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Post-acute care regains quality of life among middle-aged and older stroke patients in Taiwan

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ABSTRACT

Objective: This study aims to evaluate health-related quality of life (HRQoL) of middle-aged and older stroke patients receiving the stroke post care (PAC) program and to identify possible predictors.
Design, setting and participants: This is a retrospective cohort study. Demographic characteristics and functional outcomes (modified Rankin Scale, Barthel Index, Mini-Mental State Examination, and the Concise Chinese Aphasia Test) were collected at enrollment. EQ-5D HRQoL questionnaires were administered at the beginning and the end of PAC, and health state utilities were compared.
Results: The EQ-5D utilities of stroke patients aged 75–84 years and 85 years or above were estimated to be 0.091 and 0.159 lower than those aged less than 50 years. A decrease of the utility by 0.075 was observed among patients with the prior history of stroke. The EQ-5D utilities of patients having Barthel Index of 21–40, 41–60, and 61–100 were 0.1432, 0.1568, and 0.1387 higher than those having Barthel Index of 0–20, respectively. For patients reporting extreme problems in self-care or any dimension of EQ-5D questionnaires prior to PAC, increases in utilities by 0.0733 and 0.2875 were noted. The EQ-5D utility of PAC service duration rose by 0.0733 per one incremental day.
Conclusions and implications: This study provides vital evidence regarding time-varying benefits of PAC services to HRQoL of stroke patients and to identify multiple predictors of HRQoL among stroke patients receiving PAC services. This study thus could serve as good reference to enhance quality of PAC services among stroke patients.

1. Introduction

Stroke incurs significant clinical, economic and social burden internationally. According to the Global Burden of Disease (GBD) in 2013, stroke was responsible for 11.8% of all deaths worldwide, making it the second most common cause of deaths following the ischemic heart disease. Stroke was also the third most common cause of disability with the contribution of 4.5% of disease-adjusted life years (DALYs) from all causes (Feigin, Norrving, & Mensah, 2017). Likewise, stroke was the third leading cause of deaths and the major cause of disability in Taiwan (Hsieh & Chiou, 2014). Having a population of 23 million, Taiwan bore around 80,000 new or recurrent stroke events per annum, and stroke-related medical expenditure has amounted to US $375 million per year and to $32,367 USD for each affected case during the lifetime.

Due to the disabling nature, stroke patients usually need a longer period of time to regain their functional independence, especially in the post-acute stage. Post-acute care (PAC), mainly rehabilitation, has been recognized as one of the most important strategies to restore functional independence of stroke survivors, to reduce hospital readmission rates, and to put a damper on a fueling demand for long-term care needs (Buntin, Colla, Deb, Sood, & Escarce, 2010; Em et al., 2017; Peng et al., 2017). In Taiwan, the National Health Insurance Administration (NHIA) launched the first national PAC program for stroke patients in

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2014. The program focused on interdisciplinary cooperation and a seamless transition between organizations to secure the quality of PAC in Taiwan as the developed programs in other countries (Peng et al., 2017). Taiwan PAC programs now have been expanded to other entities, such as fragility fractures, traumatic brain injuries, heart failure and older adults with frailty. Across programs, regular functional assessment with intensive re-ablement programs through the interdisciplinary team approach was the key for care planning and outcome measurements. In addition to functional recovery, self-reported health-related quality of life (HRQoL) was another critical outcome indicator for stroke survivors receiving PAC services. Despite the importance of HRQoL for stroke survivors, very little was known regarding to the impacts of PAC on it (Algurén, Fridlund, Cieza, Sunnerhagen, & Christensson, 2012; Jeon, Kwon, Kim, & Lee, 2017; Luengo-Fernandez et al., 2013; White et al., 2016); some existing studies were only limited to single-center or regional scale (Algurén et al., 2012; Hamza, Al-Sadat, Loh, & Jahan, 2014; Katona, Schmidt, Schupp, & Graessel, 2015; Lai et al., 2017; Wang et al., 2017).

Therefore, extended from our previous study which probed into functional outcomes, subsequent healthcare utilization, and mortality of the PAC program in Taiwan (Peng et al., 2017), the main purpose of this study was to evaluate changes of HRQoL and health state utilities at different time points of stroke survivors who participated in the PAC program and to identify factors associated with these changes.

2. Methods

2.1. National stroke PAC program

Taiwan's NHIA initiated the pilot stroke PAC program in 2014 to ensure stroke patients with rehabilitation potential receiving sufficient post-acute rehabilitation and continuing care. The PAC program is an inter-organizational integrated care model that tertiary medical centers have to refer patients in need of PAC services to community hospitals. This national PAC program also required participating hospitals to create single contact windows between case managers of allied hospitals. Moreover, patients with rehabilitation potential, i.e. meeting the following criteria may be enrolled for PAC programs: (1) acute stroke, either ischemic or hemorrhagic, (2) within 30 days of stroke occurrence, and (3) with their modified Rankin Score (mRS) from 2 to 4. Following an organized national training program launched by NHIA, PAC services activated and interdisciplinary teams at community hospitals started to provide stroke PAC services. Moreover, NHIA required all participating hospitals to complete comprehensive functional assessment for all stroke PAC participants and to secure the intensity of rehabilitation. To the maximum, patients may receive 12 weeks of PAC services in community hospitals, and results of functional assessments were submitted to the NHIA after PAC services.

2.2. Study design and study participants

Extended from our previous study (Peng et al., 2017), this was a retrospective study assessing health state utilities of patients receiving PAC services in Taiwan. Data of all patients enrolled for stroke PAC services during 2014–2015 were obtained for analysis. The EuroQol-5 dimensions (EQ-5D) questionnaire was administered to all participants before and after PAC services (Golomb, Vickrey, & Hays, 2001). Those who completed the questionnaire surveys constituted the study population of this study.

2.3. Demographic characteristics of index stroke admission

Index stroke admission was defined as the first stroke admission identified during the study period. The information including demographic characteristics (age and sex), Charlson's comorbidity index (CCI), admissions for stroke within a two-year period prior to the index stroke admission, and the characteristics of index stroke admission (type of stroke, severity of stroke, length of stay, and stroke unit care) was collected in this study. Stroke was classified into ischemic and hemorrhagic stroke according to the International Classification of Disease, 9th Edition, Clinical Modification (ICD-9-CM) codes. Severity of stroke was assessed by using the modified Rankin Scale (mRS) (Quinn, Dawson, Walters, & Lees, 2009). Results of the mRS ranged from zero (no symptoms) to six (death), with a higher score indicating a greater level of disability.

2.4. Outcome measures

In this study, functional status of each participant was assessed at enrollment of the PAC program by the instruments stated as follows. To begin with, the mRS was applied to measure the degree of disability or dependence (Farrell, Godwin, Richards, & Warlow, 1991). Secondly, the Barthel Index (BI) was used to measure 10 personal activities of daily living regarding self-care and mobility, including control of bowels and bladder, grooming, toilet use, feeding, transfers, walking, dressing, stairs climbing, and bathing. The BI scores range from 0 to 100, and a lower score indicated a greater degree of dependence (Mahoney & Barthel, 1965). Thirdly, Chinese version of Mini-Mental State Examination (MMSE) was employed to evaluate cognitive function (Folstein, Folstein, & McHugh, 1975), and scores less than 24 were regarded as cognitive impairment (Tombaugh & McIntyre, 1992). Last, the Concise Chinese Aphasia Test (CCAT), which comprised nine subtests, including simple response, expository speech, matching, auditory comprehension, naming, reading comprehension, repetition, copying, and spontaneous writing, was used to assess aphasia in Mandarin Chinese, and the response to each subset was scored through a 12-point multidimensional scoring system (Zhong, Li, & Zhang, 2003).

As for the assessment of HRQoL, the validated Taiwanese version of EQ-5D-3L was employed in this study (Chang et al., 2007). Five dimensions related to quality of life, i.e. mobility, self-care, usual activity, pain/discomfort, and anxiety/depression, were evaluated in the EQ-5D. Each dimension consisted of three levels of severity (none, moderate, extreme), and patients were asked to classify and rate their pre- and post-PAC health status. We further transformed those raw scores to preference-based health state utilities through the previously published Taiwanese valuation set for EQ-5D health states using the time trade-off (TTO) method. All health state utilities laid between -1 and 1, with 1 being of full health, 0 of death, and negative number of health states worse than death (Lee et al., 2013).

2.5. Data analysis

Descriptive statistics were used to investigate the effect of the PAC program on EQ-5D utility for cases at enrollment and the end of the PAC program. The pre- and post- PAC EQ-5D utilities were expressed as mean and inter-quantile range (IQR, in parentheses) in the context. The Kruskal–Wallis test and the Wilcoxon rank-sum test were carried out to compare the changes of the pre- and post- PAC program EQ-5D utilities across different groups of the cases.

In order to recognize the variables that predict health state utility in the multivariate context, we first employed multiple logistic regression to select possible independent variables that were significantly associated with HRQoL, and performed multiple linear regression analysis with the EQ-5D health state utility as the dependent variable to estimate the effect of PAC services on HRQoL. The non-standardized regression coefficient beta of each predictor was displayed. The significance level was set at 0.05, and all data were analyzed using SAS, version 9.1.3 (SAS Institute Inc, Cary, NC).

Table 1
Baseline Characteristics of Stroke Patients Receiving Post-acute Care.

Baseline demographics and characteristics of index stroke admission	PAC case (N = 1522)
Baseline Demographics	
Age in y, mean (IQR)	65.6 (57–75)
< 50, %	11.7
50–64, %	36.2
65–74, %	26.1
75-84, %	21.0
85+, %	5.0
Male, %	62.9
CCI, mean (IQR)	1.8 (0–3)
0, %	36.4
1–2, %	36.1
3–4, %	16.9
5+, %	10.6
Admission due to stroke in the past 2 years, %	8.9
Characteristics of index stroke admission	
Type of stroke	
Hemorrhagic stroke, %	19.2
Ischemic stroke, %	80.0
Others, %	0.8
Severity	
mRS 2, %	6.1
mRS 3, %	19.9
mRS 4, %	74.0
Length of stay, mean (IQR)[a]	15.1 (9-20)
ICU care, %	94.7

3. Results

3.1. Baseline demographics and characteristics of index stroke admission

Data of 1522 cases who met the inclusion criteria and were enrolled in the PAC program were retrieved for this study. The baseline demographic characteristics of index stroke admissions of those who participated in the PAC program were encapsulated in Table 1 and our previous study (Peng et al., 2017). Most PAC cases were middle-aged (50–64 years) and the mean age of the study participants was 65.6 years. Men accounted for more than half of those who received stroke PAC. As for characteristics of index stroke admissions, 80% of strokes were ischemic. Almost all cases were admitted to stroke units for comprehensive stroke care at the acute stage, and three-quarters of those participants were with moderate-to-severe disabilities defined as being unable to attend to own bodily needs without assistance, and unable to walk without assistance.

3.2. EQ-5D utility

The pre- and post-PAC EQ-5D utilities were synopsized in Table 2. We further displayed the six-week progress in EQ-5D utilities during the program (Fig. 1) due to the facts that approximately 60% of enrollees completed PAC services at the end of the sixth week. The benefits of the PAC program to health state utilities were significantly greater in men, in those without the prior history of stroke admissions, in those with hemorrhagic strokes, and in those reporting extreme problems in any dimensions of EQ-5D questionnaire. Among patients grouped into various categories based on age, CCI, severity of stroke, and Barthel Index, advantages of the PAC program to health state utilities were significantly different.

In Table 3, results of the multivariate linear regression analysis revealed that older age, especially those aged older than 75 years, and with prior history of stroke were less likely to be benefited from PAC services. The EQ-5D utilities of patients aged 75–84 years and 85 years or above were estimated to be 0.091 and 0.159 lower than those aged less than 50 years. As for patients with the prior history of stroke, a mean decrease in the utility by 0.075 was observed. Patients with greater ADL independence at enrollment gained considerably more advantages from the program. The EQ-5D utilities of patients having Barthel Index of 21–40, 41–60, and 61–100 were measured to be 0.1432, 0.1568, and 0.1387 higher than those having Barthel Index of 0–20, respectively. It was also noteworthy that the PAC program was of greater benefits to patients reporting extreme problems in self-care or any dimension of EQ-5D questionnaires before PAC services, with increases in utilities by 0.0733 and 0.2875, respectively. Furthermore, the longer the patients stayed in the PAC services, the more benefits they gained from the program. The utility was estimated to increase by 0.0733 per incremental day of the program duration.

4. Discussion

In Taiwan, the PAC services started in 2007, which was limited to older veterans with functional care needs, and the positive results triggered this national PAC program (Chen et al., 2010; Lee et al., 2011, 2012). Nevertheless, the post-acute care needs were usually underestimated and early referrals may be of greater clinical benefits (Chou et al., 2012; Young & Green, 2010). Despite the fact that PAC programs have been developed over the past decades worldwide, previous studies placed great emphases on post-stroke functional outcomes but not patients' self-reported HRQoL (Algurén et al., 2012; Jeon et al., 2017; Luengo-Fernandez et al., 2013; White et al., 2016) or were limited to single-center or regional scale (Hamza et al., 2014; Katona et al., 2015; Lai et al., 2017; Wang et al., 2017). Before this study, only several single-centered studies in Taiwan have tried to evaluate the benefits of PAC program (Lai et al., 2017; Wang et al., 2017). To the best of our knowledge, this is the first study to evaluate the time-varying benefits of PAC services to HRQoL of stroke patients and to identify possible predictors of HRQoL among stroke patients receiving PAC services. By obtaining utility values of different health states through the social value set of Taiwan for demonstrating preferences and perception of stroke patients receiving PAC for their HRQoL, results of this current study thus substantially filled the existing knowledge gap.

Factors including age, sex, functional status, socioeconomic status, education level, smoking, psychomotor impairment, severity of stroke, stroke recurrence, cardiovascular disease (such as hypertension or angina), and other medical comorbidities (such as arthritis), have been reported to exert influences on HRQoL in stroke survivors (Algurén et al., 2012; Franceschini, Porta, Agosti, Massucci, & group, 2010; Guajardo et al., 2015; Haghgoo, Pazuki, Hosseini, & Rassafiani, 2013; Jeon et al., 2017; Luengo-Fernandez et al., 2013; White et al., 2016). Previous studies reported that age, socioeconomic status, risk of falls being reduced at the early stage, anxiety and depressive symptoms being sufficiently treated, severity of stroke, patients' ADL, psychomotor impairment, spouse as the primary caregiver, and hospital treatment charge were all possible predictors of better HRQoL in stroke patients receiving rehabilitation or PAC (Hamza et al., 2014; Katona et al., 2015). In this study, results showed that age, prior stroke, patients' ADL, psychomotor impairment, and duration of the PAC services were the prognosticators. Apparently, consensus regarding factors affecting HRQoL for stroke survivors was still lacking, which may be explained by biological factors, socioeconomic status, cultural environments, and inconsistent standards in rehabilitation or the PAC program across countries (Jeon et al., 2017).

As one of the most frequently used preference-based instruments for measuring health state utilities, EQ-5D has been considered responsive to detect health status changes related to stroke, especially functional improvement of stroke survivors undergoing rehabilitation (Payakachat, Ali, & Tilford, 2015). Previous studies in Taiwan focused on the functional outcomes of PAC program, and HRQoL measured

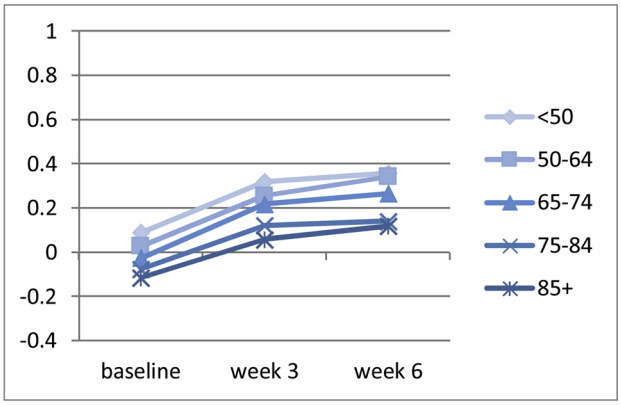
Table 2
EQ-5D utility among stroke patients receiving post-acute care.

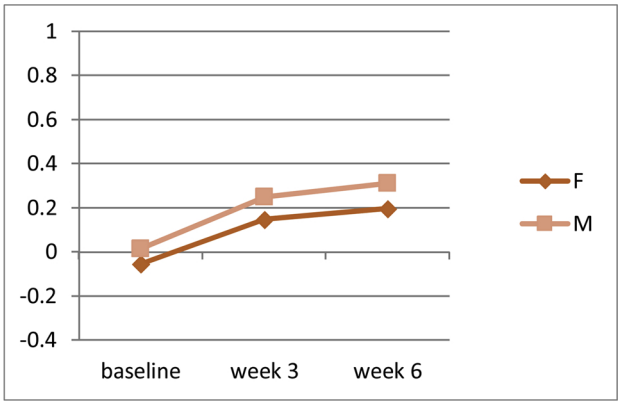
Baseline characteristics	N	EQ-5D utility, mean (IQR)		Change	*p*-value[b]
		Baseline[a]	Discharge from post-acute care		
Overall	1522	−0.003 (−0.28 to 0.29)	0.30 (0.13–0.56)	+0.31 (0 to +0.55)	–
Gender					
Female	564	−0.06 (−0.28 to 0.16)	0.23 (−0.03 to 0.44)	+0.29 (0 to +0.53)	0.05[c]
Male	958	0.03 (−0.26 to 0.32)	0.35 (0.16–0.57)	+0.32 (0 to +0.56)	
Age					
< 50	178	0.10 (−0.15 to 0.44)	0.43 (0.29–0.65)	+0.33 (+0.01 to +0.57)	< 0.01
50–64	551	0.03 (−0.26 to 0.32)	0.37 (0.16–0.61)	+0.33 (+0.03 to +0.57)	
65–74	398	−0.02 (−0.28 to 0.29)	0.30 (0.13–0.56)	+0.33 (+0.03 to +0.54)	
75–84	319	−0.07 (−0.28 to 0.16)	0.18 (−0.13 to 0.44)	+0.25 (0 to +0.45)	
85+	76	−0.11 (−0.41 to 0.13)	0.10 (−0.13 to 0.44)	+0.21 (0 to +0.45)	
CCI					
0	554	0.01 (−0.26 to 0.32)	0.34 (0.16–0.57)	+0.33 (+0.03 to +0.57)	0.02
1–2	548	−0.02 (−0.28 to 0.29)	0.29 (0.13–0.56)	+0.31 (0 to +0.57)	
3–4	258	−0.001 (−0.27 to 0.29)	0.27 (0.02–0.56)	+0.27 (0 to +0.46)	
5+	162	0.003 (−0.26 to 0.32)	0.27 (−0.01 to 0.56)	+0.27 (0 to +0.45)	
History of stroke admission					
no	1387	−0.001 (−0.28 to 0.29)	0.31 (0.13–0.56)	+0.31 (0 to +0.56)	0.01[d]
yes	135	−0.03 (−0.28 to 0.29)	0.21 (−0.13 to 0.44)	+0.24 (0 to +0.44)	
Stroke type					
Hemorrhage	293	−0.04 (−0.38 to 0.29)	0.32 (0.16–0.52)	+0.36 (+0.08 to +0.57)	0.01[e]
Ischemic	1217	0.006 (−0.26 to 0.29)	0.30 (0.13–0.56)	+0.30 (0 to +0.54)	
Severity					
mRS 2	93	0.38 (0.16–0.61)	0.61 (0.45–0.81)	+0.22 (0 to +0.37)	< 0.01
mRS 3	303	0.24 (0.13–0.44)	0.52 (0.41–0.73)	+0.27 (0 to +0.45)	
mRS 4	1126	−0.10 (−0.30 to 0.16)	0.22 (−0.03 to 0.44)	+0.32 (0 to +0.57)	
Barthel ADL index					
0–20	436	−0.25 (−0.41 to −0.13)	0.04 (−0.26 to 0.44)	+0.29 (0 to +0.57)	< 0.01
21–40	457	−0.08 (−0.28 to 0.14)	0.30 (0.14–0.44)	+0.39 (+0.12 to +0.60)	
41–60	330	0.13 (−0.13 to 0.41)	0.43 (0.29–0.61)	+0.29 (+0.02 to +0.52)	
61–100	299	0.33 (0.16–0.49)	0.56 (0.44–0.81)	+0.22 (0 to +0.37)	
EQ-5D					
Extreme problems in mobility	516	−0.34 (−0.41 to −0.18)	0.08 (−0.18 to 0.44)	+0.42 (+0.11 to +0.70)	< 0.01[f]
Extreme problems in self-care	766	−0.27 (−0.41 to −0.13)	0.14 (−0.13 to 0.44)	+0.41 (+0.12 to +0.69)	< 0.01[f]
Extreme problems in usual activities	788	−0.26 (−0.41 to −0.13)	0.15 (−0.13 to 0.44)	+0.41 (+0.12 to +0.69)	< 0.01[f]
Extreme pain/discomfort	117	−0.50 (−0.67 to −0.39)	−0.02 (−0.41 to 0.29)	+0.48 (+0.14 to +0.81)	< 0.01[f]
Extreme anxiety/depression	167	−0.44 (−0.67 to −0.28)	0.03 (−0.28 to 0.32)	+0.48 (+0.14 to +0.79)	< 0.01[f]
Cognitive impairment					
MMSE ≦ 24	1004	−0.07 (−0.28 to 0.16)	0.24 (−0.03 to 0.44)	+0.31 (0 to +0.57)	0.8
Communication impairment					
CCAT < 11	699	−0.07 (−0.28 to 0.16)	0.24 (−0.03 to 0.52)	+0.30 (0 to +0.54)	0.3

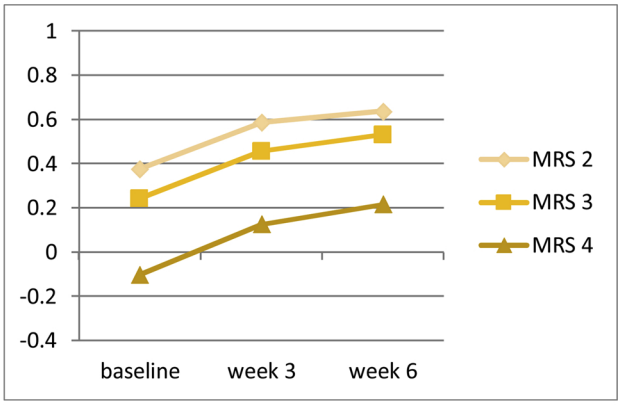
[a] Baseline here indicates discharge from the acute care for stroke.
[b] results from Kruskal–Wallis test except specifically mentioned.
[c] Wilcoxon rank sums test (two-sided), compared to female.
[d] Wilcoxon rank sums test (two-sided), compared to those without history of stroke admission.
[e] Results for other types of stroke (N = 12) not present in the table.
[f] Wilcoxon rank sums test (two-sided), compared to those reporting no or moderate problems.

through EQ-5D of stroke patients were confined to regional or single-center level. Although results of previous studies did show that PAC program lowered the EQ-5D raw scores and ameliorated participants' HRQoL, it was still unclear whether these changes were clinically meaningful and the extent of differences in EQ-5D index to achieve genuine qualitative improvement (Lai et al., 2017; Wang et al., 2017). This nationwide study thus measured changes of preference-based health state utilities through the previously published Taiwanese valuation set for EQ-5D health states using the TTO method. Overall, the results demonstrated that the EQ-5D index increased by 0.31 during the PAC program. Compared to previous studies reporting minimal clinically important differences of ED-5D-5L in stroke patients in Taiwan (Chen et al., 2016) through anchor-and distribution-based methods and of EQ-5D-3L in Korea (Kim, Kim, Jo, & Lee, 2015) through anchor-based method, our results showed significantly larger improvement than both of them (0.10 in Taiwan and 0.08 in Korea). Therefore, based on the extent of the changes of EQ-5D index brought by Taiwan's national PAC program, it should be considered clinically and functionally meaningful perceived by patients themselves.

Despite all efforts went into this present study, some limitations should be addressed. First, in this study, EQ-5D questionnaires were only administered to PAC program enrollees, but not patients who refused PAC referrals in the beginning. Therefore, no well-matched controls were available for further comparisons. Second, the study participants were relatively younger than usual stroke population. However, older patients usually require more intensive rehabilitation and clinical management due to multiple complex comorbid conditions. Therefore, the overall benefits of PAC services in health state utility may be greater in older patients. Third, we were not able to evaluate long-term benefits of PAC services due to the lack of longitudinal data. However, long-term benefits of PAC services may be projected by the improvement of HRQoL for stroke patients at post-acute stage.







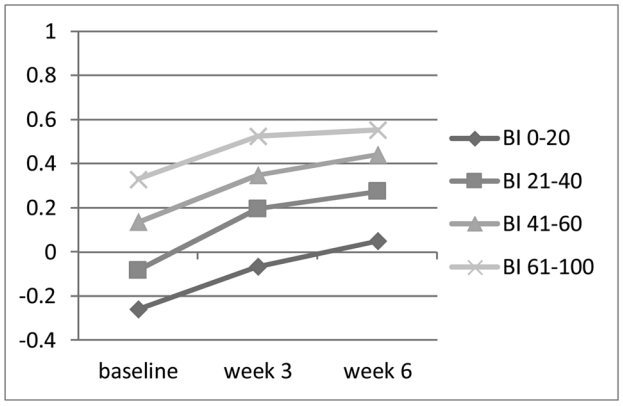


Fig. 1. Mean of EQ-5D utility assessed prior to and during the PAC program.

Table 3
Multivariate linear regression analysis of EQ-5D utility in stroke patients receiving postacute care.

Variable	Beta	*p*-value
Intercept	−0.006	0.9
Age		
< 50	1	–
50–64	−0.003	0.9
65–74	−0.024	0.4
75–84	−0.091	< 0.01
85+	−0.159	< 0.01
Stroke history	−0.075	< 0.01
Severity		
MRS 2	1	–
MRS 3	0.006	0.8
MRS 4 (worse)	−0.072	0.06
Barthel ADL index		
0–20 (worse)	1	–
21–40	0.1432	< 0.01
41–60	0.1568	< 0.01
61–100	0.1387	< 0.01
EQ5D: Extreme problems in self-care	0.0733	< 0.01
EQ5D: Reporting extreme problems in any dimension	0.2875	< 0.01
Duration of PAC (day, per one increase)	0.002	< 0.01

5. Conclusions and implications

In conclusion, patients with greater dependence in ADL and those reporting extreme problems in self-care or in any dimensions of EQ-5D questionnaires obtained considerably more benefits from the PAC program. On the contrary, patients aged older than 75 years and those ever been afflicted with stroke within 2 years prior to the enrollment were found to benefit less from the program. Further research is needed to evaluate the economic burden and survival benefits of the PAC program.

Conflicting interest

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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Author contributions

Hsiao FY and Lu WH contributed to the study concept and design. Hsiao FY, Lu WH and Chen LK acquired and analyzed the data. Hsiao FY, Chen LJ, Lu WH and Chen LK interpreted the data. Chen LJ and Hsiao FY drafted the manuscript. Hsiao FY and Chen LK revised the manuscript. All authors read and approved the final manuscript.

Appendix A. Supplementary data

Supplementary material related to this article can be found, in the online version, at doi:https://doi.org/10.1016/j.archger.2019.04.011.

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