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To explore the application value of nursing staff involved multidisciplinary continuous nursing in stroke patients with limb dysfunction

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Abstract

Background Stroke patients often experience limb dysfunction, which can significantly impact their quality of life and daily living abilities. This study aimed to explore the effectiveness of nursing programs that incorporate multidisciplinary continuing care with the participation of nursing staff for patients with stroke and limb dysfunction.

Methods This was a randomized controlled trial (RCT) conducted from August 2021 to August 2023. Ninety stroke patients were randomly assigned to a control group ($n=45$) and an observation group ($n=45$). The control group received routine discharge care, while the observation group received multidisciplinary continuing care with the participation of nursing staff. Outcomes measured included Fugl-Meyer Assessment (FMA) scores for upper and lower limb function, quality of life, daily living ability (Barthel Index, MBI), and adverse reactions.

Results The FMA scores for upper and lower limbs were significantly higher in the observation group compared to the control group. The observation group also had significantly higher scores in all quality of life dimensions and MBI scores compared to the control group. There were 10 adverse reactions reported in the observation group and 22 in the control group.

Conclusions Implementing multidisciplinary continuing care with the participation of nursing staff for stroke patients with limb dysfunction has a positive effect on improving limb function, quality of life, and daily living abilities, while also being relatively safe.

Keywords Nursing nurse, Multidisciplinary collaboration, Continuing care, Stroke, Limb dysfunction

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Introduction

Stroke is a serious neurological disease whose high incidence and impact on patient function make it an important public health issue worldwide. Stroke is one of the leading causes of disability and death in adults [1]. The mechanism of stroke limb dysfunction mainly involves two types: ischemic stroke and hemorrhagic stroke. Ischemic stroke is caused by obstruction of the cerebral blood vessels, causing ischemia and hypoxia in local brain tissue, causing damage to nerve cells, while hemorrhagic stroke is caused by rupture of the cerebral blood vessels and blood entering the brain tissue to cause damage. This kind of limb dysfunction is very harmful to patients. Bringing serious harm, loss of control of the limbs not only limits the patient's movements, but also causes psychological and social problems, increasing the patient's psychological burden. In addition, limb dysfunction also increases the patient's risk of other complications, such as deep vein thrombosis, urinary tract infection, etc. pose serious threats to patient recovery and quality of life [2–4]. Multidisciplinary continuing care with the participation of caregivers is a collaborative care model in the rehabilitation process of stroke patients. In this team, caregivers work closely with other professionals (such as rehabilitation therapists, nurses, doctors, etc.) to together provide patients with comprehensive nursing services [5, 6]. Through the professional training and practical experience of nursing nurses, patients and their families can obtain practical nursing suggestions and help patients better adapt to home life.

Traditionally, rehabilitation treatment has primarily focused on medical professionals such as doctors and physical therapists. However, in recent years, the concept of multidisciplinary teams has gained attention. Combining the knowledge and skills of multiple professions is believed to more comprehensively promote patient recovery. As an integral part of the rehabilitation team, caregivers play a crucial role in the rehabilitation process of stroke patients. Their professional knowledge and extensive skills provide patients with more comprehensive and personalized care. Research on multidisciplinary continuous care involving nursing staff in the rehabilitation of stroke patients is relatively limited. However, there have been some studies that highlight the benefits of a multidisciplinary approach in stroke rehabilitation. For example, Hendriks and Jaarsma [7] discussed the effectiveness of multidisciplinary teams in cardiovascular care, suggesting potential benefits for stroke care as well. Similarly, Poncet et al. [8] found that multidisciplinary rehabilitation programs can improve outcomes for patients with acquired brain injury, which can be extrapolated to stroke rehabilitation. Alexander et al. [9] found that Neurologic Music Therapy services are feasible and well-accepted in an acute stroke multidisciplinary team

setting, with notable improvements in patient mood and potential enhancement of rehabilitation engagement. Moreover, the study by Martha et al. [10] underscored the importance of developing Information and Communication Technology tools to support multidisciplinary rehabilitation interventions. While multidisciplinary approaches have been applied in various medical fields, including stroke rehabilitation, the specific focus on continuous care with active participation of nursing staff is novel. Previous studies have not extensively explored the continuous involvement of nursing staff in a multidisciplinary team for stroke rehabilitation. This study aims to fill this gap by systematically evaluating the impact of such an approach on stroke patients with limb dysfunction.

Various methods have been tried and applied in stroke rehabilitation, including physical therapy, occupational therapy, and speech therapy [11]. These therapies aim to improve motor function, cognitive abilities, and overall quality of life for stroke patients. Recent research has also explored the role of virtual reality and robotic-assisted therapy in stroke rehabilitation, showing promising results in enhancing motor recovery [12]. Despite these advancements, there is a paucity of research on the continuous involvement of nursing staff in a multidisciplinary care model. This study aims to address this gap by exploring the impact of nursing staff participation in continuous multidisciplinary care on the rehabilitation outcomes of stroke patients.

To compensate for the shortcomings in this field of research, this study selected 90 patients with stroke limb dysfunction treated in our hospital from 2021.8 to 2023.8 as research subjects to explore the impact of continuing multidisciplinary care with the participation of nursing nurses on stroke limb function. The actual impact on the rehabilitation of patients with disabilities aims to reveal its specific contribution to patient rehabilitation and provide strong theoretical and practical support to further improve rehabilitation strategies for stroke patients.

Materials and methods

General information

This is a randomized controlled trial (RCT) designed to evaluate the effectiveness of multidisciplinary continuous care involving nursing staff on the rehabilitation of stroke patients with limb dysfunction. This study was conducted from August 2021 to August 2023, targeting stroke patients with limb dysfunction treated in our hospital. A total of 90 patients were selected using the random number method and were divided into two groups: the control group and the observation group, with 45 cases in each group. Patients were randomly assigned to either the control group or the observation group using a computer-generated random number table to ensure

allocation concealment. The randomization process was performed by an independent researcher who was not involved in the treatment or assessment of the patients. The patients were blinded to the group assignments to reduce bias in self-reported outcomes. However, due to the nature of the intervention, it was not possible to blind the healthcare providers delivering the interventions.

The sample size was calculated based on previous studies on stroke rehabilitation, with an estimated effect size of 0.5, a significance level (alpha) of 0.05, and a power (1-beta) of 0.80. Using these parameters, the required sample size was determined to be 45 patients per group to detect a statistically significant difference between the groups. The control group included 23 males and 22 females, age ranged from 56 to 72 years (62.3 ± 3.3) years old; disease : 1 to 2 months (1.03 ± 0.23) months ; the observation group included 24 male cases and 21 female cases, the age ranged from 55 to 72 years (62.39 ± 3.32) years; the duration of the disease: 1 to 3 months (1.42 ± 0.20) months ; comparison between the selected patients and the baseline data ($P > 0.05$).

Patients aged 45–90 years old, diagnosed with acute stroke, who presented to the emergency department within 72 h after symptom onset and had complete medical records and medical history were included in the study. Exclusion criteria comprised patients with a history of previous stroke or other neurological disorders, severe cognitive or intellectual impairments, severe cardiovascular or other comorbid conditions, and those who refused to participate or provide informed consent.

Methods

Patients in the control group received routine discharge care, which included the following standardized interventions:

- (1) Assessment of Rehabilitation Needs: Medical staff conducted a thorough assessment of each patient's rehabilitation needs, focusing on limb movement, speech, and cognitive functions.
- (2) Personalized Rehabilitation Plans: Based on the assessment, personalized rehabilitation plans were developed, emphasizing daily exercise and self-care abilities. Standardized exercise protocols were provided to ensure consistency across patients.
- (3) Rehabilitation Training and Family Support: Patients and their family members received training on rehabilitation exercises and self-care techniques. This included demonstrations and instructional materials to ensure understanding and proper implementation.
- (4) Monitoring and Follow-Up: Regular monitoring of physiological indicators was conducted, and follow-up visits were scheduled to address any emerging health issues promptly.

Based on the above nursing measures, the observation group received continuing multidisciplinary care with the participation of nursing nurses:

- (1) Building a multidisciplinary stroke nursing team: The multidisciplinary stroke nursing team was led by the Deputy Director of the Nursing Department, who was responsible for overall team management and guidance, ensuring smooth operation and coordination. Neurologists were tasked with the clinical assessment and treatment of stroke patients, formulating and adjusting medical treatment plans as needed. Rehabilitation Nurses conducted rehabilitation assessments, developed individualized rehabilitation plans, provided hands-on rehabilitation therapy, and trained patients in performing exercises. Neurology Nurses performed nursing assessments, established patient electronic information files, and monitored patient progress and response to treatments. Caregivers conducted home environment assessments, provided guidance on home care skills, assisted with daily activities, and ensured patients' adherence to the rehabilitation protocols. Psychological Counselors conducted psychological assessments and provided psychological interventions to support patients' mental health and well-being.
- (2) Physiological rehabilitation of patients:
 - a. Individualized Rehabilitation Plans: Rehabilitation therapists and caregivers work closely together to formulate individualized rehabilitation training plans.
 - b. On-Site Instruction: During on-site instruction, rehabilitators teach patients and family members about passive and active exercise techniques through lectures and hands-on demonstrations. Passive exercises include joint flexion and extension, internal and external rotation, abduction and adduction, etc., aiming to promote joint flexibility and muscle coordination. Active exercises include pinching elastic balls with the fingers, raising and rotating the upper extremities, and straightening the lower extremities on the bed. Elevation, bridging, standing, and walking training, the training intensity and time are adjusted according to the patient's tolerance, and a gradual increase in exercise is encouraged to promote the patient's active activities and self-care ability.
 - c. Video Guidance: In the video guidance session, the caregiver plays a video on stroke home care knowledge and skills. Through the video, family members can learn practical nursing skills,

such as diet, dressing, hygiene, mobility, etc., to improve their ability to care for patients daily. In addition, the psychological nursing video also covers communication skills between patients and caregivers to improve mutual understanding and support.

(3) Education before discharge: Group training:

- a. Group Training Sessions: active exercise (holding elastic balls with fingers, raising and rotating upper limbs, straight leg raising, bridging, standing and walking training of lower limbs on the bed), intensity and time are based on the patient’s tolerance, encouraging a gradual increase in physical activity and independent daily activities.
- b. Video Demonstrations: The nursing staff plays videos on stroke home care knowledge, nursing skills, and psychological care, and conducts on-site demonstrations of important content to improve the nursing skills of family members. For the psychological rehabilitation of patients, psychological counselors play an important role in the team. In the team’s WeChat group, psychological counselors conduct psychological assessments through text and voice messages to understand the patient’s psychological status and needs.

Standardization of intervention

To ensure uniformity among all patients in each group, the following measures were implemented:

Table 1 Modified Barthel Index Rating Scale (MBI)

ADL project	com- pletely dependent on	great- est help	Moderate- ly helpful	mini- mal help	com- pletely inde- pendent
Modify bath	0	1	3	4	5
eating	0	2	5	8	10
Use the toilet	0	2	5	8	10
dressing	0	2	5	8	10
Bowel control	0	2	5	8	10
urinary control	0	2	5	8	10
Down stairs	0	2	5	8	10
bed chair transfer	0	3	8	12	15
walking on level ground	0	3	8	12	15
in a wheelchair	0	1	3	4	5

Standardized Protocols: All rehabilitation exercises and nursing interventions were guided by standardized protocols developed by the multidisciplinary team. These protocols were designed to be comprehensive and adaptable to each patient’s needs while ensuring consistency in the type and intensity of interventions.

Training and Supervision: All healthcare providers involved in the study received extensive training on the standardized protocols before the study commenced. Regular supervision and refresher training sessions were conducted to maintain adherence to these protocols.

Documentation: Detailed documentation of each intervention was maintained in patient electronic records. This included the type of exercise, duration, frequency, and any modifications made to accommodate individual patient needs. This ensured that all interventions were recorded accurately and consistently.

Quality Control: Regular quality control checks were performed by the Deputy Director of the Nursing Department and the team leader to ensure that all interventions were being implemented according to the standardized protocols. Any deviations were addressed promptly to maintain uniformity.

Patient and Family Education: Standardized educational materials, including brochures and instructional videos, were provided to all patients and their families. This ensured that they received consistent information and guidance on performing rehabilitation exercises and home care.

Evaluation criteria

- (1) Fugel-Meyer functional assessment (FMA) [13] is used to assess the function of the upper and lower extremities. The total score for the motor function of the upper extremities is 66 points, and the total score for the motor function of the lower extremities is 34 points. The higher the patient’s score, the better the motor function of the patient’s limb.
- (2) Quality of life: The simplified quality of life assessment scale (SF-36) [14] was used to assess quality of life. The scale includes eight elements of physical function, physiological function, emotional function, and social function. Each item has a total score of 100 points. The higher the patient’s score, the better the patient’s quality of life.
- (3) Daily living capacity: The modified Barthel index (MBI) [15] is used to evaluate the patient’s functional status in daily living activities, with a total score of 100 points. Excellent: score above 60 points, good: 45–59 points, poor: below 39 points. A higher score indicates a better patient’s state in activities of daily living. The items are shown in Table 1.

Adverse reactions

Adverse reactions were defined as any undesirable experiences occurring in patients during the course of the study that were considered related to the intervention. This included, but was not limited to, complications such as cerebral edema, constipation, pneumonia, infections, and any other health issues that arose during the rehabilitation period.

Measurement of Adverse Reactions: Adverse reactions were systematically monitored and recorded using standardized reporting forms. Each patient was assessed during each visit for any new or worsening symptoms. Medical staff used a checklist to ensure all potential adverse reactions were considered.

Attribution of Adverse Reactions: To determine whether an adverse reaction was attributable to the intervention, the following criteria were used: (1) Temporal Relationship: The timing of the adverse reaction was assessed to see if it occurred shortly after the intervention. (2) Consistency with Known Effects: The adverse reaction was compared with known side effects of similar interventions. (3) Alternative Explanations: Other potential causes for the adverse reaction were considered and ruled out. (4) Rechallenge: In some cases, the intervention was temporarily halted to see if the adverse reaction resolved and then reintroduced to see if the reaction recurred.

Ethical considerations

All methods were performed in accordance with the ethical standards established in the Declaration of Helsinki and its subsequent amendments or comparable ethical standards. This study was approved by the Ethics

Committee of Yueyang Vocational Technical College. The ethical approval number is EA2141172. All patients or their legal guardians provided written informed consent before participating in the study. They were fully informed about the nature of the study, the interventions involved, and their right to withdraw from the study at any time without any consequences for their ongoing medical care.

To protect patient privacy, all personal and medical information was kept confidential. Patient data were anonymized and stored securely. Only authorized research personnel had access to the data.

During home visits and other interactions, care was taken to ensure that discussions and assessments were conducted in a private and respectful manner, minimizing any potential for privacy violations.

Statistical methods

Data were statistically analyzed using SPSS 23.00 software. The fundamental features of the groups were compared using descriptive statistics to summarize the demographic and baseline clinical characteristics. Continuous variables were expressed as mean±standard deviation (SD) and compared using independent-samples t-tests if they followed a normal distribution. For non-normally distributed continuous variables, the Mann-Whitney U test was used. Categorical variables were expressed as frequencies and percentages and compared using chi-square tests or Fisher’s exact test when the expected frequencies were small. To evaluate the significance of disparities in outcomes between the control and observation groups, the following tests were employed: Independent-Samples t-Test: Used to compare the mean scores of continuous variables, such as Fugl-Meyer Assessment (FMA) scores, Simplified Quality of Life Assessment Scale (SF-36) scores, and Modified Barthel Index (MBI) scores between the two groups. Chi-Square Test: Used to compare categorical outcomes, such as the incidence of adverse reactions, between the two groups. Repeated Measures ANOVA: Applied to compare the changes in functional assessment scores, quality of life scores, and daily living capacity scores over time within and between the groups, adjusting for baseline differences. A p-value of less than 0.05 was considered statistically significant for all tests.

Results

Comparison of motor function (FMA score) between groups

The FMA scores of the upper and lower extremities obtained by the patients in the nursing observation group were significantly higher than those of the control group, that is, $p < 0.05$; see Table 2.

Table 2 Comparison of motor function (FMA score) between groups ($\bar{x} \pm s$, points)

Group	n	Upper limb FMA (minutes)	Lower limb FMA (minutes)
Observation group (45 cases)	Before care	20.07 ±3.22	18.23 ±2.07
	After care	42.98 ±2.54	32.65 ±2.05
t value	-	35.392	25.566
P value	-	0.000	0.000
Control group (45 cases)	Before care	19.69 ±2.18	19.08 ±2.06
	After care	23.34 ±2.22	23.063 ±2.42
t value	-	7.507	9.802
P value	-	0.000	0.000
t value of control group and observation group after nursing	-	34.008	16.023
P value after nursing control group and observation group	-	0.000	0.000

Comparison of quality of life levels between groups

Comparing the quality of life levels scores between the groups, it can be seen that the scores for each dimension in the observation group were significantly higher than those in the control group, that is, $P < 0.05$, see Table 3.

Comparison of MBI scores between groups

MBI scores between groups, before intervention ($P > 0.05$), after intervention, the MBI score of the observation group was significantly higher than that of the control group, that is, $P < 0.05$, see Table 4.

Comparison of adverse reactions

the observation group had adverse reactions, which was significantly different from the 22 cases in the control group ($P < 0.05$), as shown in Fig. 1.

Discussion

In this study, the results of multidisciplinary continuing care provided by nursing nurses to the selected patients in the observation group showed that the FMA scores of the upper and lower extremities obtained by the patients in the observation group were significantly higher than those of the control group. The results obtained in the study are highly consistent for the following reasons: First, as a member of the team, the nursing nurse can have a more comprehensive understanding of the patient’s rehabilitation needs and the actual situation through home visits and daily observations. This helps to formulate personalized rehabilitation programs, making rehabilitation training more relevant to the patient’s actual condition and more targeted, thus improving the rehabilitation effect. Similar results have been observed in other studies where continuous and personalized care led to better rehabilitation outcome [16].

When comparing the scores of the quality of life levels between groups, it can be seen that the scores of each

Table 3 Comparison of quality of life scores between groups [$(\bar{x} \pm s)$, points]

project type	Observation group (n=45)	Control group (n=45)	t value	t value
Physiological function	85.23±3.80	72.04±3.12	11.508	0.000
Physiological functions	87.27±3.45	71.20±3.09	10.667	0.000
emotional function	81.28±3.43	72.16±2.56	12.245	0.000
social function	86.19±3.45	71.08±2.25	12.028	0.000
pain	89.76±3.44	70.19±2.70	11.419	0.000
mental state	88.05±3.53	79.40±2.19	11.687	0.000
vitality	85.24±3.05	71.29±2.60	13.282	0.000
overall health score	89.23±3.90	72.76±2.22	12.445	0.000

Table 4 Comparison of MBI levels between groups ($\bar{x} \pm s$)

Group	Number of examples (n)	before intervention	after intervention	t	p
observation group	45	52.36±3.20	87.09±4.56	9.896	<0.05
control group	45	51.28±3.52	62.92±5.02	4.924	<0.05
t	-	0.708	10.674		
p	-	>0.05	<0.05		

dimension of the observation group are significantly higher than those of the control group. The reasons are: first, through home visits and observations, care nurses can. A more comprehensive understanding of the patient’s living situation and rehabilitation needs allows the nurse practitioner to more accurately develop a personalized rehabilitation plan and provide targeted intervention for the patient’s specific quality of life issues [17]. Second, the professional nursing assistance provided by the nursing staff during the rehabilitation process, such

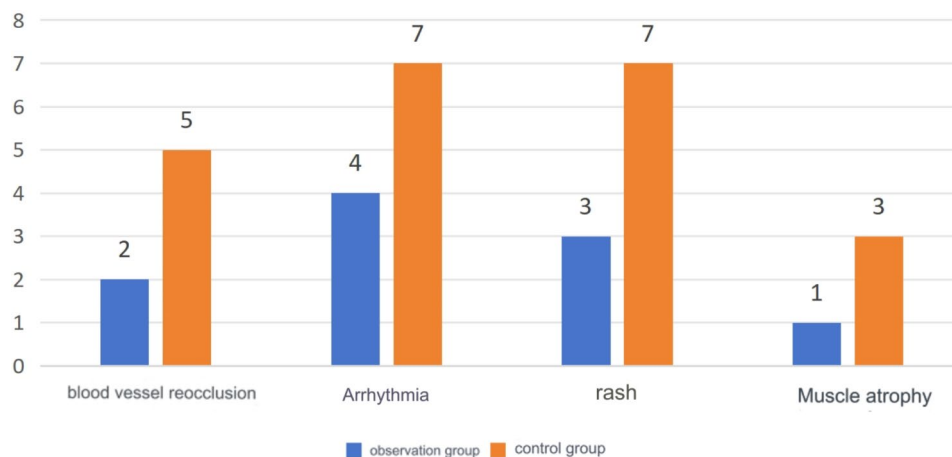


Fig. 1 The incidence of adverse reactions was compared between the observation group and the control group

as the use of assistive tools, improving the home environment, etc., can help patients cope better with various challenges in life [18]. Professional guidance and practical demonstration of nursing staff, enabling patients to carry out daily activities more independently and safely, thus improving scores in all aspects of quality of life. Furthermore, the personalized health education of nursing nurses plays a positive role in improving the quality of life of patients. Through interaction with patients and their families, nurses transmit important information about recovery, self-management and coping with challenges. This finding aligns with existing literature that emphasizes the importance of caregiver involvement in the rehabilitation process [19].

MBI scores between groups, before and after the intervention, the MBI score of the observation group was significantly higher than that of the control group. Providing more nuanced nursing assistance according to the patient's specific situation, which helps the patient to better carry out daily life activities and enhance self-care ability, thus improving the MBI score. Second, caregivers play an important role in home visits during the rehabilitation process [20, 21]. By having a thorough understanding of the patient's living environment and family support system, caregivers can more comprehensively assess the actual rehabilitation needs of the patient and emphasize the importance of rehabilitation. Self-management skills and the ability to deal with potential problems make patients more confident in recovery, more capable of participating in rehabilitation activities, and promote the improvement of MBI scores [22].

The observation group experienced adverse reactions, which was significantly different from the 22 cases in the control group. The reasons are as follows. First, nursing nurses play an important role in the multidisciplinary rehabilitation team. Through a comprehensive nursing evaluation of patients and the formulation of rehabilitation plans, it helps. It is used to adjust the nursing plan on a personalized basis and reduce the patient's discomfort with rehabilitation measures. Second, the nursing nurse also plays an active role in home visits during the rehabilitation process. Through an in-depth understanding of the patient's living environment and daily activities, nursing care can Teachers can quickly discover potential rehabilitation obstacles and discomforts and make timely adjustments and improvements, thereby reducing the incidence of adverse reactions [23]. The incidence of adverse reactions was lower in the observation group, demonstrating the safety and efficacy of the multidisciplinary continuous care model. Regular monitoring and timely intervention by the nursing team likely mitigated potential complications, aligning with findings from other studies on comprehensive care models [24].

This study primarily focused on short-term outcomes and did not include subsequent evaluation to determine the long-term sustainability of the observed effects. The absence of long-term data limits our understanding of whether the benefits of multidisciplinary continuous care persist over time. Long-term follow-up studies are essential to evaluate the durability of the improvements in motor function, quality of life, and daily living capacities. Without this data, there is a risk that the observed benefits may diminish once the intensive support provided during the study period is withdrawn. Future research should include longitudinal studies to assess the lasting impact of the intervention and identify any factors that contribute to the maintenance of these improvements.

The positive outcomes observed in this study highlight the critical role of multidisciplinary teams in stroke rehabilitation. By integrating the expertise of neurologists, rehabilitation therapists, and nursing staff, the care provided was more comprehensive and patient-centered. This collaborative approach ensures that all aspects of the patient's health are addressed, leading to better overall outcomes.

Despite these positive findings, the study has limitations. The sample size was relatively small, and the study was conducted in a single center, which may limit the generalizability of the results. Future research with larger, multicenter trials is needed to confirm these findings. Additionally, while the single-blind design minimized patient bias, the lack of blinding among healthcare providers could introduce some bias in the delivery of care. While the findings of this study are promising, their generalizability to different groups or settings may be limited. The study was conducted in a single center with a relatively small sample size, which may not represent the broader population of stroke patients. Additionally, the specific healthcare setting and resources available at the study site may differ from those in other regions or countries. Therefore, caution should be exercised when applying these findings to different groups or settings. Further research with larger, multicenter trials is needed to confirm these results and explore the applicability of the multidisciplinary continuous care model in diverse populations and healthcare environments. Factors such as cultural differences, healthcare infrastructure, and available resources should be considered when adapting this model to other settings.

Conclusion

This study demonstrates that multidisciplinary continuous care involving nursing staff significantly improves motor function, quality of life, and daily living capacities in stroke patients with limb dysfunction. The inclusion of nursing staff as integral members of the rehabilitation team provides comprehensive and personalized care,

highlighting the importance of a collaborative approach in stroke rehabilitation. These findings suggest that adopting such a model could enhance patient outcomes and should be considered in the development of future rehabilitation strategies. Future studies should explore the long-term effects of multidisciplinary continuous care involving nursing staff on stroke rehabilitation. Additionally, research should investigate the cost-effectiveness of this care model to determine its feasibility for broader implementation in clinical practice. Exploring patient and caregiver satisfaction with this care model can also provide valuable insights into its overall impact.

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Author contributions

Yuan Deng and Yufei Sang formulation overarching research goals and writing the manuscript, Yuan Deng conducting a research and investigation process, Yunfeng Shang collecting data, and Chao Wu conducting data analysis. Xiaofeng Xu edits the manuscript. All authors read and approved the final manuscript.

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Data availability

No datasets were generated or analysed during the current study.

Declarations

Ethical approval

All methods were performed in accordance with the ethical standards established in the Declaration of Helsinki and its subsequent amendments or comparable ethical standards. This study was approved with approval and consent of the Ethics Committee of the Yueyang Vocational Technical College.

Consent for publication

Not Applicable.

Competing interests

The authors declare no competing interests.

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