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ORIGINAL RESEARCH

Impact of Interprofessional Collaborative Practice on Functional Improvements Among Post-Acute Stroke Survivors: A Retrospective Cross-Sectional Study

Tsen-Pei Chen[1,2], Ying-Jia Lin[3], Yu-Lin Wang[4,5], Li-Min Wu[2,6], Chung-Han Ho[3,7,8]

[1]Department of Nursing, Chi Mei Medical Center, Tainan City, Taiwan; [2]School of Nursing, Kaohsiung Medical University, Kaohsiung City, Taiwan; [3]Department of Medical Research, Chi Mei Medical Center, Tainan City, Taiwan; [4]Department of Physical Medicine and Rehabilitation, Chi Mei Medical Center, Tainan City, Taiwan; [5]Department of Biomedical Engineering, National Cheng Kung University, Tainan,Taiwan; [6]Department of Medical Research, Kaohsiung Medical University Hospital, Kaohsiung City, Taiwan; [7]Department of Information Management, Southern Taiwan University of Science and Technology, Tainan City, Taiwan; [8]Cancer Center, Taipei Municipal Wanfang Hospital, Taipei Medical University, Taipei, Taiwan

Correspondence: Li-Min Wu, School of Nursing, Department of Medical Research, Kaohsiung Medical University Hospital, No. 100, Shin-Chuan 1st Road., Sanmin District, Kaohsiung City, 807378, Taiwan, Email painting@kmu.edu.tw; Chung-Han Ho, Department of Medical Research, Chi Mei Medical Center, No. 901, Chung Hwa Road, Yongkang Dist, Tainan City, 710, Taiwan, Email ho.c.hank@gmail.com

Background: Stroke survivors in post-acute care frequently experience physiological dysfunction and reduced quality of life. This study aims to assess the impact of the Post-Acute Care Interprofessional Collaborative Practice (PAC-IPCP) program across different care settings, and to identify sensitive tools for assessing physiological functions among post-acute stroke survivors.

Methods: This retrospective study involved 210 stroke survivors in Taiwan. Participants who self-selection for their preferred between hospital care setting and home care setting under PAC-IPCP. Multiple assessment tools were utilized, including the Barthel Index (BI), Functional Oral Intake Scale (FOIS), Mini Nutritional Assessment (MNA), EQ-5D-3L, and Instrumental Activities of Daily Living (IADL). The logistic regression was used to estimate the odds ratios of various functional assessment tools between hospital and home care settings. Additionally, the area under the ROC curves was used to determine which functional assessment tools had higher accuracy in measuring the association between care settings.

Results: Of the study population, 138 stroke survivors (65.71%) selection hospital care setting and 72 stroke survivors (34.29%) selection home care setting. The PAC-IPCP program was equally effective in both care settings for physical function status and quality of life improvements. Specifically, the BI emerged as the most sensitive tool for assessing care settings, with an adjusted OR of 1.04 (95% CI:1.02–1.07, $p < 0.0001$; AUC = 0.7557). IPCP-based hospital and home care models are equally effective in facilitating improved functional outcomes in post-acute stroke survivors.

Conclusion: The PAC-IPCP program is versatile and effective across care settings. The BI stands out as a robust assessment tool for physiological functions, endorsing its broader clinical application. Future studies should also consider swallowing and nutritional status for a more holistic approach to rehabilitation.

Keywords: stroke, neurology, subacute care, recovery of function, health care

Introduction

Stroke is a major cause of death and disability worldwide with a leading economic burden.[1–4] In Taiwan, stroke is the third leading cause of death and the most common cause of complex disability.[5] Stroke survivors often have multiple deficits, including sensory-motor dysfunction, swallowing and speech disorders, and reduced quality of life.[6] The first three months post-stroke are crucial for recovery, with 48% to 91% of functional recovery during this period.[7] Therefore, stabilized stroke survivors should begin rehabilitation therapy without delay, using the interprofessional collaborative practice (IPCP) of physical, occupational and speech therapies to restore physical function and reduce post-stroke symptoms.[8,9]

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The IPCP teamwork for post-acute care (PAC) provides individualized, multidisciplinary care, and multi-component exercise interventions, including high-intensity resistance training, suitable for reversing reverse functional decline after stroke.[9] Moreover, functional impairment and recovery are associated to the care setting.[10–12] Providing decision-making information through IPCP teams could effectively assist stroke survivors in developing survivor-centered goals.[10] Therefore, simple and accurate functional impairment scores PAC are valuable for planning IPCP team rehabilitation programs.[13–16]

Previous studies had highlighted the positive contributions of PAC to stroke outcomes.[11,14,15,17] In clinical practice, the IPCP team used assessment tools to estimate improvement in stroke survivors' functioning and inform care setting decisions. For example, the Barthel Index (BI) had been shown to better predict clinical PAC care outcomes and provide clear information on rehabilitation effectiveness.[17,18] However, multiple assessment tools may be time-consuming, and the short transition timeframe to PAC services limited clear information on PAC outcomes across different settings. Therefore, this study aims to evaluate the impact of different assessment tool between hospital and home care models among post-acute stroke survivors, and to determine which functional assessment tools had higher accuracy in measuring the association between hospital and home care settings.

Methods

Ethical Considerations

This present study was conducted in compliance with the Declaration of Helsinki and approved by the Institutional Review Board of Chi Mei Medical Center (IRB No. 11212–002). The database contained no identifiable personal information to ensure the privacy and confidentiality of stroke survivors, and informed consent was not required as the data were de-identified for analysis.

Data Source

This retrospective study was obtained from the Post-Acute Stroke Medical Services Database, an articulated acute medical record with continuous of service data related to the transition from acute care to PAC, from a medical center in southern Taiwan since 2014. This repository stands as a testament to the seamless integration of acute medical records, bridging the transition from initial acute care to subsequent PAC. Data from these records include stroke survivors' demographics, stroke risk factors, and meticulously recorded scores on physical functions and quality of life assessment tools, included baseline (pre-tests) and post-tests following the intervention of the PAC-IPCP program services. This dual-timepoint approach allows for a thorough investigation into the efficacy of the PAC-IPCP program, offering insights into the trajectory of recovery and rehabilitation outcomes.

The PAC-IPCP Program

In 2014, Taiwan established a high-intensity post-acute inpatient rehabilitation program limited to 12 weeks, with frequent (3–5 times/day) IPCP therapies for improving daily activities, nutrition, oral function, balance, walking speed, sensorimotor, and speech functions.[13,14] This program was initially launched only in a hospital care setting and included an IPCP team of neurologists, nurses, physiotherapists, occupational therapists, speech and language therapists, nutritionists, medical technicians, social workers, case managers, stroke survivors, and their families involved in PAC. In 2019, Taiwan introduced a home-based rehabilitation care model, transforming from traditional hospital-based rehabilitation to provide stroke survivors with task-oriented training in their own homes.[13] In the home care setting, the program adapted to the home environment, emphasizing skills relevant to daily activities. Stroke survivors participated in a two to four-week intensive program, with two to six sessions per week, each session lasting 50 minutes. The involvement of caregivers was encouraged to support community interaction and lasting rehabilitation. The PAC-IPCP program was subsequently expanded to include hospital and home care services. In addition, the functional assessment tools, including of Barthel Index (BI), Functional Oral Intake Scale (FOIS), Mini Nutritional Assessment (MNA), European Quality of Life Five Dimensions Questionnaire 3 Level Version (EQ-5D-3L), and Instrumental Activity Daily Living scale (IADL), were all used in PAC-IPCP program.

This core of the PAC-IPCP program is an intensive rehabilitation regimen that includes a range of therapies: facilitation, passive range of motion exercises, therapeutic exercises, bed mobility training, balance and ambulation training, transfer training, coordination and postural training, activities of daily living and functional training, as well as speech and swallowing training. This program is implemented in both hospital and home care settings, ensuring consistency in care approaches.

Key to the program's success is the IPCP team's weekly meetings, where members assess stroke survivors' progress, sharing diverse professional insights. These meetings are crucial for setting goals, planning care, and making decisions through a continuous, stroke survivor-centered dialogue. The team's approach is evidence-based, ensuring consistent and effective solutions to the stroke survivors' care challenges.

Participants

This study analyzed participants from January 2019 to December 2021, who self-selected their care setting between hospital and home care.[10] Patients were included consecutively based on the following inclusion criteria: (1) acute stroke onset within one month; (2) stabilized medical and physical condition, confirmed by the absence of neurological or stroke-related complications within three days prior to enrollment; (3) a modified Rankin Scale (mRS) score of 3 or 4 by neurologist assessment; (4) potential for functional recovery post-rehabilitation, evidenced by basic cognitive and learning abilities and the ability to sit upright for at least one hour. In addition, the exclusion criteria were as follows: (1) had previously received hospital care under the PAC-IPCP program between 2014 and 2018; (2) exhibited incomplete participation in the PAC-IPCP program due to reasons such as relocation, transfer to long-term care facilities, or discontinuation of services due to illness progression or death. Following the above criteria, all study subjects had similar baselines, reducing potential selection bias on the impact of various assessment tools.

Of the 210 participants who met the inclusion criteria and self-selected their care setting, 138 participants (65.71%) selected hospital care setting, while 72 participants (34.29%) selected home care setting (Figure 1). In this study, with a statistical power of 0.9 and a medium effect size of 0.5, the sample size of 210 achieved the minimum sample size requirement.

Measures

The measurements of this study included participants' age, sex, body mass index (BMI), stroke type, severity as measured by the National Institutes of Health Stroke Scale (NIHSS), and risk factors such as smoking, alcohol consumption, hypertension (HTN), diabetes mellitus (DM), heart disease, dyslipidemia, and history of previous strokes. In addition, the assessment tools of PAC-IPCP program were BI, FOIS, MNA, EQ-5D-3L, and IADL.

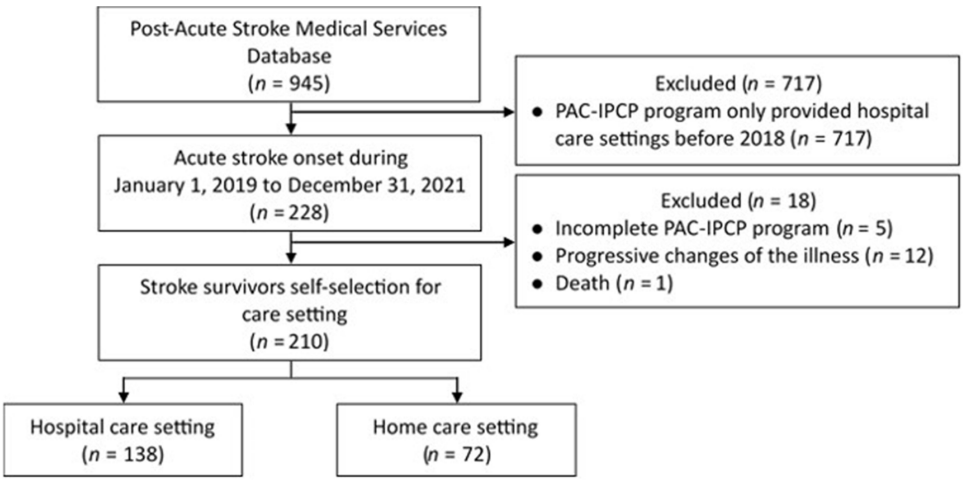


Figure 1 Flow chart of study subjects between hospital and home care settings.

BI, ranged from 0 to 100 points, was used to assess basic daily living activities with higher scores indicating greater independence in daily functioning.[19] Then, FOIS was used to evaluate oral intake capabilities, focusing on swallowing and eating abilities.[20] The FOIS scores was from 1 to 7, with higher scores denoting fewer restrictions in eating and swallowing. The MNA evaluates nutritional status between 0.0 and 30.0 scores, identifying malnutrition or risk thereof,[21,22] and higher MNA scores indicated better nutritional health. Moreover, EQ-5D-3L assesses self-perceived health across five dimensions: mobility, self-care, usual activities, pain/discomfort, and anxiety/depression,[23] and it spans a range of 5 to 15 points, where a higher score indicates greater challenges in these dimensions. Finally, IADL was used to assess essential skills for independent living within a community, such as shopping and medication management,[24] with higher scores representing better proficiency in these instrumental activities. The Cronbach's alpha range of above tools from 0.76 to 0.99.[20,22,25–27]

Statistical Analysis

All statistical analyses were conducted utilizing the Post-Acute Stroke Medical Services Database. The baseline characteristics of participants were presented using means, standard deviations, and proportions, as applicable. To estimate the differences in demographic variables and assessment tools between hospital and home care settings, chi-squared tests for categorical variables and Mann–Whitney *U*-tests for continuous variables were employed. The Wilcoxon signed ranks test was used to estimate disparities in patients' assessments at the initiation and subsequent enrollment in the care setting. For predicting the most suitable care setting, logistic regression models were used to calculate the odds ratios (ORs) of each assessment tool. Adjusted ORs with 95% confidence interval (95% C.I.) were estimated using multiple logistic regression with potential confounding factors, including age group, sex, BMI category, type of stroke, NIHSS category, and other prevalent risk factors (smoking, alcohol, HTN, DM, heart disease, dyslipidemia and previous stroke). The accuracy of each assessment tool was presented using the area under the receiver operating characteristic (ROC) curve. The comparison between different ROC curves were estimated using DeLong's test. All analyses were performed using SAS 9.4 (SAS Institute Inc., Cary, NC, USA). The statistical significance was set at $p < 0.05$ level.

Results

Table 1 presents the demographic characteristics of participants. The mean age of the 210 participants was 68.3 ± 12.6 years and 58.10% were male. The most common diagnosis among the participants was ischemic stroke (90.48%), and 36.67% had moderate to severe disability with NIHSS severity scale. In addition, a majority of the participants with risk factors were hypertension (72.38%) and dyslipidemia (86.67%). There were no statistically significant differences

Table 1 Comparison of Participants' Characteristics Between Settings

Variable	Total (*n*=210)	Hospital Care (*n*=138)	Home Care (*n*=72)	*p* value
Age Group, n(%)				0.3422
<65 years	97(46.19)	67(48.55)	30(41.67)	
≥65 years	113(53.81)	71(51.45)	42(58.33)	
Sex, n(%)				0.2593
Male	122(58.10)	84(60.87)	38(52.78)	
Female	88(41.90)	54(39.13)	34(47.22)	
Body Mass Index, n(%)				0.4036
<18.5	20(9.52)	14(10.14)	6(8.33)	
18.5–24	81(38.57)	57(41.30)	24(33.33)	
≥24	109(51.90)	67(48.55)	42(58.33)	

(*Continued*)

Table 1 (Continued).

Variable	Total (*n*=210)	Hospital Care (*n*=138)	Home Care (*n*=72)	*p* value
Stroke Type, n(%)				0.3577
Ischemic	190(90.48)	123(89.13)	67(93.06)	
Hemorrhagic	20(9.52)	15(10.87)	5(6.94)	
NIHSS Severity Scale, n(%)				0.0068
Minor Disability (≤6)	133(63.33)	78(56.52)	55(76.39)	
Moderate Disability (7–15)	71(33.81)	54(39.13)	17(23.61)	
Severe Disability (≥16)	6 (2.86)	6(4.35)	0(0)	
Risk Factors, n(%)				
Smoking Status				0.2155
Yes	67(31.90)	48(34.78)	19(26.39)	
No	143(68.10)	90(65.22)	53(73.61)	
Alcohol Consumption				1.0000
Yes	35(16.67)	23(16.67)	12(16.67)	
No	175(83.33)	115(83.33)	60(83.33)	
Hypertension				0.2064
Yes	152(72.38)	96(69.57)	56(77.78)	
No	58(27.62)	42(30.43)	16(22.22)	
Diabetes Mellitus				0.7023
Yes	103(49.05)	69(50.00)	34(47.22)	
No	107(50.95)	69(50.00)	38(52.78)	
Heart Disease				0.4495
Yes	49(23.33)	30(21.74)	19(26.39)	
No	161(76.67)	108(78.26)	53(73.61)	
Dyslipidemia				0.7975
Yes	182(86.67)	119(86.23)	63(87.50)	
No	28(13.33)	19(13.77)	9(12.50)	
Previous Stroke				0.4705
Yes	74(35.24)	51(39.96)	23(31.94)	
No	136(64.76)	87(63.04)	49(68.06)	

between the hospital care and home care in terms of age group, sex, BMI group, stroke type, and risk factors, except for a significant difference in the NIHSS severity scale group (p = 0.0068) (Table 1).

The results of physical function status and quality of life before and after program are reported in Table 2. The majority of pre-test participants before program had worse physical functions as manifested by lower BI ($p < 0.0001$) and IADL scores (p=0.0003) and higher EQ-5D-3L scores due to worse quality of life ($p < 0.0001$), indicating a preference for the hospital care. However, pre-test scores such as swallowing function (by FOIS, p=0.0596) and nutritional status (by MNA, p=0.3172) did not appear to influence the selection of care setting for participants individuals. Participants' physical function status and quality of life increased significantly in the hospital care at post-test scores (all $p < 0.05$). In contrast, the BI, FOIS, and EQ-5D-3L scores (all $p < 0.0001$) increased significantly with post-tests in the home care setting.

Post-test scores significant improvements were noted in both hospital and home care settings. Hospital care participants showed substantial gains in physical function status and quality of life, with all measures demonstrating statistical improvements (all $p < 0.05$). In the home care setting, participants experienced significant increases in BI, FOIS, and EQ-5D-3L scores (all $p < 0.0001$), indicating enhanced daily living activities, swallowing function, and quality of life.

The results of the differences on physical function and quality of life between care settings after the program are reported in Figure 2. Both settings demonstrated positive outcomes, with notable improvements across most functional

Table 2 Among Baseline (Pre) Tests and Post PAC-IPCP Program Tests Between Hospital and Home Care Settings

Tool	Hospital Care (*n* = 138)			Home Care (*n* = 72)			Between Settings
	Baseline (Pre-Tests)	Post-Tests	*p* value[a]	Baseline (Pre-Tests)	Post-Tests	*p* Value[a]	*p* Value[b]
BI	33.62 ± 18.35	66.70 ± 24.24	<0.0001	47.78 ± 20.28	76.39 ± 21.60	<0.0001	<0.0001
FOIS	4.94 ± 1.85	6.45 ± 1.05	<0.0001	5.53 ± 1.38	6.78 ± 0.56	<0.0001	0.0596
MNA	11.86 ± 1.12	11.29 ± 2.72	0.0011	11.86 ± 1.14	11.68 ± 1.73	0.4571	0.3172
EQ-5D-3L	11.14 ± 1.77	8.83 ± 2.35	<0.0001	10.06 ± 1.56	8.06 ± 1.80	<0.0001	<0.0001
IADL	1.74 ± 1.34	2.43 ± 1.70	<0.0001	2.53 ± 1.60	2.83 ± 1.88	0.2426	0.0003

Notes: a=Within care setting after PAC-IPCP program; b=Between care setting before PAC-IPCP program, Method: Wilcoxon signed rank rest[a], Mann–Whitney U test[b].
Abbreviations: BI, Barthel Index; FOIS, Functional Oral Intake Scale; MNA, Mini Nutritional Assessment; EQ-5D-3L, European Quality of Life Five Dimensions Questionnaire 3 Level Version; IADL, Instrumental Activity Daily Living scale.

measures. Importantly, these improvements were not statistically significant differences when comparison the effectiveness of the program between care settings, with neither showing superiority over the other in the measures evaluated.

A comparative analysis of care setting selection based on various assessment tools was conducted to evaluate care settings before the implementation of the PAC-IPCP program are reported in Table 3. Prior to the implementation of the PAC-IPCP

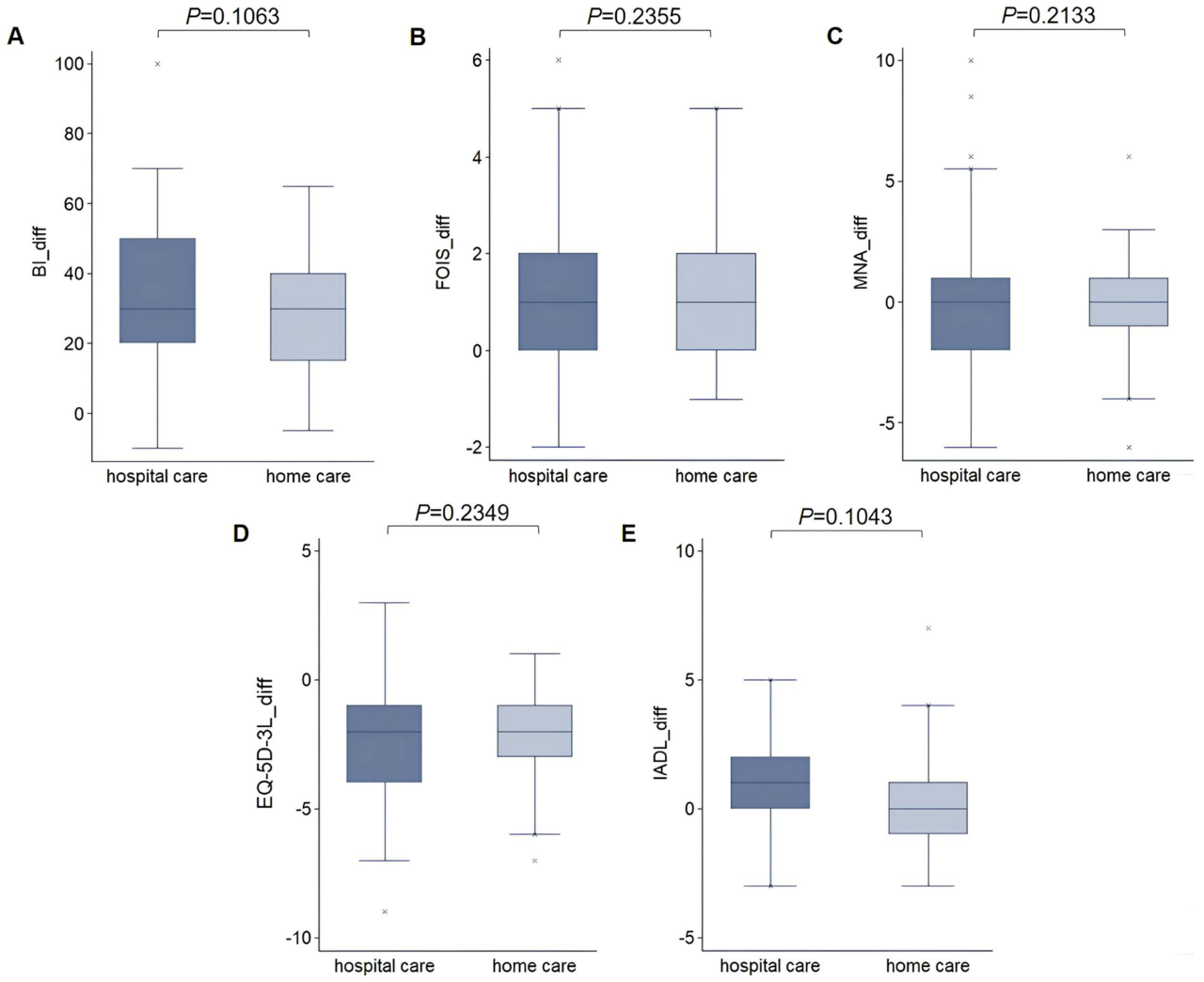


Figure 2 Comparing the change of various assessment tools in PAC-IPCP program between hospital and home care settings. (**A**) BI; (**B**)FOIS; (**C**) MNA; (**D**) EQ-5D-3L; (**E**) IADL.

Table 3 Odds Ratios for Impact of Selection of Care Setting Before the PAC-IPCP Program Using Logistic Regression

	Crude OR (95% CIs)	*p* value	Adjusted OR (95% CIs)[#]	*p* value
BI	1.04 (1.02,1.05)	<0.0001	1.04(1.02,1.07)	<0.0001
FOIS	1.24 (1.03,1.50)	0.0211	1.20(0.97,1.48)	0.0900
MNA	1.01 (0.78,1.30)	0.9704	0.89(0.64,1.24)	0.4773
EQ-5D-3L	0.68 (0.57,0.82)	<0.0001	0.68(0.54,0.84)	0.0005
IADL	1.45 (1.18,1.79)	0.0004	1.43(1.14,1.79)	0.0021

Note: [#] Adjusted ORs were adjusted with age group, sex, BMI group, stroke type, NIHSS group, and selected risk factors (smoking, alcohol, HTN, DM, heart disease, dyslipidemia and previous stroke).

program, significant differences were observed in BI, EQ-5D-3L, and IADL scores between two settings (all $p < 0.05$). For each unit increase in BI and IADL scores, the odds of receiving home care setting increased by approximately 4% and 43%, respectively (adjusted OR:1.04, 95% CI:1.02–1.07, $p < 0.0001$ vs adjusted OR:1.43, 95% CI:1.14–1.79, $p = 0.0021$). For each unit decrease in EQ-5D-3L score (indicating a poorer quality of life), the odds of receiving home care setting decreased by approximately 32% (adjusted OR:0.68, 95% CI:0.54–0.84, $p = 0.0005$).

Figure 3 show the sensitivity of various assessment tools using ROC analysis. According to the area under the ROC curves, the BI (AUC = 0.7557), EQ-5D-3L (AUC = 0.7253) and IADL (AUC = 0.7064) demonstrated higher sensitivity. In contrast, the FOIS (AUC = 0.6698) and MNA (AUC = 0.6218) demonstrated lower sensitivity. The results indicate that BI, EQ-5D-3L, and IADL are more sensitive tools for selecting care settings.

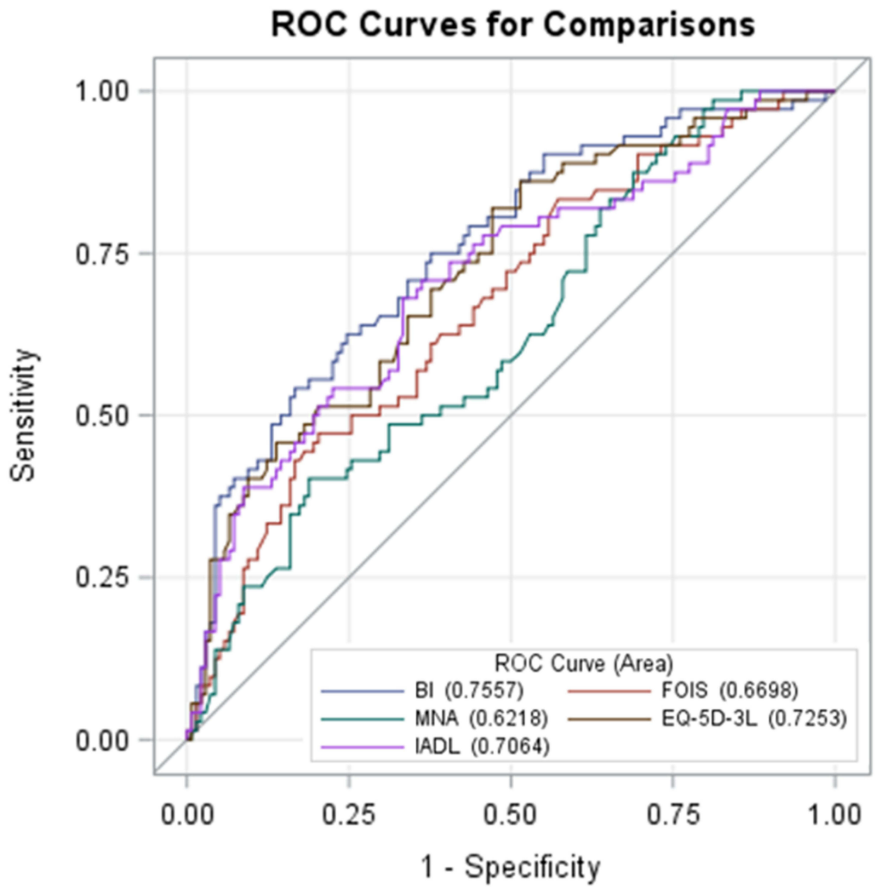
Discussion

This study indicated the stroke survivors in PAC-IPCP program had different characteristics in different care settings. Moreover, of all the assessment tools (BI, EQ-5D-3L, and IADL) are particularly sensitive and effective for selecting appropriate care settings for stroke survivors. Especially, the BI demonstrates quality sensitivity in measuring physical functions and improvements between hospital and home care setting. Therefore, the BI scores may offer objective estimation for stroke survivors in selecting the most appropriate care settings.

Franz et al (2020)[28] proposed that interprofessional practice teams are essential for the health promotion and effective management of stroke survivors, improving the efficiency and quality of rehabilitation teams. It has been reported that stroke survivors' functional outcomes related to the post-acute care setting (OR:4.05, 95% CI:3.78–4.33).[29] Our study presented significant functional outcomes, with equally functional improvements between care settings for stroke survivors. We also found that a higher percentage of stroke survivors with greater post-stroke functional impairment select the hospital care setting, and conversely preferred the home care setting. This finding is consistent with studies by Grimley et al (2019)[30] and Stein et al (2020).[31] Although the home care setting was of lower severity, intensity and duration than the hospital care setting, it still show a significant functional improvement in the PAC stroke survivors. Therefore, regardless of the care setting, collaborative interprofessional practice is an important key to promoting improved positive functional outcomes in care settings.

The percentage of stroke survivors in current study had similar results to other countries, such as 54.5% in Korea,[32] 61.2% in the United States,[33] and 66.5% in Japan.[34] Our study compared the hospital and home care settings of the PAC-IPCP program, indicating that a significant portion of stroke survivors (65.71%) selected the hospital care setting. Comparable studies on stroke survivors' choices for care settings indicated that our results are consistent with international trends.[32–34] Therefore, the PAC-IPCP program could prove the broad effectiveness, reinforcing its potential impact on diverse populations and settings.

Our study revealed baseline differences in stroke severity scores between hospital and home care settings. Stroke survivors with moderate to severe disability had significantly higher rates of disability in the hospital care setting than in the home care setting. Previous studies also indicated that patients with more severe disabilities are more inclined to choose hospital-based rehabilitation due to the availability of medical interventions and advanced rehabilitation



ROC Contrast Estimation and Testing Results by Row		
Contrast	Estimate	P-value
FOIS - BI	-0.09(-0.16,-0.01)	0.0202
MNA - BI	-0.13(-0.21,-0.06)	0.0005
EQ-5D-3L - BI	-0.03(-0.08,0.02)	0.2431
IADL - BI	-0.05(-0.11,0.01)	0.0826

Figure 3 AUC comparison of various assessment tools for Impact of selection of care setting.

equipment.[35] However, this preference has significant resource and cost implications, potentially burdening the health-care system. Our findings indicated that stroke survivors with minor disabilities could benefit as effectively from functional improvements in the home care setting as those with more moderate to severe disability from hospital-based interventions.

Our results indicated that improvements in BI score were significantly different between the hospital and home care settings. A 20-point change in BI score was used as an indicator of significant functional improvement,[36] and the mean total improvement in BI score in the hospital and home care settings exceeded this threshold (33.08 vs 28.61, respectively); this finding also agrees with that of a previous study conducted in Taiwan that reported a mean improvement in BI score of 24.1 in the hospital care setting of the PAC- IPCP program.[37] A Malaysian study reported a BI score improvement of 29.3 in stroke survivors with their first-ever acute stroke after 30 days of rehabilitation,[38] and another study reported a BI to score improvement of 34.21 at a mean of 58.15 days after beginning the hospital care setting of the PAC- IPCP program.[39]

Another study reported that BI can provide more specific information about moderate and severe dysfunction in stroke survivors, with an optimal cut-off of 65 points and 10 points, respectively.[40] Therefore, to enhance the assessment tool, we propose establishing an optimal severity-based cut-off point. This would offer a more effective reference for objectively selecting the care setting and serve as a foundation for improving physiological functioning progress. Additionally, we recommend reviewing the PAC-IPCP program guidelines to specify score thresholds and recommendations for selecting hospital care settings for individuals with higher physiological severity. Conversely, a home care setting is recommended for those with lower physiological severity.

In the clinical setting, the accurate and ready-to-use of simple and changeable assessment tool variables is meaningful because some known influencing factors, such as stroke survivors' sex,[41] age,[41–44] and stroke severity,[16,42–45] cannot be modified by the PAC-IPCP program. It has been reported that the Barthel Index is widely used as an indicator of functional improvement in rehabilitation treatment or assessment of ability to perform activities of daily living.[18,45–47] Multiple features of the assessment tool generate more comprehensive information about the status of stroke survivors than single features of the assessment tool.[47] However, given the heterogeneous nature of the stroke population, Harari et al (2020) advocate the inclusion of multiple predicted outcome measures in research studies was recommended.[48] In the present study, the BI, EQ-5D-3L and IADL had a higher discriminatory power, making them the most important assessment tools for PAC care. These tools effectively quantified stroke functional improvements and made IPCP teams in selecting appropriate care settings for stroke survivors.

The current findings suggest that the results of the assessment tool provide objective and immediate information. However, making decisions about care settings can be challenging for stroke survivors. Studies have shown that stroke survivors experience varying degrees of psychological distress, as well as external influences such as professionals' suggestions, accessibility, continuity and coordination of care, previous experiences of their family and friends, and economic factors.[12] As making decisions, positive thinking, confidence and resilience come from a supportive base of family members and the health care team.[49] Therefore, the IPCP team becomes a partner with stroke survivors in the development and implementation of PAC plans, providing objective and appropriate information. This allows stroke survivors to have more complete information to make decisions and participate in care plans to achieve physical recovery goals.

Limitations

The present study had limitations. First, the present study is a single-center, retrospective design with a limited sample size to detect nuanced improvements in swallowing and nutritional status. Additionally, the retrospective design and self-selection of care settings by participants could introduce bias, affecting the generalizability of our findings. Specifically, the decision-making process among stroke survivors and their families involved multiple biopsychosocial factors that were not fully accounted for, potentially influencing the choice of hospital or home care settings. To address these challenges, multicenter designs and incorporating comprehensive biopsychosocial factors into analyses could increase the generalizability of findings and better capture nuanced improvements in swallowing and nutritional status in the future research.

Additionally, this study is the lack of language diagnosis assessments. A system review article had indicated the importance of accurately assessing dysarthria severity in stroke patients may affect impact stroke recovery and rehabilitation outcomes.[35] Therefore, language disorders, such as dysarthria, should be considered in the future research. Moreover, although we had excluded the neurological or stroke-related complications within three days prior to enrollment, unmeasured complications, such as infections, may affect the rehabilitation process during the study periods. Unrecognized or untreated infections had been demonstrated a key risk factor impacted the rehabilitation process.[50] The future study should include the management of such complications.

Furthermore, our study did not evaluate the impact of arrhythmias on stroke recovery using cardiac monitoring, such as holter electrocardiography. Previous studies had indicated the higher ACEF risk scores predict a greater risk of arrhythmias, highlighting the importance of cardiac monitoring in stroke patients, especially those at high risk.[51,52] Thus, routine use of Holter ECG helps detect arrhythmias early and guide more targeted interventions to prevent adverse cardiac events during stroke recovery.[53] Future research should consider incorporating comprehensive cardiac monitoring

and language diagnosis assessments to more accurately evaluate the effectiveness of interventions and improve rehabilitation outcomes.

Conclusion

The results of the present study provide evidence that the PAC-IPCP program in promoting improved physical function status and quality of life for stroke survivors, despite the selection to select different options for care settings. In particular, the BI, EQ-5D-3L, and IADL assessment tools proved to be the most sensitive in assessing functional severity and progression in stroke survivors. However, gaps remain in the intensity of training for swallowing and nutritional status. Therefore, future interventions must address this gap to ensure overall physiological functions recovery.

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Disclosure

The authors report no conflicts of interest in this work.

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