
Assessment of Functional Independence and Quality of Life Among Stroke Survivors: A Pilot Study

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Summary. *Background.* Treatment of people after stroke is usually focused on their survival. However, currently more attention is paid not only to the functional state and survival time, but to the quality of life as an additional measure of condition and the index of treatment effectiveness as well. Quality of life and long term functional independence of stroke patients in Lithuania has been not sufficiently monitored and evaluated.

The aim of the study was to evaluate quality of life, functional independence and patient-related factors among stroke survivors one year following stroke.

Subjects and methods. The study included 21 stroke survivors who had suffered a stroke 12 months earlier and were treated at Department of Neurorehabilitation. Functional independence was evaluated by Functional Independence Measure (FIM), quality of life - by SF-12 questionnaire. Medical, psychosocial and demographic data were collected using study questionnaire.

Results. On average, quality of life among stroke patients one year after stroke was 28.7 pts, FIM score 65.2 pts; most affected functions after one year were walk/wheelchair and climbing stairs. Functional independence was significantly associated with stroke type (hemorrhagic 80.1 pts, ischemic 54.1 pts), use of out-patient procedures (yes 48.0 pts, no 70.6 pts), and sense of vitality (low 56.5 pts, high 87.2 pts). The highest and significant correlation of FIM and SF-12 scales and subscales was among FIM motor subscale and SF-12 physical subscale ($r=0.82$). FIM and SF-12 scales correlate statistically significantly, especially regarding physical functioning.

Conclusion. For individuals who experienced stroke it is essential to ensure an appropriate quality of life, to maintain their social relationships, to have functional independence and the ability to return to work. For patients after in-patient rehabilitation it is necessary to ensure continuity of rehabilitation if our goal is the highest possible level of functional independence.

Keywords: stroke, rehabilitation, quality of life.

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INTRODUCTION

Stroke is the third cause of mortality in Europe, Asia, and North America. It has a huge economic burden and is among the main causes of adult disability [1]. After a stroke, the recovery is distinguished by three stages: acute phase (which takes about two weeks), subacute (lasting for up to six months after stroke), and chronic phase (which lasts for months or even years after stroke; this phase can sometimes last for the rest of life) [2]. Langhorne et al show that the main motor and cognitive recovery occurs during the first weeks after stroke. Gradual functional recovery is observed up to six months after stroke. Later there still is a probability of functional recovery, though minor [3].

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Treatment of people after stroke is usually focused on their survival indicators. However, currently more attention is paid not only to functional state and survival time, but to the quality of life as an additional measure of condition and the index of treatment effectiveness as well [4, 5].

Quality of life and long term functional independence of stroke patients in Lithuania have been not sufficiently monitored and evaluated. Furthermore, the follow-up of stroke patients when they are at home is not so common and their health status as well as quality of life are usually underinvestigated. Additionally, the factors leading to better outcomes in relatively long term (one year and longer) are also under question. There is only fragmented research done in Lithuania in this area, which provides limited information and the quality of life is considered as related to some conventional indicators (e. g., household income, living conditions assessment), that reveal the quality of life only partially [6]. Therefore, the aim of this study was to evaluate the quality of life, functional independence and related factors among stroke survivors within one year after stroke.

SUBJECTS AND METHODS

Study design. Longitudinal study design. 21 patients were prospectively enrolled and interviewed 12 months post stroke at their homes. This study was approved by the Bioethics Center (No. BEC-SLF (B)-67). All participants provided their written informed consent prior to their participation in the study, in accordance with the ethical principles of the Declaration of Helsinki.

Participants. The study included 21 stroke survivors who had suffered a stroke 12 months earlier and were treated at the Department of Neurorehabilitation (Hospital of Lithuanian University of Health Sciences Kauno Klinikos) following stabilization of their clinical condition at the Department of Neurology and Department of Neurosurgery (two weeks after stroke). The inclusion criteria for the study were as follows: residence in Kaunas city and stroke experienced 12 months earlier. The exclusion criterion: Mini-Mental State Examination score of less than 11 points (mild and moderate cognitive impairment).

Interventions. In this study, two questionnaires and one test were conducted to evaluate patients' clinical condition, quality of life, demographic and psychosocial indicators. A general questionnaire was constructed on the basis of previous literature. It included items on age, gender, education, occupation, stroke type, number of strokes, procedures during out-patient rehabilitation, family support, and vitality. The SF-12 quality of life questionnaire was also used. It consists of 12 items that represent 8 domains: physical functioning, role limitations due to physical ailments, role limitations due to emotional problems, social functioning, emotional well-being, energy/fatigue, pain, and general health perceptions. The general score ranges from 0 to 100. The Functional Independence Measure (FIM) was used to estimate the levels of patients' disabilities. It assesses how much assistance is required by a subject to perform activities of daily living. FIM was filled in by an investigator; it contained 18 items – 13 motor tasks and 5 cognitive tasks, rated on a 7-point Likert scale. The total FIM score ranges from 18 (lowest) to 126 (highest) points. The data about patients were collected in twelve months after stroke. The data were collected from patients at their homes. Filling in the questionnaires and evaluation of the FIM test were performed by patients, family members, relatives, or an investigator.

Statistical analysis. Statistical analysis was performed using the software packages MS Excel 2010 and "IBM SPSS Statistics Base 17.0". Quantitative variables are described using the mean±standard deviation (SD), or the median, and interquartile range (IQR), and qualitative variables are described using percentages (%). Comparison of two independent samples was made using the Mann-Whitney U test, and comparison of dependent samples was made using the Wilcoxon signed-rank test. Associations between two continuous or ordinal variables were estimated using Spearman's rank correlation coefficient. Differences were accepted as statistically significant for values of $p < 0.05$.

RESULTS

The study included 21 stroke survivors who had suffered a stroke about 12 months earlier. Patients under study were 70.7 ± 10.57 years old on average. About half of them (47.6%) were 66–75 years old, about a quarter of sample was younger and a quarter was older.

The majority of the patients had experienced one stroke ($n=18$; 85.7%). After discharge from hospital a quarter ($n=5$; 23.8%) of the patients underwent out-patient procedures, while 28.6% ($n=6$) of the patients reported high vitality – they reported having sufficient energy to stay throughout the day. On average, quality of life among study patients was 28.7 pts and the Functional Independence Measure score was 65.2 pts (Table 1).

Most impaired functions (FIM items) one year after stroke were stair locomotion (FIM average 2.14 pts) and walk/wheelchair locomotion (FIM average 2.62 pts). In one-year period, the least progress was observed in eating (from 3.57 to 4.43 pts) and memory (from 3.86 to 4.57 pts) functions. FIM items one year after stroke improved by 1.10 pts on average (Fig. 1).

Comparison of patient-related factors included socio-demographic, medical, and psychosocial indicators. Asso-

Table 1. Characteristics of the study sample

Indicator	Value	n	%
Baseline			
Age	40–65 years	5	23.8
	66–75 years	10	47.6
	76–85 years	6	28.6
	Average	70.7±10.57 (median 72.00; IQR 65.50–79.50)	
Gender	Male	8	38.1
	Female	13	61.9
Stroke type	Ischemic	12	57.1
	Hemorrhagic	9	42.9
Number of strokes	1	18	85.7
	>1	3	14.3
FIM	Average, pts	45.3±9.46 (median 47.0; IQR 39.0–52.0)	
After 12 months			
Education level	Lower than secondary	10	47.6
	Secondary or higher	11	52.4
Out-patient procedures	Yes	5	23.8
	No	16	76.2
Family support	Low	4	19.0
	High	17	81.0
Vitality	Low	15	71.4
	High	6	28.6
SF-12	Average, pts	28.7±17.37 (median 23.0; IQR 15.5–35.5)	
FIM	Average, pts	65.2±24.21 (median 64.0; IQR 43.0–81.5)	

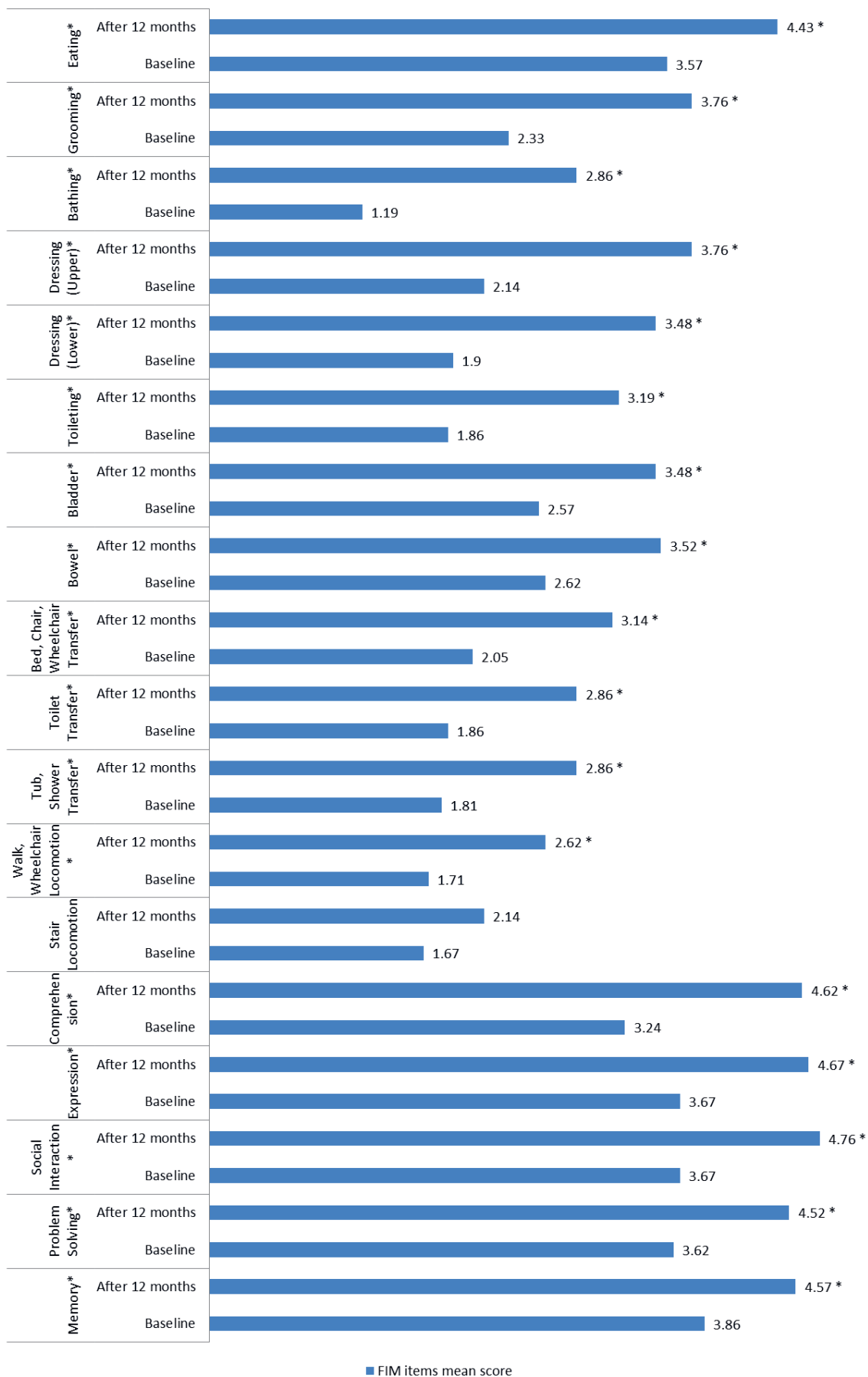


Fig. 1. FIM items mean score at baseline and at 12 months after stroke
 *p<0.05

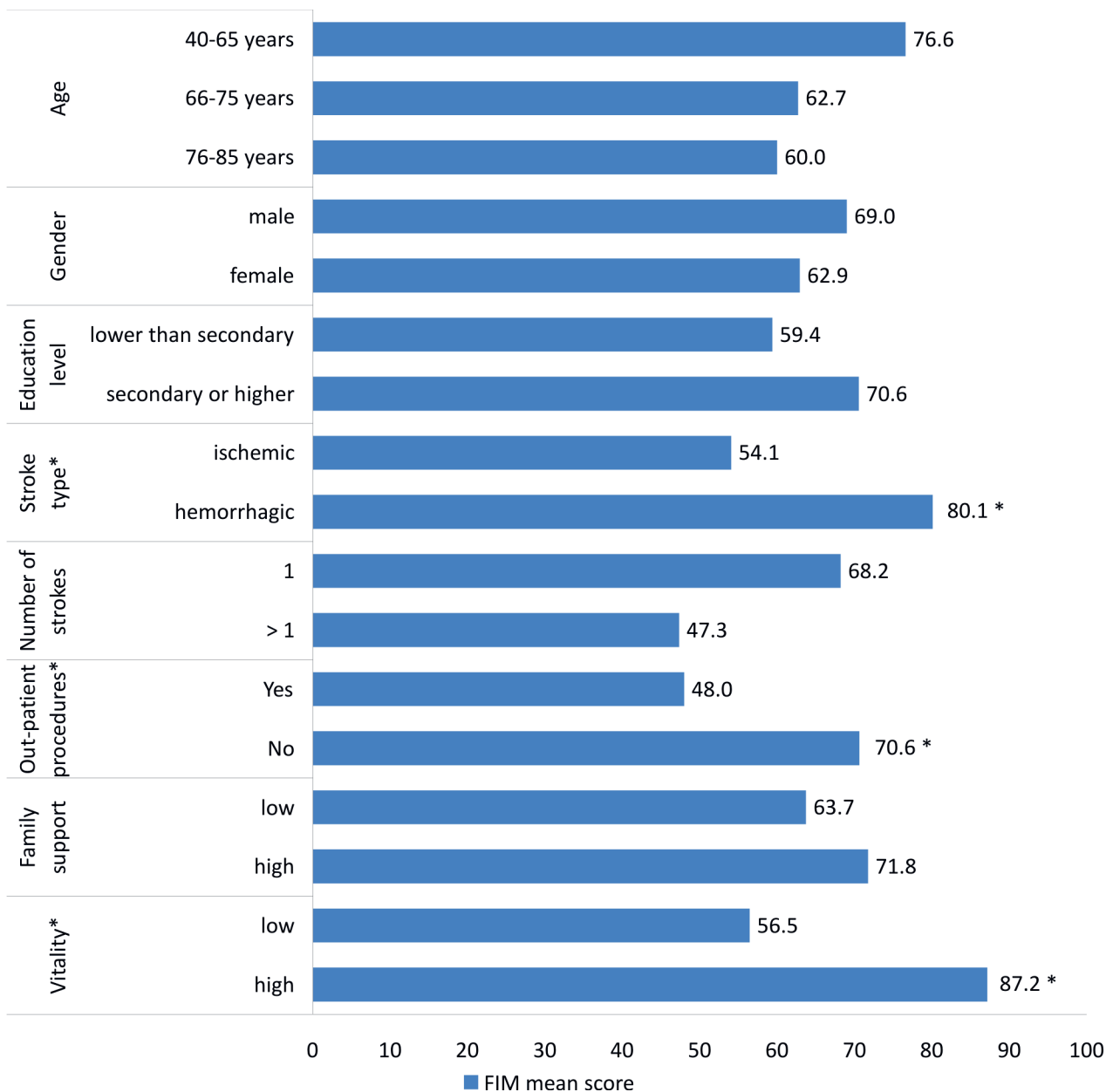


Fig. 2. Functional independence and related factors among stroke survivors one year after stroke

*p<0.05

ciations of these factors with functional independence are presented in Fig. 2. Functional independence analysis showed that it statistically significantly related with stroke type, presence of out-patient procedures, and vitality. Thus, patients who experienced hemorrhagic stroke had statistically significantly better functional condition than in ischemic stroke cases (81.1 vs 54.1 pts, $p=0.019$). Similarly, patients with high vitality had more independence than patients with low vitality (87.2 vs 56.5 pts, $p=0.029$). After discharge from hospital, patients with lower FIM scores underwent more additional out-patient procedures (70.6 vs 48.0 pts, $p=0.047$) than other stroke patients. Overall, functional independence was highest among patients with high vitality (FIM score 87.2 pts, on average), survivors of hemorrhagic stroke (80.1 pts), and 40–65 year old patients (76.6 pts), while the subgroups with the lowest

functional independence were patients with history of more than one stroke (47.3 pts, on average), patients needing out-patient rehabilitation within a year following the stroke (48.0 pts), ischemic stroke cases (54.1 pts), and patients with low vitality (56.5 pts). Analysis of other factors (family support, number of stroke, education level, gender, age) revealed that better functional independence was more common in younger patients, patients with high family support, and secondary or higher education level, though these trends were statistically non-significant ($p>0.05$).

Associations of sociodemographic, medical, psychosocial factors with the quality of life are presented in Fig. 3. Quality of life and education level were statistically significantly related: individuals with secondary or higher education evaluate quality of life better than those with lower

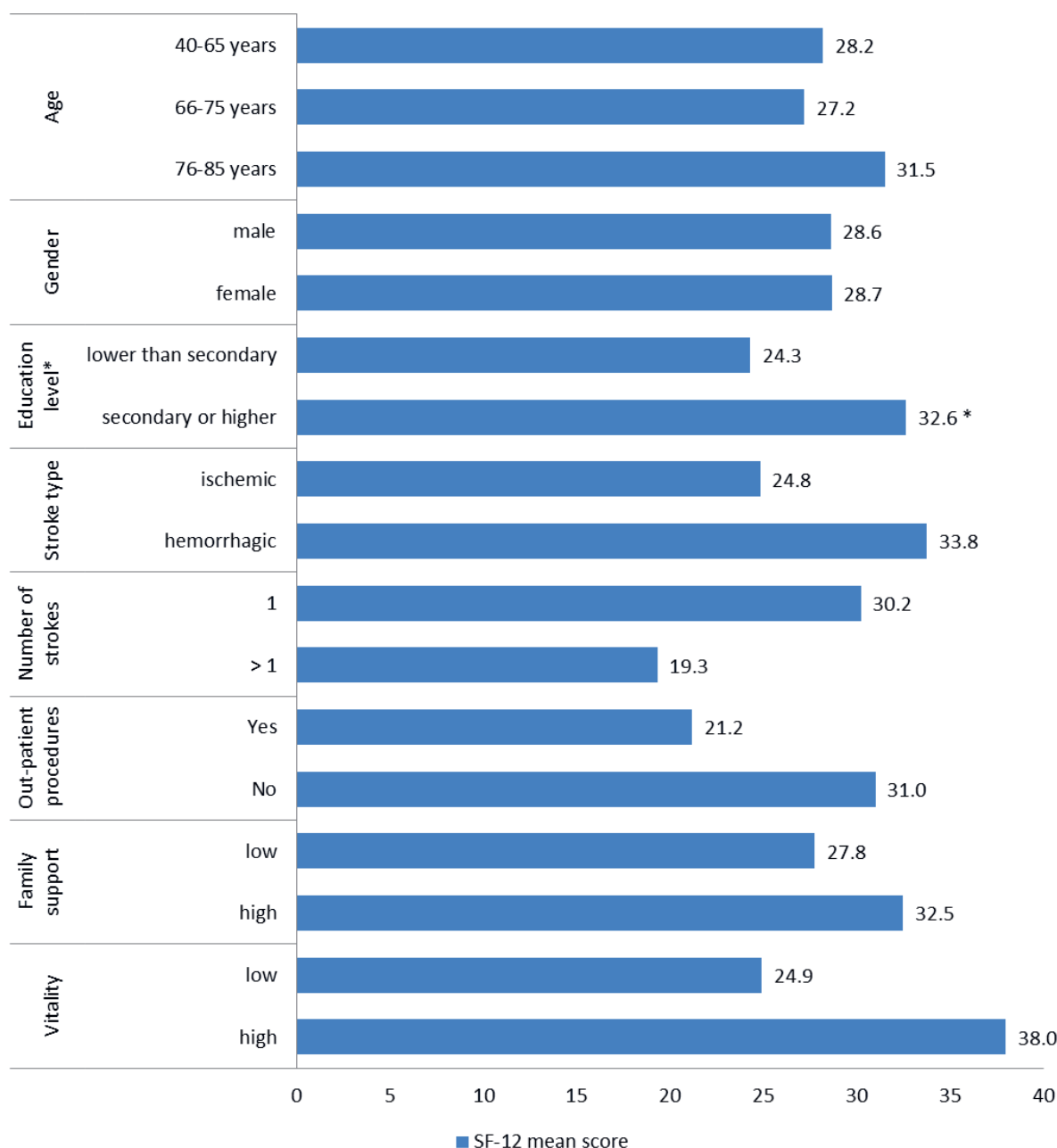


Fig. 3. The quality of life and related factors among stroke survivors one year after stroke

*p<0.05

than secondary education (32.6 pts and 24.3 pts, respectively; $p=0.041$). Other factors revealed statistically non-significant associations, and the trends were such that male age, gender, stroke type, number of stroke, out-patient procedures, family support, and vitality. Subgroup analysis showed that better quality of life is characteristic for patients with high vitality (38.0 pts), high family support (32.5 pts), oldest patients (31.5 pts), hemorrhagic stroke cases (33.8 pts), and patients who suffered only one stroke (30.2 pts). Lower quality of life was observed in patients who suffered more than one stroke (19.3 pts) and who had additional procedures (21.2 pts) after discharge from hospital ($p>0.05$).

Analyzing patient-related factors associated with functional independence and quality of life, we can emphasize

that the most related factors were high vitality (FIM difference was 30.7 pts, SF-12 difference 13.1 pts), hemorrhagic stroke (26.0 pts and 9.0 pts, respectively), patients who did not have out-patient procedures (22.6 pts and 9.8 pts, respectively), and who had suffered one stroke (20.9 pts and 10.9 pts, respectively). The study investigated how the functional independence (as measured by FIM) and the quality of life (as measured by SF-12) correlate in terms of scales and subscales (Table 2).

In general, functional independence and quality of life correlated strongly and statistically significantly ($r = 0.75$). However, interestingly, total FIM score correlated more with physical area ($r = 0.76$) of the quality of life than with the total score or mental subscale. The total quality of life score also correlated more with total FIM score than its

Table 2. **Functional Independence Measure and SF-12 scales and subscales among patients one year following stroke: intercorrelations**

FIM	SF-12		Mental 40.8±16.59	Physical 16.7±21.16	Total 28.7±17.4
Motor 42.1±20.33	r		0.585*	0.824*	0.741*
Cognitive 23.1±5.68	r		0.554*	0.429	0.565*
Total 65.2±24.21	r		0.639*	0.762*	0.755*

*p<0.05

subscales (motor and cognitive). Additionally, FIM Motor subscale most extensively correlated with physical subscale of SF-12 ($r = 0.82$), and this was the highest correlation among all scales and subscales observed. Meanwhile, SF-12 Mental subscale and FIM Cognitive subscale had only moderate correlations with other subscales and total scores.

DISCUSSION

Worldwide, annually about 15 million people suffer a stroke; one third of them die and one third are left permanently disabled [7]. Based on the World Health Organization forecasts, disability-adjusted life lost to stroke will rise from 38 million in 1990 to 61 million in 2020. The estimated costs of stroke in Europe are estimated at 64 billion euros [7]. All this demonstrates a big burden of disease caused by stroke. One third of people after stroke live with some degree of disability. The reason could be too short rehabilitation, absence of home rehabilitation, difficult adaptation at home etc. Patient's functions after stroke usually recover within the first three months and in majority of cases patients are discharged from in-patient to out-patient care if no complications exist. Economic estimates show that a policy of early hospital discharge and home-based rehabilitation for patients with stroke may reduce the use of hospital beds without compromising clinical outcomes: this service is a cost-saving alternative to conventional in-patient stroke rehabilitation for important subgroup of patients with stroke-related disability [8]. Nevertheless, the follow-up of stroke patients when they are at home is not so common and their health status as well as quality of life is usually underinvestigated. Additionally, the factors leading to better outcomes in relatively long term (one year and longer) are also under question. Therefore, our study aimed to evaluate quality of life, functional independence and related factors among out-patients one year following stroke. The study revealed that functional independence among stroke survivors had increased within a year following stroke. It was found that better independence was observed among patients who had hemorrhagic stroke, reported higher vitality, and had no need for out-patient procedures. Also, better functional independence was related with better quality of life as

assessed using SF-12, especially regarding physical and motor skills. However, differently from functional independence, the better quality of life was associated only with higher level of education of patients. This seems to be opposite finding compared with previous studies showing that education does not affect the quality of life [9] or showing a weak relationship with better quality of life [10]. Of note, we have to be careful in extrapolation of our findings across all stroke patients, because about 25–40% of stroke patients die within a year [11]. When we were searching for the subjects for our study we found that 20% of potential subjects were dead one year after stroke. A study in Denmark found that risk of mortality after 4 weeks following a stroke was 28%, after 1 year – 41%, and after 5 years – 60% [12]. Another issue is that those patients who stayed as out-patients during first year were also not involved into our analysis. This means, that our study sample as such represents the strongest survivors cohort rather than the general sample of stroke patients. Additionally, our study patients had an opportunity for home rehabilitation that was outside health care system in general, except some available out-patient procedures in particular. Our study demonstrated that the average improvement of functional independence among stroke survivors was about one third, increasing from 45 to 65 pts, on average, which can suggest that our stroke survivors were in need of minimal assistance (subject performs >75% of the task). Another study showed that after one year post stroke the mean FIM score was from 99 to 112 pts [13], but it included patients with a first stroke, a one-sided supratentorial lesion and aged above 18 (relatively young). Thus, lower scores of our patients could be due to stroke severity and older age. Analysing how stroke affects functional independence (FIM items) we found that after one year post stroke the most impaired were stair locomotion and walk/wheelchair locomotion. Other authors found that one year post stroke the patients still required mild or moderate assistance in dressing, bathing and use of stairs [14]. Perhaps this is due to the fact that all these functions are complex movements requiring good coordination, proprioception, strength, good movement accuracy and precision. Also, many studies worldwide try to establish the factors influencing functional independence. We also tried to analyze factors associated with age, gender, education level, stroke type, number of strokes, out-patient procedures, family support and vitality. Analyzing how functional independence is related with stroke type we found that patients with hemorrhagic stroke were 1.5 times more independent compared to patients with ischemic stroke. Studies in other countries show that individuals with hemorrhagic stroke have more functional, self-sufficiency disorders than those with an ischemic stroke. Persons with comparably serious hemorrhagic stroke make better progress in recovering lost functions than those after ischemic stroke [15]. Canadian researchers found that people after hemorrhagic stroke rehabilitation reached 2.5 times better performance than those after ischemic stroke [16], which is consistent with results of

our study. Italian study revealed that if at the beginning of rehabilitation two patients had the same basal neurological severity, basal functional disability, age, gender, and onset-admission interval, hemorrhagic patients showed better neurological and functional prognosis compared with ischemic ones [17]. Examination of differences in pathophysiological processes between ischemic stroke and hemorrhagic stroke suggests possible explanation of different recovery patterns. Schepers et al. hypothesize that in case of a hematoma the surrounding white matter will be pushed aside more, whereas in an ischemic stroke the metabolism of cerebral tissue is more directly affected by the hypoperfusion [18]. As hematoma resolves and edema diminishes, the brain tissue can partially or wholly restore its function. In ischemic stroke, the recovery depends on tissue repair and location and size of non-irreversibly damaged areas. Slower, more gradual and sustained pattern of recovery in the ischemic stroke group is expected [18]. This shows that better performance of hemorrhagic stroke survivors can have biological basis. We found that patients with higher independence feel more vital during the day. This finding supports one Swedish study of fatigue after stroke, showing that functional independence two years after stroke correlates with lack of energy during the day. Those who felt the lack of energy were more dependent in daily activities [19]. Therefore, vitality can be regarded as a subjective indicator of general performance in patients or even serve as a proxy for functional independence. It is interesting that patients without out-patient procedures after in-patient rehabilitation had higher FIM than those who had these procedures. Patients with lower functional status indicated that they used physical therapy, massage services, rarely occupational therapy. In Lithuania, home rehabilitation to help patients to adapt to home situation is not yet created, though internationally out-patient care is accepted as an essential component of rehabilitative care [20]. Out-patient rehabilitation can be used to help patients maintain functional gains, while ensuring rapid and timely discharge [20]. From this perspective, the findings that show the association between absence of out-patient procedures and better functional independence may be reasonably explained – a patient with better health status and functionality needs less additional procedures to improve it. Additionally, such association can be explained by the self-selection of patients for certain health care procedures. Other factors (age, gender, education level, family support) were not statistically significant in our study, but this can be explained by limited statistical power of our study. Some other studies show that male gender [21], higher education [22], younger age [23], high family support [3, 23] are all related with better functional independence. We found that quality of life was statistically significantly associated only with education level of patients. In our sample, patients with secondary or higher education SF-12 had by 8.3 pts better quality of life than other patients. Some researchers claim that adverse impact of disability on sense of mastery or control after a stroke is substantially reduced in those

with a greater number of years of education [24]. They suggest that it is because the educational resources foster flexible coping skills that empower survivors to adapt to problems and challenges associated with living with disability; in terms of socioeconomic resources, survivors with more education reported greater sense of personal growth, purpose in life, and environmental mastery than survivors with fewer years of education [24]. Similarly, other study included individuals from stroke unit in southern Sweden and found that ability to perform personal and social activities, interests, younger age, education (elementary school) and shorter hospital stay were all related with better quality of life [25]. Other researchers also found that better education was positively associated with quality of life [26]. However, some authors have found that education and quality of life in stroke patients are not related [10, 27]. Analyzing factors such as gender, stroke type, number of strokes, family support, vitality we did not find statistically significant differences. In contrast, other researchers report that patients with hemorrhagic stroke [26], females [26, 28], patients with high family support [26] and high vitality [9] are related with better quality of life. There are scarce reports about relationship between functional independence and quality of life among stroke survivors. We found that they correlated strongly and statistically significantly. The highest correlation among all scales and subscales was between FIM motor subscale and SF-12 physical subscale. It is likely that physical estimates encompass less specific tasks and daily activities therefore they seem similar and show high correlations with different measurement tools. This can be partly supported by a study of FIM and SF-36 in the US [10]. Meanwhile, cognitive and mental subscales measure relatively different functional entities and therefore correlate less between FIM and SF-12, which can also be partly supported by other studies [10]. Some authors suggest that cognitive and communication aspects of independent functioning may contribute to emotional and social aspects of quality of life but very little to physical aspects of it [10]. Another study from India also showed that all domains of quality of life had positive correlation with FIM scores [29]. Our study suggests that quality of life and functional independence are significantly associated and could be useful in evaluation of functional independence as a measurement of quality of life in stroke survivors in Lithuania. It is necessary to educate patients and their relatives about prognostic factors to give better premises for increased independence and better monitoring, particularly of the most impaired functions.

CONCLUSION

Our study showed that for individuals who experienced stroke it is essential to ensure an appropriate quality life, to maintain their social relationships, to have functional independence and the ability to return to work. Thus, for pa-

tients after in-patient rehabilitation it is necessary to ensure continuity of rehabilitation, if our goal is the highest possible level of functional independence.

STUDY LIMITATIONS

Our study had some limitations. Our study included stroke survivors admitted to a rehabilitation hospital, therefore our sample was selected on the basis of the need for physical rehabilitation. Another limitation was that the patients were not investigated in the follow-up throughout the year and only tested one year after stroke. Many factors in our study, which could affect functional independence and quality of life, were statistically non-significant – possibly, these factors could have been established by study with higher statistical power. Nonetheless, the essential strength of our study was the attempt to find the condition of patients and related factors in relatively long term, while many studies on stroke patients are mainly focused on effectiveness of rehabilitation during early period. This question could be further investigated by future studies involving more subjects and following the recovery of patients throughout the year or longer.

Statement of Conflict of Interest

The authors declare no conflict of interest.

Ethics

The study was approved by the Bioethics Center (No. BEC-SLF (B)-67).

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ASMENŲ, PATYRUSIŲ GALVOS SMEGENŲ INSULTĄ, GYVENIMO PILNATVĖS IR SAVARANKIŠKUMO VERTINIMAS: BANDOMASIS TYRIMAS

Santrauka

Tyrimo pagrindimas. Sergančiųjų galvos smegenų insultu gydymas yra sutelktas į jų išlikimą. Pastaruoju metu daugiau dėmesio skiriama ne tik sergančiųjų funkcinei būklei ir gyvenimo trukmei, bet ir tolimesnei išgyvenusių po patirto galvos smegenų insulto asmenų gyvenimo pilnatvei. Duomenų apie Lietuvoje išgyvenusių po patirto galvos smegenų insulto asmenų gyvenimo pilnatvės ir funkcinio nepriklausomumo vertinimą atokiuoju ligos periodu neradome.

Darbo tikslas – įvertinti asmenų, patyrusių galvos smegenų insultą, gyvenimo pilnatvę ir savarankiškumą, praėjus ne mažiau kaip metams po ankstyvos stacionarios reabilitacijos.

Metodai. Tiriamieji buvo prieš metus patyrę galvos smegenų insultą, reabilituoti LSMUL KK Neuroreabilitacijos skyriuje. Tyrimui naudoti anketinės interviu apklausos ir statistinės analizės metodai. Savarankiškumo atsigavimas vertintas pagal funkcinio nepriklausomumo testo (FNT) duomenų kitimą prieš ir po stacionarios reabilitacijos ir praėjus metams po išrašymo iš LSMUL KK Neuroreabilitacijos skyriaus. SF-12 klausimynas buvo naudojamas įvertinti gyvenimo pilnatvę. Papildomas klau-

simynas naudotas siekiant įvertinti su savarankiškumu, gyvenimo pilnatve susijusius veiksnius.

Rezultatai. Tiriamųjų savarankiškumas, pagal FNT, po metų vidutiniškai buvo padidėjęs nuo 45,3 iki 65,2 balo, gyvenimo kokybė, pagal SF-12 klausimyną, buvo vidutiniškai 28,7 balo. Po vienerių metų ryškiausiai atsigavo vaikščiojimo, važiavimo neįgaliojo vėžimėliu, lipimo laiptais funkcijos. Funkcinio savarankiškumo pokytis priklausė nuo insulto tipo: po hemoraginio galvos smegenų insulto savarankiškumas, pagal FNT, buvo 16,0 balų didesnis nei asmenų, patyrusių išeminį galvos smegenų insultą, kai $Z = -2,349$, $p = 0,019$; nuo ambulatorinių procedūrų po stacionarios reabilitacijos (atitinkamai 48,0 ir 70,6 balo); nuo energingumo lygio (mažiau energingų FNT siekė 56,5 balo, daugiau – 87,2 balo). Didžiausia ir reikšmingiausia koreliacija nustatyta tarp FNT motorinės subskalės ir SF-12 fizinės subskalės ($r = 0,82$).

Išvados. Asmenims, patyrusiems galvos smegenų insultą, būtina užtikrinti tinkamą gyvenimo pilnatvę, palaikant jų socialinius santykius, užtikrinant funkcinį nepriklausomumą ir sudarant galimybes grįžti į darbą. Po ankstyvos stacionarios reabilitacijos būtina užtikrinti reabilitacijos tęstinumą, siekiant kuo aukštesnio asmenų, patyrusių galvos smegenų insultą, funkcinio nepriklausomumo.

Raktažodžiai: galvos smegenų insultas, reabilitacija, gyvenimo pilnatvė.

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