positioning, wound care, medication adherence, warning signs of complications	Explanation, demonstration, discussion
Session 3: Nutrition and Healthy Recovery	Balanced diet, protein-rich foods, calcium/vitamin D sources, hydration, constipation prevention, sleep and rest	Education, illustrated materials, discussion
Session 4: Early Mobilization and Exercise	Bed mobility, ankle exercises, quadriceps exercises, sitting, standing, progressive activity according to clinical condition	Demonstration and return demonstration
Session 5: Safe Mobility and Fall Prevention	Safe transfers, walking with assistive devices, balance and environmental safety, prevention of recurrent falls	Demonstration, supervised practice
Session 6: Functional Independence	Dressing, bathing, toileting, grooming, feeding, energy conservation, adapting daily activities to physical limitations	Demonstration, practice, reinforcement
Session 7: Psychological Resilience and Coping	Fear of falling, anxiety, emotional adjustment, positive coping, motivation, relaxation, social/family support	Counseling, active listening, discussion
Session 8: Home Care, Caregiver Education, and Reinforcement	Home exercise, medication and wound care, nutrition, safety, follow-up, warning signs, caregiver role, review of all previous content	Review, return demonstration, question-and-answer

Session 1: Orientation and Assessment

The first session established a therapeutic relationship between the nurse and the older adult. The researcher explained the purpose of the program, assessed the participant's baseline physical and psychological condition, and identified individual learning and care needs. The importance of active participation was emphasized.

Session 2: Postoperative Care and Pain Management

The participant was educated about postoperative pain, prescribed analgesics, correct positioning, wound care, medication adherence, and signs requiring immediate medical attention. The nurse demonstrated appropriate positioning and reinforced the importance of reporting uncontrolled pain or changes in the surgical wound.

Session 3: Nutrition and Healthy Recovery

Education focused on adequate protein and energy intake, calcium- and vitamin-D-containing foods, sufficient hydration, prevention of constipation, and the importance of adequate sleep and rest. The nurse discussed practical dietary choices appropriate for the older adult's medical condition.

Session 4: Early Mobilization and Exercise

The nurse demonstrated safe postoperative exercises and progressive mobility activities, including ankle pumping, lower-limb exercises, bed mobility, sitting, and standing. Activities were performed according to the patient's medical condition and prescribed rehabilitation recommendations. Return demonstration was used to ensure correct performance.

Session 5: Safe Mobility and Fall Prevention

This session focused on preventing falls and improving confidence during mobility. Participants were trained in safe transfers, appropriate use of walkers or other prescribed assistive devices, and safe walking techniques. Environmental hazards such as loose rugs, poor lighting, and obstacles were discussed.

Session 6: Functional Independence

The nurse trained participants to gradually resume activities of daily living, including feeding, grooming, dressing, toileting, bathing, transfers, and mobility. The principle of **"maximum safe independence"** was emphasized, encouraging patients to perform activities themselves whenever clinically possible rather than becoming unnecessarily dependent on caregivers.

Session 7: Psychological Resilience and Coping

The nurse addressed common psychological challenges after hip fracture, including fear, anxiety, frustration, dependence, and fear of falling again. Participants were encouraged to express their concerns and were supported through active listening, reassurance, positive reinforcement, simple relaxation techniques, problem-solving, and encouragement to maintain social and family support.

Session 8: Home Care and Reinforcement

The final session consolidated all previously discussed information. The nurse reviewed medications, wound care, exercises, mobility, fall prevention, nutrition, activities of daily living, psychological coping, and follow-up recommendations. The caregiver was educated regarding appropriate assistance while avoiding unnecessary dependence. Return demonstration and questions were used to evaluate the participant's understanding and readiness for continued recovery at home.

Educational Methods and Materials

The program used individualized teaching, group discussion when appropriate, demonstration, return demonstration, counseling, positive reinforcement, and question-and-answer techniques. Educational materials included an illustrated booklet/handout containing information about postoperative care, exercises, nutrition, medication adherence, fall prevention, activities of daily living, psychological coping, and home-care instructions. The program emphasized the integration of education with nursing care and functional rehabilitation, rather than providing education alone. This integrated approach was intended to improve physical recovery while simultaneously promoting independence and psychological resilience.

Phase IV: Evaluation and Follow-Up

At the end of the intervention, participants were reassessed using the same study tools used during the baseline assessment. Physical recovery, functional independence, and psychological resilience were compared with pre-intervention findings. Participants and caregivers were also encouraged to continue the recommended exercises, safety measures, nutritional practices, medication adherence, and psychological coping strategies after discharge. Follow-up contact was used to reinforce education, identify difficulties, and encourage continued adherence to the recovery plan.

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Statistical Analysis

The collected data were coded, tabulated, and statistically analyzed using the Statistical Package for the Social Sciences (SPSS), version 26. Data were first checked for completeness, accuracy, and consistency before analysis. Descriptive statistics were used to summarize the characteristics of the studied older adults and the study variables. Frequencies and percentages were used to describe qualitative variables, while means, standard deviations, medians, and ranges were used to summarize quantitative variables according to the nature and distribution of the data. For comparison of the studied participants' physical recovery, functional independence, and psychological resilience before and after implementation of the nurse-led integrated educational–care program, the appropriate paired statistical test was used. For normally distributed quantitative variables, the paired-samples t-test was applied to compare pre- and post-intervention mean scores. For categorical variables measured before and after the intervention. The relationships between the major study outcomes were examined using the Pearson correlation coefficient (r) when the variables were normally distributed and the assumptions of parametric correlation were met. Correlations were used particularly to determine the relationship between physical recovery, functional independence, and psychological resilience. Where appropriate, correlation coefficients.

RESULTS:

Table (1): Distribution of the Studied Older Adults According to Their Sociodemographic Characteristics (N=100)

Sociodemographic characteristics	No.	%
Age (years)		
60–<70	38	38.0
70–<80	42	42.0
≥80	20	20.0
Mean ± SD	71.8 ± 8.1	
Sex		
Male	44	44.0
Female	56	56.0
Marital status		
Married	58	58.0
Widowed	34	34.0
Single/Divorced	8	8.0
Educational level		
Illiterate	46	46.0
Basic education	28	28.0
Secondary education	18	18.0
University education	8	8.0
Residence		

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Sociodemographic characteristics	No.	%
Rural	63	63.0
Urban	37	37.0
Occupation before retirement		
Manual worker/farmer	38	38.0
Housewife	35	35.0
Government/private employee	17	17.0
Other	10	10.0

Table (1) demonstrates that 42.0% of the studied older adults were aged 70–<80 years, with a mean age of 71.8 ± 8.1 years. Females constituted 56.0% of the sample compared with 44.0% males. More than half of the participants (58.0%) were married, while 34.0% were widowed. Regarding educational level, 46.0% were illiterate and only 8.0% had university education. Nearly two-thirds of the studied older adults (63.0%) lived in rural areas. Concerning previous occupation, 38.0% were manual workers/farmers and 35.0% were housewives.

Table (2): Distribution of the Studied Older Adults According to Their Clinical and Health Characteristics (N=100)

Clinical and health characteristics	No.	%
Type of hip fracture		
Femoral neck fracture	42	42.0
Intertrochanteric fracture	38	38.0
Subtrochanteric fracture	20	20.0
Operative procedure		
Internal fixation	47	47.0
Hemiarthroplasty	38	38.0
Total hip replacement	15	15.0
Presence of chronic diseases		
Hypertension	54	54.0
Diabetes mellitus	41	41.0
Cardiovascular disease	28	28.0
Osteoporosis	37	37.0
Chronic respiratory disease	16	16.0
Number of chronic diseases		

Clinical and health characteristics	No.	%
None	18	18.0
One	37	37.0
Two or more	45	45.0
Previous history of falls		
Yes	43	43.0
No	57	57.0

Table (2) shows that femoral neck fracture was the most common fracture type (42.0%), followed by intertrochanteric fracture (38.0%). Internal fixation was performed for 47.0% of the participants, whereas 38.0% underwent hemiarthroplasty. Hypertension was the most frequently reported chronic disease (54.0%), followed by diabetes mellitus (41.0%) and osteoporosis (37.0%). Nearly half of the participants (45.0%) had two or more chronic diseases, reflecting the high burden of comorbidity among older adults undergoing hip fracture surgery. Furthermore, 43.0% had a previous history of falls.

Table (3): Distribution of the Studied Older Adults According to Their Pre-Fracture Functional Status (N=100)

Pre-fracture functional status	No.	%
Independent	61	61.0
Partially dependent	28	28.0
Dependent	11	11.0

Table (3) indicates that nearly two-thirds of the studied older adults (61.0%) were independent in their usual daily activities before the hip fracture, while 28.0% were partially dependent and 11.0% were dependent.

Table (4): Distribution of the Studied Older Adults According to Their Physical Recovery Domains Before and After the Nurse-Led Integrated Educational–Care Program (N=100)

Physical recovery domains	Pre-intervention No. (%)	Post-intervention No. (%)	McNemar–Bowker test	p-value
Adequate pain control	31 (31.0)	82 (82.0)	47.41	<0.001
Satisfactory wound/surgical recovery	39 (39.0)	88 (88.0)	49.00	<0.001
Adequate mobility	24 (24.0)	79 (79.0)	46.42	<0.001
Improved muscle strength/physical activity	28 (28.0)	76 (76.0)	38.40	<0.001
Adequate balance and safety	26 (26.0)	81 (81.0)	43.78	<0.001
Absence/reduction of postoperative complications	42 (42.0)	86 (86.0)	38.22	<0.001
Adequate nutritional/general physical status	35 (35.0)	84 (84.0)	43.11	<0.001

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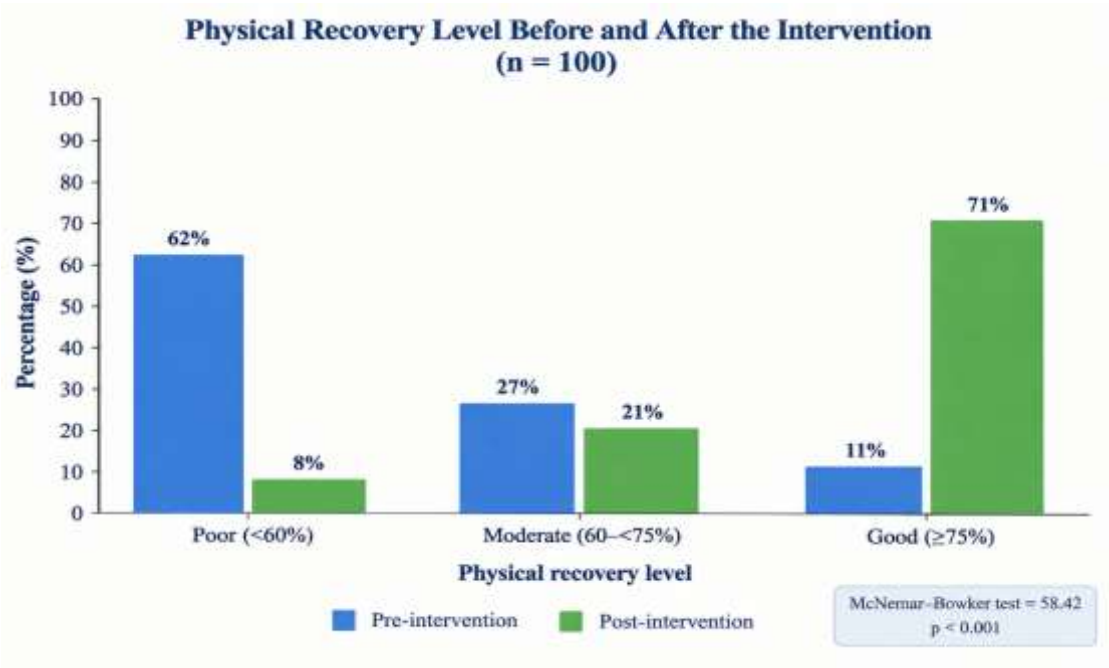
Physical recovery domains	Pre-intervention No. (%)	Post-intervention No. (%)	McNemar–Bowker test	p-value
Overall satisfactory physical recovery	22 (22.0)	83 (83.0)	52.17	<0.001

Note: *p < 0.001 = highly statistically significant.*

Table (4) reveals a marked improvement across all domains of physical recovery following implementation of the nurse-led integrated educational–care program. The proportion of older adults achieving adequate pain control increased from 31.0% before the intervention to 82.0% after the intervention. Similarly, satisfactory wound/surgical recovery increased from 39.0% to 88.0%, while adequate mobility increased from 24.0% to 79.0%. Improvements were also observed in muscle strength and physical activity (28.0% versus 76.0%), balance and safety (26.0% versus 81.0%), and nutritional/general physical status (35.0% versus 84.0%). Overall satisfactory physical recovery increased substantially from 22.0% pre-intervention to 83.0% post-intervention. All observed improvements were statistically highly significant (**p < 0.001**).



Note: *p < 0.001 = highly statistically significant.*

Figure (1): Distribution of the Studied Older Adults According to Their Overall Physical Recovery Level Before and After the Intervention (N=100)

Figure (1) demonstrates a substantial shift in physical recovery levels following the intervention. Before implementation, most participants (62.0%) had poor physical recovery, compared with only 11.0% who demonstrated good recovery. Following the intervention, the proportion with poor recovery decreased markedly to 8.0%, while those achieving a good recovery level increased to 71.0%. The observed change was highly statistically significant (**McNemar–Bowker = 58.42, p < 0.001**).

Table (5): Mean Scores of the Studied Older Adults on the Barthel Index of Activities of Daily Living Before and After the Intervention (N=100)

Barthel Index domains	Pre-intervention Mean ± SD	Post-intervention Mean ± SD	Paired t-test	p-value
Feeding	7.1 ± 2.9	9.0 ± 1.8	8.31	<0.001
Bathing	2.8 ± 1.4	4.8 ± 0.7	12.67	<0.001

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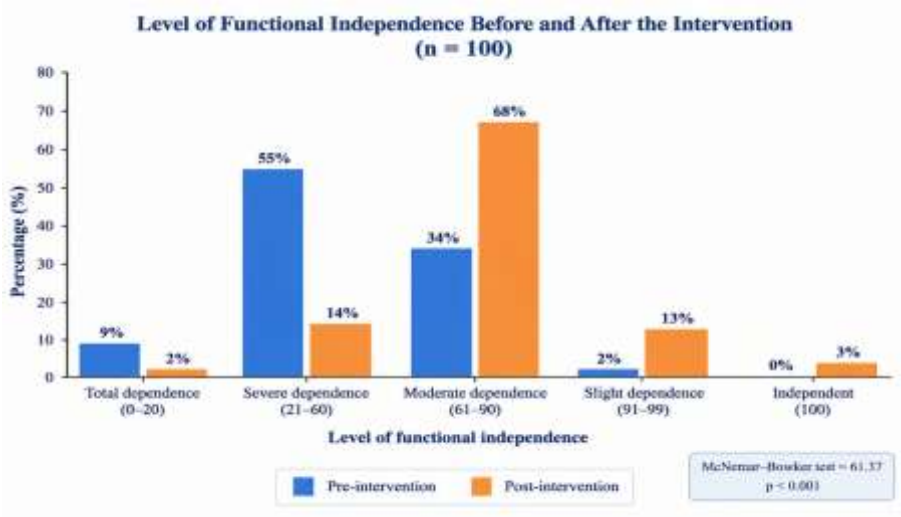
Barthel Index domains	Pre-intervention Mean ± SD	Post-intervention Mean ± SD	Paired t-test	p-value
Grooming	3.1 ± 1.5	4.5 ± 0.9	8.52	<0.001
Dressing	5.2 ± 2.1	7.6 ± 1.8	9.03	<0.001
Bowel control	7.5 ± 2.4	9.1 ± 1.5	6.84	<0.001
Bladder control	7.0 ± 2.7	9.0 ± 1.6	7.72	<0.001
Toilet use	4.4 ± 2.3	7.0 ± 2.1	8.32	<0.001
Transfers	6.0 ± 3.0	12.2 ± 2.7	15.26	<0.001
Mobility	5.8 ± 3.1	13.0 ± 2.9	17.14	<0.001
Stairs	2.1 ± 1.7	6.0 ± 2.0	15.01	<0.001
Total Barthel Index	51.0 ± 15.8	78.2 ± 13.4	18.47	<0.001

Note: *$p < 0.001$ = highly statistically significant.*

Table (5) shows a significant improvement in all components of functional independence after implementation of the intervention. The total Barthel Index mean score increased from **51.0 ± 15.8** before the intervention to **78.2 ± 13.4** after the intervention, with a highly significant paired t-test value (**t = 18.47, p < 0.001**). The greatest improvements were observed in mobility, transfers, and stair climbing, which are particularly important functional domains following hip fracture surgery. Improvements were also evident in self-care activities including feeding, bathing, grooming, dressing, and toilet use.



Note: *$p < 0.001$ = highly statistically significant.*

Figure (2): Distribution of the Studied Older Adults According to Their Level of Functional Independence Based on the Barthel Index Before and After the Intervention (N=100)

Figure (2): demonstrates a pronounced improvement in functional independence following the intervention. Before the intervention, 55.0% of participants demonstrated severe dependence and 9.0% had total dependence. After the intervention, severe dependence decreased to 14.0% and total dependence decreased to only 2.0%. At the same time, moderate independence increased from 34.0% to 68.0%, while slight dependence increased from 2.0% to 13.0% and complete independence emerged in 3.0% of participants. The overall change was highly statistically significant (**61.37, p < 0.001**).

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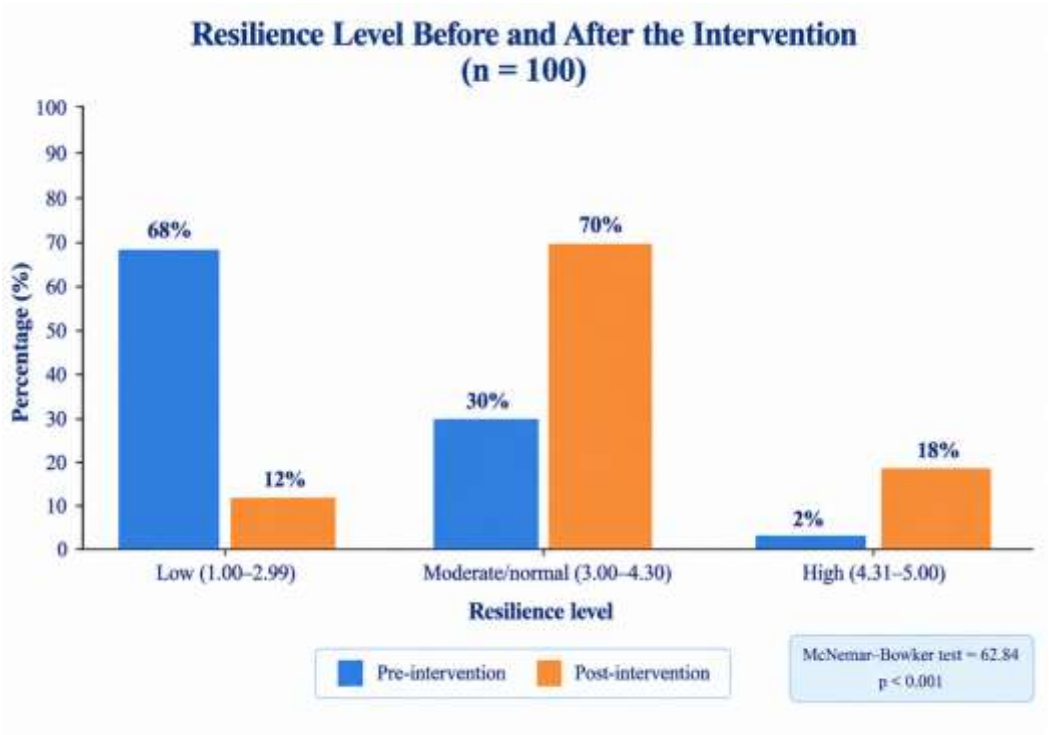
Table (6): Mean Scores of the Studied Older Adults on the Brief Resilience Scale Before and After the Intervention (N=100)

Brief Resilience Scale items	Pre-intervention Mean ± SD	Post-intervention Mean ± SD	Paired t-test	p-value
Item 1	2.6 ± 0.9	3.9 ± 0.8	11.21	<0.001
Item 2*	2.4 ± 0.8	3.8 ± 0.7	12.34	<0.001
Item 3	2.7 ± 0.9	4.0 ± 0.7	11.68	<0.001
Item 4*	2.5 ± 0.9	3.9 ± 0.8	10.92	<0.001
Item 5	2.8 ± 0.8	4.1 ± 0.7	12.16	<0.001
Item 6*	2.5 ± 0.9	3.9 ± 0.8	11.74	<0.001
Total BRS mean score	2.58 ± 0.51	3.93 ± 0.46	22.61	<0.001

*Items 2, 4, and 6 are reverse-scored. **Note:** *$p < 0.001$ = highly statistically significant.*

Table (6) demonstrates a clear improvement in psychological resilience after implementation of the nurse-led integrated educational–care program. The overall mean BRS score increased from **2.58 ± 0.51** before the intervention to **3.93 ± 0.46** after the intervention. This improvement was highly statistically significant (**t = 22.61, p < 0.001**).



Note: *$p < 0.001$ = highly statistically significant.*

Figure (3): Distribution of the Studied Older Adults According to Their Psychological Resilience Level Before and After the Intervention (N=100)

Figure (3) reveals a substantial positive shift in psychological resilience levels following the intervention. Before the intervention, 68.0% of participants had low resilience, whereas only 2.0% had high resilience. After the intervention, the proportion with low resilience decreased markedly to 12.0%, while moderate/normal resilience increased from 30.0% to 70.0% and high resilience increased from 2.0% to 18.0%. The overall change was highly statistically significant (**62.84, p < 0.001**).

Table (7): Correlation between Physical Recovery, Functional Independence, and Psychological Resilience among the Studied Older Adults After the Intervention (N=100)

Variables	Physical recovery	Functional independence	Psychological resilience
Physical recovery	1	r = 0.64	r = 0.58
Functional independence	r = 0.64	1	r = 0.52
Psychological resilience	r = 0.58	r = 0.52	1
p-value	—	<0.001	<0.001

Note: *$p < 0.001$ = highly statistically significant.*

Table (7) demonstrates statistically significant positive correlations among the three major outcome domains after the intervention. Physical recovery was strongly positively correlated with functional independence ($r = 0.64$, $p < 0.001$). Physical recovery was also positively correlated with psychological resilience ($r = 0.58$, $p < 0.001$), while functional independence showed a significant positive correlation with resilience ($r = 0.52$, $p < 0.001$).

DISCUSSION

Hip fracture is a major health challenge among older adults because it can result in substantial deterioration in mobility, self-care ability, physical function, and psychological well-being. Recovery is influenced not only by surgical management but also by rehabilitation, continuity of care, prevention of complications, and the individual's psychological capacity to adapt to functional loss. The present study therefore evaluated a nurse-led integrated educational–care program addressing physical recovery, functional independence, and psychological resilience among older adults undergoing hip fracture surgery. The findings demonstrated significant improvements across the three major outcome domains following implementation of the program.

The present study showed that the largest proportion of participants were aged 70–<80 years, with a mean age of 71.8 ± 8.1 years, and that females represented slightly more than half of the sample. This distribution is consistent with the epidemiological characteristics of hip fracture populations, in which advancing age and female sex are important characteristics because of age-related reductions in bone strength, muscle mass, balance, and functional reserve. The predominance of participants from rural areas and those with limited educational attainment also has important nursing implications, because postoperative education may need to rely more heavily on simple language, demonstrations, repeated reinforcement, and caregiver participation. Recent evidence emphasizes that hip fracture recovery is complex and affected by multiple individual, social, and rehabilitation-related factors rather than by surgery alone **(Rocha et al., 2024).**

The findings showed that femoral neck and intertrochanteric fractures represented the majority of fracture types, while hypertension, diabetes mellitus, and osteoporosis were the most frequently reported comorbidities. Nearly half of the participants had two or more chronic diseases, and 43% reported a previous history of falls. This pattern is clinically important because multimorbidity can reduce physiological reserve and complicate postoperative rehabilitation, while previous falls may indicate persistent balance, environmental, or functional risk factors. The systematic review by **Pantouvaki et al. (2023)** emphasized that exercise-based rehabilitation after hip fracture can improve functional recovery and contribute to prevention of subsequent falls. Thus, the inclusion of balance training, safe mobility, and fall-prevention education in the present nursing program was particularly appropriate.

The present findings demonstrated that 61% of the studied older adults were independent before the fracture, whereas a smaller proportion had partial or complete dependence. This baseline status is important because the objective of postoperative rehabilitation is not simply to improve clinical parameters but also to facilitate return toward the individual's previous level of functioning. Hip fracture can produce a substantial gap between pre-fracture and postoperative functional capacity, making early rehabilitation and individualized goal setting essential. **Ansah et al. (2023)** identified rehabilitation and resilience building as important domains in the recovery journey following hip fracture, supporting the need to consider pre-fracture function when planning individualized nursing care.

The present study demonstrated statistically significant improvements in all assessed physical recovery domains after implementation of the nurse-led integrated educational–care program. These findings suggest that the intervention addressed several interconnected components of recovery rather than focusing on mobility alone. The improvement may be explained by the combination of pain-management education, wound monitoring, nutritional guidance, progressive mobilization, balance and safety training, complication prevention, and continuous nursing reinforcement. These findings are consistent with **Fairhall et al.,(2022),** evidence showing that structured rehabilitation following hip fracture can improve physical function and mobility. **Bai et al. (2023)**, in a systematic review and meta-analysis of 15 studies, reported that intensive exercise after hip fracture surgery improved physical function compared with regular or no exercise. Similarly, **Chang et al. (2024)** reported beneficial effects of comprehensive rehabilitation training, particularly programs incorporating balance-related rehabilitation, on postoperative recovery and function.

The present study showed a pronounced shift from poor to good physical recovery following the intervention. This substantial improvement can be attributed to the integrated nature of the program, which combined education with direct nursing care, progressive activity, safety promotion, nutritional support, and reinforcement. The findings are supported by **Osama et al. (2023),** who concluded that exercise-based rehabilitation can promote functional recovery following hip fracture. They also agree with the findings of **Chang et al. (2024)**, whose meta-analysis demonstrated beneficial effects of comprehensive rehabilitation on postoperative recovery and function.

However, the present results should be interpreted cautiously because the study used a one-group pretest–posttest design without a concurrent control group. Therefore, although the magnitude and statistical significance of improvement strongly support the usefulness of the program, natural postoperative recovery and other aspects of routine care may have contributed to part of the observed improvement. This limitation is particularly important because recent evidence indicates heterogeneity among rehabilitation approaches and uncertainty regarding the superiority of one specific community-based rehabilitation strategy over another.

The present study demonstrated significant improvement in all domains of the Barthel Index, with the total mean score increasing. The most noticeable improvements occurred in mobility, transfers, and stair climbing, which are critical functional activities following hip fracture surgery. These improvements may be explained by the program's emphasis on progressive mobilization, safe transfers, use of assistive devices, strengthening, balance, and repeated practical demonstrations. The findings are consistent with **Kamo & Haraguchi, (2026)**, who found that intensive exercise after hip fracture surgery improved physical function, mobility, and activities of daily living. They are also consistent with the principle that functional recovery requires repeated practice of meaningful daily activities rather than relying exclusively on passive postoperative care.

The present study showed a major shift in functional status. Severe dependence decreased, while moderate independence increased, slight dependence increased, and complete independence appeared in three perecent after the intervention. This improvement indicates that the intervention was not limited to improving isolated physical parameters but translated into meaningful gains in activities of daily living. Such improvement is particularly important among older adults because loss of independence following hip fracture may result in prolonged dependence on family members and increased need for institutional care. **Ko et al. (2023)** similarly emphasized the importance of transitional care after hip fracture surgery because recovery extends beyond the acute hospitalization and requires continuity between hospital-based treatment and subsequent home rehabilitation.

The present study revealed a significant improvement in psychological resilience, with the mean BRS score increasing from 2.58 ± 0.51 before the intervention to 3.93 ± 0.46 after the intervention. This improvement suggests that participants became better able to cope with the physical and emotional consequences of hip fracture surgery. The intervention's psychological components, including counseling, reassurance, positive reinforcement, coping education, individualized communication, and gradual restoration of independence, may have contributed to this change. The findings are strongly supported by the **REGAIN, (2023)** secondary analysis, which demonstrated that greater psychological resilience was associated with lower odds of death or new inability to walk independently at 60 days after hip fracture surgery. The investigators consequently suggested that interventions aimed at strengthening resilience may have potential value in this population.

The present study demonstrated a substantial improvement in resilience categories. These findings suggest that psychological support should be considered an integral component of postoperative rehabilitation rather than an optional addition to physical care. Hip fracture can be experienced as a life-altering event associated with loss, fear, uncertainty, and prolonged negative

emotions. A recent systematic review of qualitative studies reported that psychosocial distress can persist throughout the recovery process and recommended assessment and management of psychosocial needs during rehabilitation.

The findings also agree with **McClennen et al., (2025)** more recent evidence demonstrating that better mental health and fewer depressive symptoms are associated with higher resilience among older women recovering from hip fracture. Thus, the improvement in resilience observed in the present study may reflect the combined effects of emotional support, improved physical function, increased confidence in performing activities, and reduction in perceived dependence.

The present study demonstrated significant positive correlations between physical recovery and functional independence, physical recovery and psychological resilience, and functional independence and psychological resilience. These findings support **Lim et al., (2020),** the multidimensional nature of recovery after hip fracture. Improvement in physical status may facilitate participation in activities of daily living, while increasing independence may enhance self-confidence and psychological adaptation. Conversely, greater psychological resilience may encourage active participation in rehabilitation and promote recovery behaviors. This interpretation is supported by **Su et al., (2026)** a research demonstrating an association between psychological resilience and physical function among older adults undergoing hip fracture surgery. More recently, **the REGAIN analysis, (2023)** showed that greater resilience was associated with better recovery-related outcomes, including lower odds of death or new inability to walk independently. Therefore, the positive correlations in the present study provide further support for an integrated nursing approach addressing physical, functional, and psychological dimensions simultaneously.

CONCLUSION

Based on the findings of the present study, the present study concluded that the nurse-led integrated educational–care program was effective in improving physical recovery, functional independence, and psychological resilience among older adults undergoing hip fracture surgery. Significant improvements were observed in pain control, wound recovery, mobility, balance, nutritional status, and overall physical recovery. Functional independence also improved significantly, as demonstrated by the increased Barthel Index scores and the shift from severe dependence toward moderate, slight, and complete independence. In addition, psychological resilience improved significantly following the intervention, with a marked reduction in low resilience and an increase in moderate and high resilience. The significant positive correlations among physical recovery, functional independence, and psychological resilience further emphasize that recovery after hip fracture is a multidimensional process.

Recommendations

Based on the findings of the present study, the following recommendations are proposed:

1. Implement nurse-led integrated educational–care programs routinely for older adults undergoing hip fracture surgery to improve recovery, independence, and psychological resilience.
2. Initiate early individualized rehabilitation and education focusing on mobility, strengthening, balance, assistive devices, pain management, and fall prevention.
3. Integrate functional and psychological assessment into nursing care using standardized tools such as the Barthel Index, with appropriate support for patients at risk.
4. Enhance discharge and transitional care through caregiver education, home-care guidance, follow-up, and reinforcement of rehabilitation goals.
5. Promote multidisciplinary collaboration and further research to evaluate and strengthen the long-term effectiveness of nurse-led care programs.
6. Conduct randomized controlled studies with larger samples to confirm the effectiveness of integrated nurse-led programs and compare them with conventional postoperative care.

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