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*Original Article*

# Voluntary training undertaken by stroke patients during the recovery phase and related factors

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**ABSTRACT**
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**Objective:** This study assessed factors related to voluntary training undertaken by stroke patients.
**Methods:** Patients who had been hospitalized for 1 or more months after stroke completed a questionnaire regarding their background, disease characteristics, voluntary training, outcome expectations, efficacy expectations, and the degree of life satisfaction. The Mann-Whitney *U* test, Fisher's exact test, and Spearman's rank correlation coefficient were used for analysis.
**Results:** There was a significant positive correlation between the number of training days per week and the number of months after stroke. However, there was no significant correlation between the number of training days per week and outcome expectations, efficacy expectations, and the degree of life satisfaction.
**Conclusions:** The factor related to the number of voluntary training days per week undertaken by stroke patients during the recovery phase was the number of months after stroke. In this period, outcome expectations, efficacy expectations, the degree of life satisfaction, and voluntary training by stroke patients may not be related. This may be because patients have mental agitation or a low degree of satisfaction during this period.

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**Key words:** apoplexy, convalescence, rehabilitation, voluntary, self-efficacy

## Introduction

The number of stroke patients in Japan is estimated to be more than 1.2 million [1]. They account for 24.1% of all adults requiring long-term nursing care, and stroke is the leading cause of severe disability corresponding to a nursing care level of 4 and 5 [2]. To avoid becoming bed-bound, it is important to start rehabilitation immediately after stroke and continue it for a long period [3−7]. Given the limited healthcare resources that are currently available, it is vital to help stroke patients perform voluntary training.

Saitoh et al. [8] and Nagai et al. [9] indicated the importance of focusing on changing patient behavior and encouraging active participation in training programs in the clinical practice of rehabilitation medicine. In line with this, stroke patients are expected to voluntarily exercise; being an active rather than passive participant is a key to success.

According to the social learning theory proposed by Bandura, outcome expectations and efficacy expectations are predictors of human behavior. It has been postulated that these factors are acquired through learning and can be modified [10−13]. Outcome expectations are "anticipations that certain behavior will lead to certain outcomes" [11]. Outcome expectations are classified into three types (physical, social, and self-evaluative), and each of these factors may facilitate or inhibit behavior [13]. Efficacy expectations are "beliefs in the individual's capability to perform a course of action to attain a desired outcome" [11]. People tend to perform certain behaviors when efficacy expectations are high. Self-efficacy is regarded as high when the individual has positive efficacy expectations. It is believed that self-efficacy is one of the most important determinants of behavior.

Studies in an elderly population demonstrated that

intervention focusing on strengthening outcome expectations improved exercise activity [14, 15] and that outcome expectations were strongly correlated with exercise performance after 3 and 9 months [16]. A study in stroke patients also reported that outcome expectations influenced exercise behavior [17].

Regarding efficacy expectations, many studies focused on and reported that higher self-efficacy was associated with exercise habits in middle-aged adults and the elderly [18,19], and that elderly individuals with higher self-efficacy tended to extend functional independence by one year [20]. It was also reported that intervention that enhanced efficacy expectations improved exercise behavior [15]. In addition, self-efficacy was predictive of exercise activity [14] and strongly correlated with exercise performance after 3 months [16]. Studies in stroke patients also reported that higher self-efficacy was associated with exercise habits [21], and that those with higher self-efficacy had a higher Barthel index (BI) scores [22]. It was also reported that self-efficacy was associated with voluntary training [23] and exercise behavior [17, 24], and had a direct effect on the reduction of differences between potential and actual activity levels [25].

These findings indicate that outcome and efficacy expectations are related to exercise performance, and that interventions that strengthen expectations lead to improvements in the degree of functional independence and activity levels. However, the relationship between expectations and behaviors related to voluntary training has not been clarified.

Health care professionals can facilitate changes in patient behavior by understanding the factors influencing the behavior. We assumed that positive expectations might facilitate voluntary training, prevent becoming bed-bound, and improve the quality of life (QOL). The objective of this study was to determine the factors associated with voluntary training in stroke patients, focusing on expectations for exercise behavior.

## Methods

### 1. Study participants

The participants were 33 stroke patients admitted to convalescent rehabilitation wards in three hospitals located in the suburbs in prefecture A. Excluded patients were those who had a stroke within one month, those who had difficulty in communicating with healthcare providers and had difficulty in understanding questions, and those with severe dementia or aphasia. The characteristics of the study participants are shown in Table 1. The mean age was 66.9 years. Many were living with their spouse. The mean time from onset was 2.7 months. The activities of daily living were evaluated using the BI. The mean BI total score was 67. The results for each item of the BI are shown in Figure 1. No participants were independent for stairs (item 7). Many needed help with bathing (item 5). For the rest of the items, the most common result was independent, followed by needs help. As shown in Figure 2, the degree of hemiplegia according to Brunnstrom stage was V in the majority of patients.

### 2. Study period

The study periods were from March to October 2008 and June to November 2015.

### 3. Operational definitions of terms

The operational definitions of the terms used in this study were as follows.

**1) Voluntary training**

Voluntary training is defined as training that the stroke patient undertakes voluntarily to perform exercise on one's own outside the training room with the aim of improving activity levels, after receiving instruction from a health care professional.

**2) Rehabilitation**

Rehabilitation is defined as functional training aiming to improve basic and applied motor skills. This includes both functional training under the supervision of a health care professional and voluntary training on one's own (Figure 3).

**3) Outcome expectations for rehabilitation**

Outcome expectations for rehabilitation are predictions and expectations about outcomes of rehabilitation.

**4) Efficacy expectations for rehabilitation**

Efficacy expectations for rehabilitation are predictions and expectations about one's ability to perform rehabilitation to achieve desired outcomes.

### 4. Study methods

A cross-sectional quantitative descriptive study using an interview-based questionnaire was conducted with the participants as described above.

**1) Data collection method**

This study was approved by the ethics committee of the institution (approval number 79). Written and oral informed consent was obtained from all participants after explaining the purpose and methods of the study. After this, the questionnaire was administered to each participant by the researcher using an interviewing format. In the interview, the researcher read the questions slowly and repeated them so that the respondent could fully understand the questions and have enough time to consider before answering. The respondents were encouraged to answer each question after imagining that they were voluntarily exercising. The average time for the interview was 34 minutes.

**2) Measurement items**

To assess the current status of voluntary training, each respondent was asked to answer "yes" or "no" as to whether he/she was performing functional exercise outside the training room. Those who answered yes were asked the number of days spent in voluntary

**Table 1.** Patient characteristics.

$n = 33$

| | | (Number) | (%) | Mean ± SD (range) |
|---|---|---|---|---|
| **[General backgrounds]** | | | | |
| Age (years) | | | | 66.9 ± 13.0 (36–86) |
| Sex | Man | 26 | (78.8) | |
| | Woman | 7 | (21.2) | |
| Marital status | Married | 22 | (66.7) | |
| | Unmarried | 11 | (33.3) | |
| Family other than spouse | Present | 27 | (81.8) | |
| | Absent | 6 | (18.2) | |
| Job status | Employed | 11 | (33.3) | |
| | Unemployed | 22 | (66.7) | |
| **[Disease characteristics]** | | | | |
| Types of stroke | Cerebral hemorrhage | 14 | (42.4) | |
| | Brain infarction | 17 | (51.5) | |
| | Subarachnoid hemorrhage | 1 | ( 3.0) | |
| | No response | 1 | ( 3.0) | |
| Age at onset (years) | | | | 66.3 ± 12.9 (36–86) |
| Number of months after stroke | | | | 2.7 ± 2.0 (1–10) |
| Number of stroke events | | | | 1.2 ± 0.5 (1–3) |
| | One | 28 | (84.8) | |
| | Two | 3 | ( 9.1) | |
| | Three | 2 | ( 6.1) | |
| Hemiplegia | Right | 11 | (33.3) | |
| | Left | 12 | (36.4) | |
| | Bilateral | 2 | ( 6.1) | |
| | None | 8 | (24.2) | |
| Sensory impairment | Present | 14 | (42.4) | |
| | Absent | 19 | (57.6) | |
| Barthel Index total score | | | | 67.0 ± 18.6 (25–90) |
| Inconvenience due to hemiplegia | Present | 25 | (75.4) | |
| | Absent | 8 | (24.2) | |
| Handedness | Right-handed | 29 | (87.9) | |
| | Left-handed | 3 | ( 9.1) | |
| | No response | 1 | ( 3.0) | |

training for the week.

To assess the factors associated with voluntary training, two expectations scales and visual analogue scales (VAS) were used. The expectations scales consisted of an outcome expectation scale for rehabilitation (15 items) and an efficacy expectation scale for rehabilitation (12 items). The questionnaire items were constructed based on the social learning theory by Bandura [10, 13] and previous related studies in middle-aged adults and the elderly, as there were no studies in this topic in stroke patients. The outcome expectations scale, consisting of three categories (physical, social, and self-evaluative), was created after reviewing the self-efficacy for exercise scale by Resnick et al. [14], the outcome expectation scale by Takase [16], and the psycho-social factor scale of physical exercise behavior by Hashimoto et al. [26]. The physical category comprised questions regarding perceptions of pleasure/pain (items 11 and 14) and physical satisfaction (items 1, 3–7, and 10). The social category comprised a question regarding approval by others (item 13). The self-evaluative category comprised self-worth (item 2) and self-satisfaction (items 8, 9, 12, 15). The efficacy expectation scale was created after reviewing the outcome expectations for exercise scale by Resnick et al. [27], the methods by Kitada et al. [18] and Oka [19], the psycho-social factor scale of physical exercise behavior by Hashimoto et al. [26], and the self-efficacy for health promotion scale by Yokokawa et al. [28]. The items on the efficacy expectation scale comprised questions regarding the confidence to perform voluntary training. The items included compliance with instructions (item 1) and confidence to perform voluntary training continuously (items 4 and 5), in any place (item 2) and setting (item 9), while recognizing the importance (items 3, 8, and 11), even if a psychological, time-related, or physical burden was

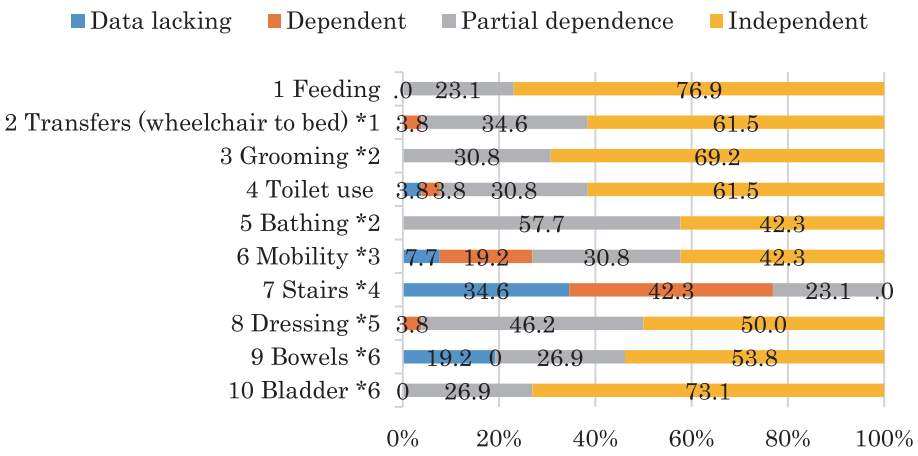


**Figure 1.** Assessment of activities of daily living with the Barthel index (results for each item).

*1 (item 2): No participants were completely dependent or unable, and mostly dependent was classified as dependent.

*2 (items 3, 5): Unable was classified as partial dependence.

*3 (item 6): Able to walk > 45 m without help was classified as independent, able to walk >45 m with help as partial dependence, and unable to walk (wheelchair-bound) as dependent.

*4 (item 7): Unable was classified as dependent.

*5 (item 8): Moderately dependent was classified as dependent.

*6 (items 9, 10): Continent was classified as independent, occasionally incontinent as partial dependence, and others as dependent.

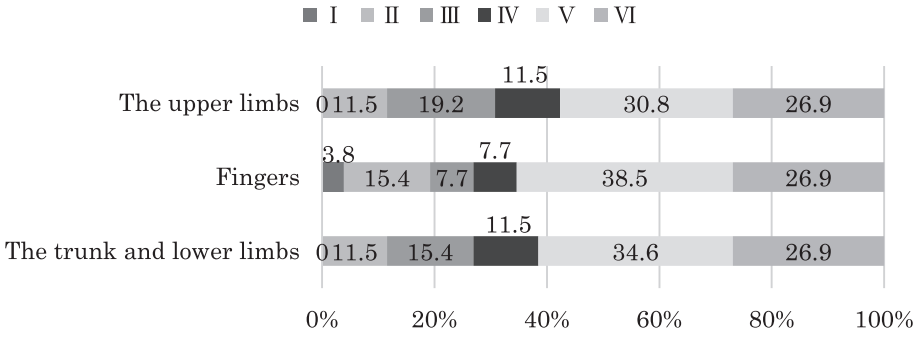


**Figure 2.** Participants' Brunnstrom Stage.

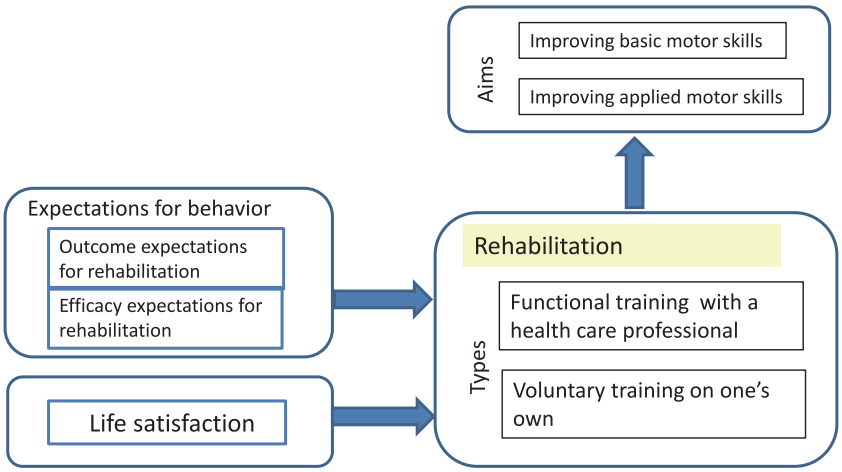


**Figure 3.** Relationship between expectations of behavior and life satisfaction and rehabilitation.

**Table 2.** Outcome and efficacy expectation scales for rehabilitation.

| Questionnaire items |
|---|
| **[Outcome expectation scale for rehabilitation]** |
| 1 I think exercise is good for the recovery of hemiplegia. |
| 2 I think exercise has a meaning to my life. |
| 3 I think exercise is good for my health. |
| 4 I think exercise can improve walking ability. |
| 5 I think exercise can improve physical performance. |
| 6 I think exercise can improve activities of daily living. |
| 7 I think exercise reduces physical inconvenience. |
| 8 Exercise makes me happy. |
| 9 Now exercise is a part of my life. |
| 10 I do not think exercise is good for recovery. * |
| 11 I think exercise makes me physically more fit. |
| 12 Exercise does not provide a sense of fulfilment. * |
| 13 I am praised for doing exercise. |
| 14 Exercise makes me tired. * |
| 15 I am not interested in exercise. * |
| **[Efficacy expectation scale for rehabilitation]** |
| 1 I can continue exercise according to instructions. |
| 2 I can continue exercise even in areas outside of the hospital. |
| 3 I can continue exercise without being told. |
| 4 I can continue exercise regularly. |
| 5 I will continue exercise into the future. |
| 6 I can exercise even when I am lazy. |
| 7 I can exercise even when I am reluctant. |
| 8 I can voluntarily start exercising. |
| 9 I can incorporate exercise into daily life. |
| 10 I can continue exercise without being influenced by the opinions of others. |
| 11 I can take time to continue exercise. |
| 12 I can continue exercise while paying careful attention to my fatigue levels. |

*Reversed items (the Likert scale was reversed for the analysis)
The Likert scale (a 5-point scale) was ordered from "not agree at all" (1 point) to "strongly agree" (5 points).
Greater scores indicate greater expectation.

present (items 6, 7, 11, and 12). The validity of the questions was reviewed by two nurses specialized in rehabilitation medicine and chronic stage nursing. The participants were asked to answer "yes" or "no" and to complete the VAS for the questions regarding outcome expectations (the expectation that functional training leads to good outcomes) and efficacy expectations (the confidence to perform exercise). Satisfaction with life was measured using the VAS.

**5. Analysis methods**

Statistical analysis was performed using IBM SPSS Statistics 18. Quantitative variables were analyzed using the Mann-Whitney *U* test. Associations between the qualitative variables were analyzed using Fisher's exact test. Correlations between the quantitative variables, such as the expectation scales and VAS, were analyzed using Spearman's rank correlation coefficient. Internal consistency of each scale was assessed using Cronbach's α coefficient. Statistical significance was set at $p = 0.05\%$.

## Results

**1. Outcome expectation scale and efficacy expectation scale**

As shown in Table 3, Cronbach's α coefficient of each scale was 0.8 or greater, showing high internal consistency. To test convergent validity, correlations between the two scales (yes-no questions) and VAS scores were calculated. The correlation coefficients between the outcome expectation scale and outcome expectation VAS scores ($\rho s = 0.403$, $p = 0.020$) and between the efficacy expectation scale and efficacy expectation VAS scores ($\rho s = 0.519$, $p = 0.002$) were 0.4 or greater, indicating positive and significant correlations. To test concurrent validity, correlation coefficients between the expectation scales and the

**Table 3.** Expectation scales and VAS scores, α coefficients, and correlations. $n = 33$

| Measures | Mean ± SD (range) | α coefficient | ρs ($p$ value) |
|---|---|---|---|
| Outcome expectation scale total score | 59.4 ± 8.7 (41−75) | 0.852 | |
| Outcome expectation VAS score | 76.8 ± 22.5 (14.4−100) | | 0.403 (0.020*) |
| Efficacy expectation scale total score | 46.5 ± 9.2 (23−60) | 0.956 | |
| Efficacy expectation total score | 77.7 ± 22.2 (33.3−100) | | 0.519 (0.002**) |
| Life satisfaction VAS score | 55.7 ± 28.1 (0−100) | | |

ρs, Spearman's rank order correlation coefficient.
**: $p < 0.01$, *: $p < 0.05$.
VAS, Visual Analog Scale.
The VAS consisted of a line 0 to 100 mm in length, ranging from 0 to 100.
0 indicates "not agree at all" "not confident at all" or "not satisfied at all." 100 indicates "completely agree," "definitely confident," or "completely satisfied."
The score was the distance (mm) between point 0 and the point marked by the participant.

number of days spent in voluntary training for the week were calculated. However, the number of training days was not significantly correlated with the outcome expectation scale ($\rho s = -0.112$, $p = 0.543$) or the efficacy expectation scale ($\rho s = -0.197$, $p = 0.280$).

**2. Association between the status of voluntary training and each variable**

The mean ± SD (range) number of days spent in voluntary training for the week was 4.4 ± 3.1 (0−7) days.

As shown in Table 4, the number of days spent in voluntary training was positively and significantly correlated with the number of months after stroke ($\rho s = 0.437$, $p = 0.014$) but not with the outcome expectation scale, efficacy expectation scale, or life satisfaction.

As shown in Table 5, 23 participants answered "yes" to the question "Are you exercising outside the training room in order to improve your functional status?"; the remaining 10 participants answered "no" to the question. There were no significant differences in any variables between the two groups.

**3. Relationship between the number of months after stroke and each variable**

The time from onset (the number of months after stroke) was significantly and negatively correlated with the outcome expectation VAS scores ($\rho s = -0.418$, $p = 0.017$) and efficacy expectation VAS scores ($\rho s = -0.500$, $p = 0.004$). To examine the effects of time from onset on the variables, the participants were divided into those within 2.7 months (mean value) after stroke and those 2.7 months or more after stroke for comparison, as shown in Table 6. There were no significant differences in age or family size between the two groups. The efficacy expectation scores were significantly lower in those 2.7 months or more after stroke than in those within 2.7 months after stroke ($p = 0.014$). There was no significant difference in the life satisfaction VAS scores between the two groups.

## Discussion

The present study examined related factors with the aim of improving our understanding of voluntary training in stroke patients. The results showed that the number of days spent in voluntary training was associated with the time from onset: that is, a greater number of months after stroke was associated with more days spent in voluntary training. Based on the social learning theory proposed by Bandura, we hypothesized that the status of voluntary training was associated with outcome expectations and efficacy expectations but could not find a significant association.

Many stroke patients start to recover in the early days after stroke and become more independent with time [3−7]. Therefore, it is unsurprising that patients with a longer time after stroke are more able to perform voluntary training because they are more physically and cognitively capable of participating in activities. According to the social learning theory, positive outcome expectations and efficacy expectations facilitate an individual to perform a behavior. However, the results of this study were not consistent with the hypothesis. There are studies reporting that self-efficacy was not associated with exercise behavior in the elderly [29], and that there was no significant difference in the expectations for rehabilitation between stroke patients doing exercise and those not doing exercise after discharge (the mean age was 64 years; the time from onset ranged from 6 months to 3 years) [30]. Given that self-efficacy is regarded as an efficacy expectation and expectations for rehabilitation as outcome expectations, these results and present findings suggest a possibility that efficacy and outcome expectations are not associated with exercise behavior, or that outcome expectations are not associated with exercise performance in stroke patients within 3 years after onset. The results of this study showed that

**Table 4.** Correlations between the number of days spent in voluntary training and variables.

$n = 33$

| Variables | $\rho$s | $p$ value |
|---|---|---|
| Number of months after stroke | 0.437 | 0.014* |
| Number of family members | −0.030 | 0.871 |
| Outcome expectation scale | −0.112 | 0.543 |
| Efficacy expectation scale | −0.197 | 0.280 |
| Outcome expectation VAS | −0.184 | 0.312 |
| Efficacy expectation VAS | −0.347 | 0.056 |
| Life satisfaction VAS | 0.140 | 0.452 |

$\rho$s, Spearman's rank order correlation coefficient.
*: $p < 0.05$.
VAS, Visual Analog Scale.

**Table 5.** Comparison between the voluntary training group (outside the training room) and the non-voluntary training group.

$n = 33$

| Variables | | Voluntary training group ($n = 23$) | | Non-voluntary training group ($n = 10$) | |
|---|---|---|---|---|---|
| | | (Number) | Mean ± SD (range) | (Number) | Mean ± SD (range) |
| **[General background]** | | | | | |
| Sex | Man | 18 | | 8 | |
| | Woman | 5 | | 2 | |
| Marital status | Married | 16 | | 6 | |
| | Unmarried | 7 | | 4 | |
| Family other than spouse | Present | 18 | | 9 | |
| | Absent | 5 | | 1 | |
| Job status | Employed | 8 | | 3 | |
| | Unemployed | 15 | | 7 | |
| Age (years) | | | 65.1 ± 13.6 (36–86) | | 71.1 ± 11.3 (51–86) |
| Number of family members | | | 2.4 ± 1.5 (1–7) | | 2.5 ± 1.7 (1–7) |
| **[Disease characteristics]** | | | | | |
| Age at onset (years) | | | 64.6 ± 13.4 (36–85) | | 70.1 ± 11.6 (51–86) |
| Number of months after stroke | | | 3.0 ± 2.2 (1–10) | | 2.1 ± 1.4 (1–4) |
| Number of stroke events | | | 1.3 ± 0.6 (1–3) | | 1.1 ± 0.3 (1–2) |
| Sensory impairment | Present | 11 | | 3 | |
| | Absent | 12 | | 7 | |
| Inconvenience of hemiplegia | Present | 18 | | 7 | |
| | Absent | 5 | | 3 | |
| Handedness | Right-handed | 19 | | 10 | |
| | Left-handed | 3 | | 0 | |
| | No response | 1 | | | |
| **[Functional training]** | | | | | |
| Number of days spent in voluntary training in the week (days) | | | 6.1 ± 1.7 (2–7) | | 0 |
| **[Expectation scales and VAS scores]** | | | | | |
| Outcome expectation scale (point) | | | 59.3 ± 9.1 (45–75) | | 59.7 ± 8.1 (41–68) |
| Outcome expectation (%) | | | 75.4 ± 22.9 (14.4–100) | | 80.0 ± 22.1 (50–100) |
| Efficacy expectation scale (point) | | | 45.3 ± 9.6 (23–60) | | 49.4 ± 7.8 (40–60) |
| Efficacy expectation VAS (%) | | | 74.8 ± 22.8 (33.3–100) | | 84.0 ± 20.7 (50–100) |
| **[Life satisfaction]** | | | | | |
| Life satisfaction VAS (%) | | | 59.3 ± 26.7 (0–100) | | 47.7 ± 30.8 (0–100) |

VAS, Visual Analog Scale. Mann-Whitney $U$ test and Fisher's exact test were used for the analysis, and no significant differences were observed between the two groups.

**Table 6.** Comparison between < 2.7 months after stroke group and ≥ 2.7 months after stroke group. $n = 33$

| Variables | Mean±SD (range) | | $p$ value |
|---|---|---|---|
| | < 2.7 months after stroke group ($n = 21$) | ≥ 2.7 months after stroke group ($n = 11$) | |
| Age | 66.2 ± 13.5 (38–86) | 67.2 ± 12.9 (36–86) | 0.968 |
| Number of months after stroke | 1.5 ± 0.5 (1–2) | 4.9 ± 2.1 (3–10) | 0 |
| Number of family members | 2.2 ± 1.5 (1–7) | 2.7 ± 1.6 (1–7) | 0.166 |
| Number of days spent in voluntary training in the week | 3.7 ± 3.1 (0–7) | 5.6 ± 3 (0–7) | 0.079 |
| Outcome expectation scale | 60.6 ± 9 (41–75) | 58.3 ± 7.7 (48–71) | 0.404 |
| Efficacy expectation scale | 48.0 ± 8.8 (34–60) | 44.6 ± 9.9 (23–57) | 0.438 |
| Outcome expectation VAS | 83.4 ± 18.7 (40–100) | 70.0 ± 19.5 (50–100) | 0.073 |
| Efficacy expectation VAS | 85.8 ± 19.6 (50–100) | 65.0 ± 17.2 (50–80) | 0.014* |
| Life satisfaction VAS | 56.1 ± 26.9 (0–99) | 55.4 ± 32.7 (0–100) | 0.95 |

VAS, Visual Analog Scale. Mann-Whitney $U$ test. *: $p < 0.05$.

participants with a longer time from onset had spent more days in voluntary training but had decreased outcome and efficacy expectations. We considered that this may be related to psychological changes during recovery, considering that most stroke patients show rapid recovery within 2 to 3 months after onset of disease but often experience slow recovery there after [31]. Therefore, it was assumed that patients in the early stage of recovery had high self-efficacy because they were actually recovering and getting well, but may have lost confidence and expectations for rehabilitation and recovery after they experienced slow recovery. It is of note that a study reported that stroke patients experienced despondency several times within 6 months after onset [31]. Therefore, expectations of stroke patients may not be related to exercise behavior in the early phase of recovery due to the significant psychological changes related to the recovery process.

On the other hand, previous studies in an elderly population reported the association between outcome expectations and exercise behavior [14, 16] and the effectiveness of efficacy-enhancing interventions on exercise maintenance [32]. There are also studies reporting that outcome expectations influenced exercise behavior in stroke patients with a mean age of 62.9 years and a mean duration after onset of 5 years [17], or a mean duration after stroke of 4.6–6.9 years [23, 25, 33]. These studies suggest the association between expectations and behaviors in chronic stroke patients. To our knowledge, no other studies have investigated this topic in stroke patients in the early phase of recovery. Therefore, further studies are required to determine whether the lack of association between the expectations and exercise behavior found in the present study is related to the early recovery phase, and whether the association differs according to time from onset. The present questionnaire had a limitation in evaluating expectations. It mainly consisted of general rather than specific questions about physical function and activity levels, and involved fewer questions regarding interest from others and social participation and roles. This limitation might have affected the results, and some revision of the questions may be required to obtain more specific responses. The degree of life satisfaction was not associated with the number of days spent in voluntary training. In addition, comparison of life satisfaction between participants with longer (≥ 2.7 months) and shorter time from onset (< 2.7 months) showed no significant difference. Sugisawa [34] examined the subjective well-being of patients with a history of stroke using the revised Philadelphia Geriatric Center Morale Scale, which was developed to measure subjective QOL including life satisfaction, and reported that it took stroke patients approximately 2 years to reconstruct their life and improve subjective well-being. Given that the participants in the present study were within several months after stroke, they were expected to be struggling to recover and experiencing psychological distress caused by the sudden onset of stroke-related impairments. Therefore, it may take them more time to gain a sense of satisfaction with their life. This might be the reason for the lack of association between the degree of life satisfaction and the number of days spent in voluntary training. However, we cannot deny another possibility that voluntary training is not associated with life satisfaction, irrespective of the phase of recovery. Further investigations are required to clarify this issue.

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