ASSOCIATION BETWEEN POSITIVE EMOTIONS, DEPRESSION AND FUNCTIONAL RECOVERY IN POST-STROKE PATIENTS

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CERTIFICATION

This is to certify that the candidate, Dr Low Jong Sern had carried out this research project. To the best of my knowledge, this dissertation is entirely his work.

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ABSTRACT

Background and Objective: Stroke is a major health problem in Malaysia which leads to substantial disease burden to the country. Post-stroke depression was well studied in association with functional outcome. However, there was no study on positive emotion in post-stroke patients in local setting. The objective of this study is to assess positive emotion and depression in post-stroke patients in Hospital Pulau Pinang and their association with functional recovery.

Method: A total of 136 patients at 6-12 weeks post stroke, were recruited from Occupational Therapy Unit and Rehabilitation Clinic Hospital P. Pinang. All the patients were given Demographic and Clinical Data Questionnaire, Positive Emotion Rating Scale (PERS) or Malay version Positive Emotion Rating Scale (PERS-M) and Montgomery-Asberg Depression Scale-Self (MADRS-S) or Malay version Montgomery-Asberg Depression Scale-Self (MADRS-BM). Patients were also assessed for functional status using Modified Barthel Index (MBI)

Results: 65.4% of patients have shown to have good positive emotion and 23.5% of patients have depression. Patients with the length of stay less than 5 days were 7.3 times more likely to have good positive emotion and 12.3 times less likely to have depression. Patients with less than 3 medical co-morbidities were 4.3 times less likely to have depression. Based on bivariate analysis, both total PERS and total MADRS-S scores were significantly associated with functional independence and functional recovery in 6 to 12 weeks post-stroke. However, using multiple linear regression, only total PERS, but not total MADRS-S, was significantly associated with both functional independence and functional recovery. Other factors that showed significant in

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functional independence were the length of stay and MBI (discharge). Whereas in functional recovery, significant factors were spouse and age.

Conclusion:

Length of stay of less than 5 days was 12.3 times less likely to have depression and 7.3 times more likely to have good positive emotion. Positive emotion is a stronger predictor of functional independence and function recovery compared to post-stroke depression. Other strong predictors of functional outcome were the length of stay, MBI(discharge), patient with spouse and age.

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ABSTRAK

Latar Belakang dan Objektif: Strok adalah masalah kesihatan utama di Malaysia yang membawa beban penyakit yang ketara kepada negara. Kemurungan selepas strok banyak dikaji dan didapati berkait rapat dengan pemulihan fungsi activiti-activiti harian. Namun, tiada kajian yang mengkaji mengenai emosi positif dalam strok. Objektif kajian ini ialah untuk mengkaji emosi positif dan kemurungan dalam pesakit-pesakit strok di Hospital Pulau Pinang dan hubungan mereka dengan permulihan fungsi.

Kaedah: Sejumlah 136 pesakit strok dalam tempoh enam hingga 12 minggu selepas serangan strok yang menghadiri sesi di Unit Carakerja dan Klinik Rehabilitasi telah menyertai kajian ini. Semua pesakit dinilai dengan menggunakan borang soal selidik berkenaan latar belakang sosial dan klinikal, Positive Emosion Rating Scale (PERS) atau versi Bahasa Melayu Positive Emotion Rating Scale (PERS-M) dan Montgomery-Asberg Depression Scale-Self (MADRS-S) atau versi Bahasa Melayu Montgomery-Asberg Depression Scale-Self (MADRS-BM). Modified Barthel Index digunakan untuk menilai fungi aktiviti-aktiviti harian.

Keputusan: Terdapat 65.4% daripada jumlah pesakit yang mempunyai emosi positif yang baik dan 23.5% mengalami kemurungan. Tempoh pesakit di wad yang kurang daripada 5 hari mempunyai 7.3 kali lebih cenderung untuk mengalami emosi positif yang baik dan 12.3 kali kurang berkemungkinan untuk mengalami kemurungan. Pesakit yang mempunyai kurang daripada 3 keadaan ‘comorbid’ adalah 4.3 kali kurang berkemungkinan untuk mengalami kemurungan. Dengan mengunakan analisa bivariate, kedua-dua jumlah PERS dan jumlah MADRS-S berkait rapat dengan tahap

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fungsi dan pemulihan fungsi dalam tempoh 6 hingga 12 minggu selepas strok. Namun menggunakan analisa multipe linear regression, hanya PERS mempengaruhi tahap fungsi dan permulihan fungsi. Faktor tempoh di wad dan markah MBI (discaj) berkait rapat dengan tahap fungsi, manakala faktor pasangan dan umur juga berkait rapat dengan pemulihan fungsi.

Kesimpulan: Tempoh di wad yang kurang daripada 5 hari merupakan faktor peramal yang kuat untuk emosi positif dan kemurungan. Emosi positif adalah faktor yang lebih ketara untuk meramal tahap fungsi dan pemulihan fungsi di kalangan pesakit-pesakit strok. Faktor-faktor lain yang berkait rapat dengan fungsi pesakit-pesakit strok adalah umur, pasangan, tempoh di wad dan MBI (discaj).

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LIST OF ABBREVIATIONS

DSM-5 Diagnostic and Statistical Manual of Mental disorder, 5th Edition

MADRS-S Montgomery-Asberg Depression Rating Scale- self-reported scale

MADRS-BM Malay Version Montgomery-Asberg Depression Rating Scale- self-reported scale

MBI Modified Barthel Index

PERS Positive Emotion Rating Scale

PERS-M Malay Version Positive Emotion Rating Scale

CI Confidence Interval

OR Odds Ratio

PSD Post-Stroke Depression

SHAPS Snaith–Hamilton Pleasure Scale

CESD Center for Epidemiological Studies-Depression

NIHSS National Institute of Health Stroke Scale

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CHAPTER 1: INTRODUCTION

Stroke is defined as a sudden loss of blood supply to the brain, which leads to permanent tissue damage. Tissue damage can be caused by thrombotic, embolic, or hemorrhagic events. Almost 85% of strokes are ischemic, while 12% are hemorrhagic. The incidence of stroke varies over the course of life. The incidence rates range between 10 and 20 per 10,000 individuals at the age of 55–64, to 200 per 10,000 individuals for those aged over 85. Stroke is a major public health problem. It is the second leading cause of mortality and the third leading cause of disability worldwide. (Bulletin of the WHO 2016).

According to Malaysia National Burden of Diseases Study and Study on Vital Registry System in 2000, stroke was the second leading cause of death and the top tenth cause of hospitalization. Nevertheless, in term of disease burden, it was ranked top five. From the review of previous local studies, the range of the mean age of stroke onset in Malaysia was 54.5 to 62.6 years (Cheah WK et al., 2016). Based on the fourth National Health and Morbidity Survey (NHMS) in 2011, the prevalence of stroke was 0.7% among Malaysians, with 1.7% among those aged 55-59 years, 2% in those aged 60-64 years, 3% in those aged 65-69 years, 3.5% in those aged 70-74 years and 7.8% in those aged 75 years and above. Up to two-thirds of the reported stroke were ischaemic in origin and the remaining one-third were hemorrhaegic in origin which constitutes intracerebral and subarachnoid hemorrhage. Majority of the cerebral vascular accident (CVA) patients presented with features of focal neurological deficit, mainly unilateral body weakness, which was reported up to 90.5%. Other clinical features include seizures, headache, vomiting, slurring of speech and vision loss. (Yew KL et al., 2014)

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In terms of stroke outcomes for survivors, morbidity post-stroke produces substantial burden to the survivors, their caregivers, healthcare systems and providers. Functional disability is the main contribution to post-stroke morbidity.

Functional recovery is the main predictor of functional outcome. Post-stroke recovery can be classified into neurological and functional recovery; neurological recovery varies according to nature of stroke, whereas functional recovery can be influenced by multiple factors besides stroke nature (Anderson et al., 1974).

Functional evaluation is used in research to assess post-stroke disability and its complications. ADL functioning assessment is reliable indicators of the functional status of post-stroke patients during the initial evaluation. Assessment of these activities is used by increasing numbers of medical professionals as a tool for the development of effective management plans for post-stroke patients. Modified Barthel Index (MBI) widely used in occupational therapy unit and rehabilitation unit in in Malaysian hospitals for post-stroke patients' functional assessment. (Pelan Operasi Standard, Pemulihan Carakerja Untuk Pesakit Strok, 2013)

Stroke is associated with neuropsychiatric disorders with which includes depression, anxiety disorder, cognitive disorder, apathy, psychosis, mania, pathological affective display, catastrophic reactions, fatigue, and anosognosia (Robinson RG et al., 2016). According to Bulletin of the WHO 2016, stroke is a leading cause of depression. Numerous studies have shown that depression has high prevalence among post-stroke patients, ranging from 12% to 61% (Stefano Paolucci, 2008). This varies as the patient selection and criteria used were different in those studies.

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In Malaysia, the prevalence of post-stroke depression (PSD) was 36% for a post-stroke duration range from 4 weeks to 8 weeks (AH Sulaiman et al., 2002). Despite being an important complication of stroke, post-stroke depression is often overlooked. As a result, its impact on stroke outcome remains under-recognized (RK Tamara et al., 2014). Patients with PSD showed far less functional recovery compared to nondepressed patients. Post-stroke patients have impaired physical function and it affects the ability to carry out activities of daily living (ADL function). This, in turn, affects their quality of life (Niloufar Hadidi MS et al. 2009). There is also evidence that PSD patients treated with antidepressants shown improvement in functional status (Robinson RG, Spalletta G, 2010). Therefore, early detection, correct diagnosis, and appropriate treatment of PSD are essential to enhance the functional recovery among post-stroke patients.

Positive emotions is proposed to be a link to recovery from a medical illness. There are studies that link positive emotions to speed recovery from cardiovascular disease (Boehm JK et al., 2011). The "broaden and build hypothesis" by Frederickson 1998 suggested that the positive emotions will offset the anxiety and depression a patient has during the early stage of the illness, which believed to be harmful and affecting recovery of an illness. There is also literature suggested that positive emotions help in the recovery process by promoting the sense of control over the external environment, coping and adaptation towards stressful situation, optimism on future events and strengthening the social relationship. (Taylor & Brown, 1994; Ryff & Singer, 1996; Clark & Watson, 1998)

In recent years, there were a few studies reported on the importance of positive emotions in affecting functional recovery of post-stroke patients (GV Ostir et al., 2008; Gary SS et al., 2010). Although the prevalence of PSD and impact of PSD on

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post-stroke recovery is well established, another aspect of emotion, which is positive emotions, is not well studied, especially in local settings. Thus, a study on the mood component that involves positive emotions is needed to have more holistic understanding on the prevalence, association and impact of mood disorder in post-stroke patients.

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CHAPTER 2: LITERATURE REVIEW

2.1 Stroke/Cerebrovascular accidents

According to World Health Organization (WHO), stroke is defined as a clinical syndrome consisting of rapidly developing clinical signs of focal (or global in case of coma) disturbance of cerebral function which lasting more than 24 hours or leading to death with no apparent cause other than a vascular origin. (Hatano S 1976). Meanwhile, transient ischaemic attack (TIA) is a clinical syndrome that is similar to a stroke, but stroke signs and symptoms resolve within 24hours. Stroke is emerging as a major health problem, causing great mortality and morbidity in developing and developed countries. According to the Global Burden of Diseases, Injuries and Risk Factors Study (GBD) in 2010, stroke is rank as number three commonest cause of disability-adjusted life-years (DALYs). Stroke is also ranked as the second most common cause of death from the report above.

Stroke is preventable and treatable. The main presentation of stroke is sudden onset of any neurological disturbance, including limb numbness or weakness, speech disturbance, disturbance of balance or visual loss. A growing body of evidence has repealed the old perception that stroke is part of aging which inevitably results in death or severe disability. The evidence is accumulating for more effective primary and secondary prevention strategies. The evidence also supports care processes and interventions in stroke rehabilitation. Understanding the various risk factors of strokes and various predictors of functional outcome of stroke helps in developing better clinical guidelines and care plans for post-stroke patients. (NICE guideline for stroke 2008).

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For stroke classification, there are two broad categories of stroke, hemorrhage and ischemia. One prospective study on the nature of stroke was conducted in Penang Hospital and reported that 74.8% of all stroke patients were ischaemic and 25.2% were haemorrhagic. Malaysia has more hemorrhagic strokes compared to other higher income countries. (Cheah WK et al., 2016). Hamidon B et al. (2003) reported that 46.8% of the ischaemic stroke patients in a local hospital suffered from lacunar infarct and 14.2% was middle cerebral artery (MCA) infarct. Cerebral infarcts over the right hemisphere comprise 38% of the cases, 35.7% for the left hemisphere, 17.6% for both hemispheres and 6.3% for the cerebellar region.

In Malaysia, mortality due to stroke constituted 8.9% of total certified death for males and 12.1% of total certified death for females. The age-standardized stroke mortality were 103 per 100,000 males and 97 per 100,000 females (Yusoff AF et al., 2005). Haemorrhagic stroke patients had a higher mortality rate (27.3- 36.8%), compared to those with ischaemic stroke (10.1-11.7%) (Hamidon B et al. 2003; Grover CS et al., 2014).

Morbidity associated with stroke poses a significant burden to the patients, their caregivers, healthcare systems and providers. Functional disability is the main contribution to stroke morbidity. Upon discharge, only 13% of patients were able to ambulate with aids and 87% required assistance for ambulation of varying degree. At 3 months, 82% showed improvement in overall function, 60% were ambulating independently with the remaining 40% still required assistance (Rameezan BA et al., 2005).

Other than physical disability, post-stroke patients are also at high risk of developing neuropsychiatric symptoms. Among those, the commonest is post-stroke

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depression with prevalence as high as 61%. Other symptoms include irritability (33%), eating disturbance (33%), agitation (28%), apathy (27%), anxiety (23%) and insomnia (18%). Other less common symptoms are euphoria and disinhibition (10%), hallucination (1%) and delusion (2%)(Angelelli et al., 2004). Neuropsychiatric symptoms are another strong predictor of poor functional outcome in stroke patients. They are a major source of disability and diminished quality of life (CG Lyketsos et al., 2007).

As for the social effect of post-stroke patients, the majority of them were dependent after discharge from wards (Rameezan BA et al., 2005). They needed full-time caretakers which is a stressful situation for both the patient and care taker. A systematic review showed that even for the family with more robust network members, a significant strain was observed in the family (Sarah N et al., 2015). Robert DB et al. (1999) did a population-based analysis and found out that by a year of post-stroke, 70% of the patients had required some nursing home stays. These showed the great impact on social effect after a stroke.

Post-stroke patients are at a greater risk of having the physical and functional disability, neuropsychiatric symptoms and also social deprivation and burden to the care taker. The management of a stroke patient should consist of a more holistic way to tackle the bio-psycho-social issues post-stroke.

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2.2 Functional Recovery in Stroke

Stroke is the leading cause of serious, long-term disability worldwide. (Bulletin of WHO 2016). The burden of post-stroke disability is of primary public health importance. Disability after stroke has shown varying degree of functional recovery mainly within the first 6 months post-stroke. Although most stroke patients suffered from severe neurological impairments and disabilities in early post stroke period, they are able to achieve some degree of recovery over time (Wade and Hewer, 1987; Duncan et al., 1992). For instance, early motor function recovery occurred in some post-stroke patients, primarily within the first few months. The degree of paralysis is a primary predictor of motor recovery. However, it cannot be used to accurately predict the rate of motor recovery during the subacute stage (Hendricks et al., 2002). Lower limbs motor function improvement is observed in around 65% of patients with initial motor deficits (Hendricks et al., 2002). However, for upper limbs, the probability of normal recovery is very low (<15%) (Cauraugh and Summers, 2005). During the first few weeks post-stroke, the rate of functional recovery is relatively rapid. However, it slows considerably between one and three months later. The recovery has slowed so much as to be barely noticeable in between three and six months after stroke, although there is a trend toward some additional recovery during this time (Duncan and Lai, 1997). Most recovery from a stroke takes place in the first 3 months and only minor measurable improvement occurs after the 6 months post stroke. (Bard G and Hirschberg GG, 1965)

Post-stroke recovery is typically classified as neurological recovery and functional recovery. Neurological recovery varies depending on the stroke pathogenesis and lesion site. Functional recovery is influenced by the external environment, continuity of rehabilitation, and motivation (Anderson et al., 1974).

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Factors known to affect prognosis in functional recovery in post stroke patients include age, severity of brain injury, degree of motor disability, existence of systemic disease, time of starting rehabilitation, degree of cognitive and perceptive deficiencies, and psycho-environmental factors particularly, depressive symptoms, which vary in severity according to time since onset of stroke and patients' cognitive states (M. Aström, R. Adolfsson, K. Asplund, 1993). It is vital to understand the initial functional state and functional states that change over time.

Around 10% of post-stroke patients recovered almost fully. A quarter of them recovered with minor impairments. Most of them (40%) experienced moderate to severe impairments requiring special care. 10% required long-term care in the care facility. 15% will die shortly after the stroke. Nevertheless, those patients who were attending rehabilitation services were associated with better functional outcome (Zeev M et al., 2015). Stroke rehabilitation requires a coordinated and sustained effort from a large team. The team includes the patient, friends, family, other caregivers, nurses, doctors, physiotherapist, occupational therapist, speech therapist, psychologist, dietitian and social workers. Coordination and communication between a large team are vital to improve the efficiency and effectiveness of rehabilitation. Stroke rehabilitation is acknowledged as an integral part of functional recovery with specific repetitive and restorative learning process that target on individual disability. It is the key to improve physical function, mobility and activities of daily living (Langhorne et al., 2011).

Although rehabilitation is associated with good functional outcome, non-adherence to follow-up is common among stroke patients. A study conducted to assess the non-adherence rate of post-stroke patients to attending physiotherapy (Ntamo NP et al., 2013). The author found out that majority of the patients came to

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their first appointments. However, as high as 86% of total patients defaulted follow-up once they were discharged from the inpatient rehabilitation. The main reason 9 out of 10 defaulters that failed to attend for outpatient physiotherapy was due to financial problem. Other reasons were migrations to other area and living a long distance from the hospital. However, this study was done in Africa. The situation is different from the culture in developed countries where the patients do not mind going out of the house to attend physiotherapy as they can meet different people and as a relief for the caretaker (Hale et al., 2003).

In the local setting, there was a rising number of stroke patients discharged from the tertiary centers and continued follow-up under primary care clinic due to heavy patient load at tertiary hospitals. The burden of the primary care doctors has slowly increased over the years. A local study done by family physicians, looking into the care of post-stroke patients in primary care centers found out that 4 needs were lacking, i.e. access to rehabilitation services, coordination between tertiary centers and primary care centers, the standardized guideline for the use of primary care doctors, and also the family and caregiver support (AFA Aziz et al., 2014). This suggests that management of the post-stroke patients is challenging. Multidisciplinary team and rehabilitation are vital in improving patient's outcome, hence the disease burden to the country. Also, rehabilitation services should be expanded further to cover those in need in the periphery.

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2.3 Post-stroke depression

According to DSM-5, post-stroke mood disorder is defined as mood disorder due to stroke with depressive features, major depressive-like episode, or mixed-mood features. Major or minor vascular neurocognitive disorder is the only disorder in DSM-5 that is specific for the cerebrovascular disease.

A diagnosis of mood disorder due to stroke with a major depression-like episode is made to a post-stroke patient when he or she has depressed mood or loss of interest or pleasure along with four other depressive symptoms lasting 2 or more weeks. Patients with a diagnosis of mood disorder due to stroke with depressive features must have depressed mood or loss of interest or pleasure along with at least two but less than five symptoms of major depression lasting for 2 weeks or longer.

Alexopoulos et al. proposed the clinically defined term of vascular depression in 1997. Krishnan et al., 1997 later validated the diagnosis based on the presence of subcortical pathology and white matter hyperintensities from MRI scans.

Patients with vascular depression have less family and personal history of depression, later age onset, greater cognitive impairment and greater physical impairment than geriatric patients with nonvascular depression. Moreover, those vascular depression patients with executive dysfunction and/or patients who show progression of white matter hyperintensities over time have a more chronic and relapsing clinical course of depression and they have poorer responses to treatment with antidepressants. (Taylor WD et al., 2003). Although PSD is related to large-vessel infarction whereas vascular depression is usually related to small-vessel ischemia, most studies have found similarities between both conditions, such as less

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family and personal history of depression, greater disability and prominent executive dysfunction compared with non-microvascular geriatric depression.

The frequency of PSD was studied in many countries around the world. Meta-analysis was utilized to create a large database. According to recent meta-analysis which included 61 cohort studies with a total of 25488 patients, 31% of patients developed depression at any point within 5 years post-stroke (Hackett ML, Pickles K, 2014). In 2008, Stefano Paolucci did a review on available literatures found that despite abundant literatures done in the past, the real prevalence of PSD was difficult to define. The prevalence from his review ranged from 12% to 61%. As for Malaysia, AH Sulaiman et al., 2002 has examined the stroke survivors who attended the neurological clinic in Universiti Malaya Medical Centre (UMMC) in between four to eight weeks post-stroke (n=50) and the prevalence for PSD was found to be 36%. Another Malaysian study (n=90) done in 2000 on three to six months post-stroke patients and found out that the prevalence of PSD was 15% (Glamcevski MT and Tan CT, 2000). The variation mainly due to differences methodology (study population, the timing of assessment, assessment tools) and the complexity of recognition and diagnosis of PSD.

In terms of risk factors of PSD, factors that have been frequently examined in the literature are genetic factors, age, gender, medical and psychiatric history, lesion location, type and severity of the stroke, social support and degree of disability.

A few genes were examined as risk factors for PSD. The 5-HTTLPR and the STin2 VNTR polymorphisms of the serotonin transporter gene (SERT) were associated with PSD in stroke survivors (Kohen R et al., 2008). Increased methylation

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status that was observed in the presence of the 5-HTTLPR s/s genotype, has been associated with PSD as well (Kim JM et al., 2013).

In term of demographic factors, gender was not a significant risk factor for PSD according to a systematic review of 24 studies (RG Robinson et al., 2016). However, one-third of above studies identified female gender as a risk factor for PSD. Age was not a risk factor for PSD (RG Robinson et al., 2016).

For clinical features associated with PSD, patients with high vascular risk were not associated with PSD (RG Robinson et al., 2016). Personal history of anxiety or depression or both, as well as the family history of depression were associated with PSD in a few studies. (De Ryck A et al., 2014; Kutlubaev MA, Hackett ML 2014; Johnson JL et al.,2006) In terms of stroke characteristic and lesion location, the evidence available suggested that stroke severity was strongly associated with PSD (Ayerbe L et al., 2013; Kutlubaev MA and Hackett ML, 2014). Some recent systematic reviews also suggested that there is an association between PSD and type (hemorrhagic or ischemic) or mechanism (embolic or thrombotic or etc) of stroke (De Ryck A et al., 2014; Kutlubaev MA and Hackett ML 2014; Johnson JL et al.,2006). Despite stroke lesion or location was extensively investigated as an associated factor for PSD, the findings have been inconsistent (RG Robinson et al., 2016). Nevertheless, RG Robinson believed that there is an association between left basal ganglia and left frontal lesions with PSD within two months of first clinical stroke. This is due to availability of strong scientific evidence of brain lateralization of emotion (Davidson RG, Irwin W, 1999). There was also a study that reported the association of PSD with left frontal hemisphere lesions and with proximity to the frontal pole (Rajashekaran P et al., 2013).

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The severity of post-stroke functional impairment in ADL was a factor that most consistently associated with PSD (RG Robinson et al., 2016). The association between cognitive impairment (especially executive dysfunction) and PSD has been well established as well (RG Robinson et al., 2006).

For association between PSD and social support, the evidence available was conflicting (RG Robinson et al., 2016). Nevertheless, there was a prospective study that showed PSD at 3-months follow-up was associated with lack of social support on admission (Hermann N et al., 1998).

For the impact of PSD on stroke recovery, there were numerous studies and reviews looking into this relationship. Five studies that examined the severity of depression on stroke survivor and predictors of functional impairment in ADL in 1-year follow-up, found that depression severity was an independent predictor of severity of impairment in ADL (Robinson RG, 2006). A longitudinal study showed that response to treatment with nortriptyline or fluoxetine in PSD patients over 12 weeks lead to improved cognitive function to the similar level seen in non-depressed stroke patients that lasted for more than 2 years (Kimura M et al., 2000). Patients with PSD who received treatment of antidepressants (nortriptyline or fluoxetine) showed better improvement in ADL activities compared to those on placebo (Chemerinski E et al., 2001).

Increased mortality rate was also associated with PSD. The first prospective study (10 years, n=103) was published in 1993, found out that patients with similar physical impairment who developed PSD during acute post-stroke period had higher mortality rate compared to patients who have no depression (Morris PL et al., 1993). House et al (2001) also found that PSD was associated with mortality as early as 1-year post

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stroke. A cohort of 51119 hospitalized stroke patients was followed (Williams LS, Ghose SS, Swindle RW, 2004) and found that those who developed PSD had a higher 3-year mortality risk than those who did not have PSD. In term of treatment of PSD with antidepressants, there was a 9-year follow-up study with PSD patients who had been treated with fluoxetine 40mg/day and nortriptyline 100mg/day for 12 weeks (n=53). Patients who received active treatment had an increased probability of survival (at 9 years follow-up) compared to patients given placebo (Ried LD et al., 2011)

In term of etiology of PSD, there was evidence supporting the role of biological, psychological and social factors in the mechanism of PSD (De Ryck A et al., 2014),

In stroke literature, the most consistent findings associated with PSD are stroke severity and the degree of functional physical and cognitive impairment (Kutlubaev MA, Hackett ML, 2014). However, it is uncertain whether biological factors are related to brain damage that contributed to the bidirectional relationship between disability and depression or whether the level of impairment is etiologically associated with the development of PSD through a "reactive" psychological mechanism.

Alterations in hypothalamic-pituitary-adrenal (HPA) axis abnormalities (Aström M, Olsson T, Asplund K, 1997), ascending monoamine systems (Li W et al., 2014), alterations in neuroplasticity and in glutamate neurotransmission (Noonan K et al., 2013) , disruption of prefrontal-subcortical circuits (TaylorWD et al., 2013), and an excess of proinflammatory cytokines (Spalletta G et al., 2006) were all the empirical evidence that associated PSD with biological factors. Yet, there is no coherent explanatory model currently available to formulate and integrate all these changes.

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There are numerous possible physiological mechanisms related to PSD as explained above. However, many experts have concluded that PSD is a complex disorder, like most major psychiatric disorders not associated with stroke. PSD may best be described as a bio-psycho-social disorder (Robinson RG, 2016). However, this framework does little help to find out the actual pathophysiological mechanisms. These different etiological factors described above may have more salient roles in some forms or symptoms of PSD and also their effects may vary at different time after stroke. Future investigators should attempt to identify the clinical characteristics of PSD or mechanism of specific symptoms rather than the whole syndrome.

2.4 Positive emotion and stroke

The definition of emotion is varied based on different references. However, it is commonly divided into two categories as positive emotion and negative emotion (Burgdorf & Panksepp, 2006). Numerous literature review especially those related to mood disorders focused more on negative emotion rather than positive emotion (Fredrickson, 1998).

Negative emotion has become the common focus of psychological problems as it is more distressing in the context of a prolonged, extreme or inappropriate state of emotions which including phobia, anxiety disorders, depression and suicide, eating disorders, violence and aggression (Fredrickson, 2004). For clinicians, this led to the tendency to focus more on negative emotion in their practice. Positive emotion, on the other hand, is not usually a life-threatening situation and always given lower priority

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in term of psychological perspective and also clinical practice. As a result, knowledge of positive emotion is often under reviewed and received little focus compared to negative emotion.

Compared to negative emotion, positive emotion has only recently received attention on scientific research (Burgdorf & Panksepp, 2006). Positive emotion is an essential component of human well-being (Fredrickson, 1998). lt has an important role to facilitates adaptive behaviour to the surrounding environment (Fredrickson, 2001). Fredrickson (2001, 2004) described the theory of broaden-and-build of positive emotion. The theory explains that, when people are coping with negative emotional circumstances, positive emotion helps to broaden the thoughts and behaviour tendencies (Fredrickson, 1998). Positive emotion helps to generate flexible and adaptive solution to solve the problems and widen the options when one is coping with stress (Fredrickson. 2001). Comparison with the effect of negative emotion is worthwhile for better understanding of the broaden theory of positive emotion. When people are facing stressful events, negative emotion will lead to specific action tendencies as a reflex to the autonomic response of fight-and-flight (Fredrickson, 2005). Negative emotion also helps to focus and narrow down the thought and action options so that people can react immediately (Fredrickson, 2002). Nevertheless, positive emotion broadens the options to help people to cope with stressors and solve the problems (Fredrickson, 1998, 2002, 2004). Positive emotion helps to build and shape a cognitive flexibility, by means forming a flexible and adaptive pattern of thought and behaviour when people are coping with stress (Fredrickson, 2001). The author also believes that the cognitive flexibility formed will help to build one's

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personal and social resources, as well as psychological resilience when coping with any constraints in the future.

Overall, the broaden-and-build theory explains that the positive emotion helps to broaden people's thoughts and action-repertoires and to build personal resources and psychological resilience when people are coping with daily life crisis and challenges (Fredrickson, 2001). The overall effect of the broaden-and-build theory will initiate upward spiral towards increasing emotional wellbeing (Fredrickson, 2002). Evidence also showed that positive emotion undoes the effects of negative emotion (Fredrickson, 1998). Positive emotion was found to be able to downregulate the effects of negative emotions, where it helps to speeds up the recovery of the psychological and physiological effects of negative emotion following a stressful circumstance (Fredrickson, 2001). Hence, it is believed that positive emotion helps to regulate experience from the negative emotion by undoing the effects of negative emotion (Fredrickson, 2004). Emotional regulation is the mechanism that links positive emotion to effective coping and resilient (Fredrickson, 2004). Emotional regulation refers to a complex process of downregulating and upregulating of both positive and negative emotions when facing with stressful situations (Parrot, 1993). Human daily life is governed by a complex emotional regulation process (Tugade Fredrickson, 2007). It can be either conscious or subconscious regulation of one's own feelings towards surrounding stimuli, especially towards negative experiences process (Gross, 1999). Emotional regulation involves an attempt to change or influence own emotions to various situations in daily life (Gross, 1999). Good positive emotions regulation when coping with negative experiences will help people

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to maintain wellbeing and promote resilient (Tugade & Fredrickson, 2007). Emotional competence is an adaptive regulation of emotions. refers to a state where someone knows how to regulate own emotion and use their emotion to the full advantage to achieve their goals and respond to challenges appropriately (Gross. 1998). Emotional competence will promote social competence, as people who are emotionally competent will be able to regulate their emotion to respond in situation appropriate ways (Gross, 1998). Overall, positive emotion is associated with good outcomes (Mauss et al., 2011). Many literatures show related that positive emotion improves personal well-being and psychological functions (Fredrickson & Losada, 2005; Gross, 1998; Santos et al., 2013). The benefit of positive emotion is also shown to have better health outcome, in a way it is associated with better health practices (Richman et al., 2005). Hence, positive emotion promotes overall personal well-being and improves one's quality of life (Cohn, Frearickson, Brown, Mikels, & Conway, 2009; Maass et al.. 2011). Positive emotion reduces the level of mental health problems (Mauss et al.. 2011) and fosters better physical health (Fredrickson, 2001). Decreased in positive emotion is associated with poorer psychological health and lower life satisfaction (Brown & Barlow, 2009; Gruber, Kogan, Quoidbach, & Mauss. 2013). In addition, increase in negative emotion has been associated with an increased risk of mortality and morbidity from cardiovascular diseases, diabetes, hypertension and adverse health behaviours such as lower physical activities, smoking and excessive alcohol consumption (Richman et al., 2005). Generally, the overall balance and stability of both positive and negative emotions are crucial in

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order to help people to achieve optimal functioning and maintain psychological well-being (Fredrickson, 2001, 2004).

There are numerous evidence points towards positive emotion to be a vital component when facing health challenges (Scheier MF et al., 1989; Steptoe A and Wardle J, 2005; Pressman SD and Cohen S, 2005; Steptoe A et al., 2005). There are also individual reports on positive emotion. When under the most stressful and difficult circumstances positive emotion may be necessary for recovery and survival (Folkman S et al., 2000; Viney LL et al., 1989; Westbrook MT and Viney LL, 1982; Mossey JM et al.,1989). A 15 years prospective study, Greer et al, 1990 found those women who had high hope after being diagnosed with breast cancer had better prognosis compared to those who were in despair. Mossey JM et la., 1989 found that hip fracture patients with positive emotion were 3 times more inclined to walk without assistance than patients who were depressed. High positive emotion in HIV patients also showed to help in longer survival times, slower immune decline and later symptoms onset (Reed GM et al., 1994 and 1999). Positive emotion after experiencing a stressful situation was also able to decrease the possibility of being depressed (Fredrickson BL, Levenson RW.1998).

By having positive emotion, patients were able to develop a good coping mechanism when facing with stressful events such as being diagnosed with chronic ailment and being hospitalized (Thompson, 1991; Folkman, 1997; Frederickson, 2003; Spacapan & Zinn et al., 2004). It was believed that high positive emotion patients have better motivation to enhance recovery after an illness by involving in intentional acts (i.e., thoughts, volitional acts, behaviors) (Dunn & Brody, 2008; Lyubomirsky, Sheldon, & Schkade, 2005). Besides, being hopeful and confident about the future (Taylor & Brown, 1994), feeling in control over external events (Ryff

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& Singer, 1996) and the association between high positive emotion and healthy social relationships (Clark & Watson, 1998) were also demonstrated in literature.

From the more recent literature, positive emotions consist of discrete pleasant-valenced emotions such as pride, joy, love or contentment (JR Carl et al., 2013) . Other definition of positive emotions is a composition set of response tendencies that open up in a comparatively short period of time. In other words, it is a trait-like dimension of emotional temperament that reflects an individual's tendency to undergo positive emotions. When people undergo positive affects, they are more likely to feel, act and think in ways that enhance capital formation and movement toward goals (DP Soskin et al, 2012). Ng CG et al. (2016) developed Positive Emotion Rating Scale (PERS) to be used to measure positive emotions in all dimensions for depressed patients. It is an easy and simple to use scale with satisfactory validity and reliability for the measurement of positive emotion in depressed patients.

For literature on positive emotion in post-stroke patients, there were only two studies found. Ostir and colleagues in 2008, examined 823 older stroke survivors. After depressive symptoms and other relevant risk factors were adjusted, patients discharged from inpatient rehabilitation facility with good positive emotion has better cognitive and motor function 3 months post-stroke. The findings were subsequently replicated by Gary SS et al in 2010 and showed that good functional recovery was associated with improved positive emotion 3 months post-stroke as compared to those without changes or worsening of positive emotion. Authors concluded that positive emotion can be a dynamic process.

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CHAPTER 3: OBJECTIVES

3.1 General Objective

The aim of this study is to assess positive emotion and depression in post-stroke patients in Hospital Pulau Pinang and their association with functional recovery.

3.2 Specific Objective:

1. To determine the prevalence of high positive emotion and its associated factors in post-stroke patients

2. To determine the prevalence of depression and its associated factors in post-stroke patients

3. To assess the functional recovery in post-stroke patients by assessing

    - Improvement of MBI (difference) score (MBI upon discharge(earlier) - MBI (current) during interview)
    - Severity of MBI during interview (at any one point between 6 – 12 weeks)

4. To examine the association of functional recovery in post-stroke patients with positive emotion, depression, socio-demographic and clinical data.

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3.3 Rationale of the study

Stroke is a major global health problem that causes tremendous disease burden. Functional disability is the main contribution to disease burden. One of the strong predictors of the functional status of stroke patients is PSD. The prevalence of PSD is well studied and ranged from 12% to 61%. Due to its prevalence and its impact on functional recovery, it is important to explore how PSD affect recovery of post-stroke patients.

Nevertheless, another domain of mood, which is the positive emotion, is not given scientific attention until lately when it was thought to be vital in promoting recovery process of medical illness. There were two studies on post-stroke functional recovery overseas and found out that it significantly improved recovery. However, it was not well studied in the local population. It is important that a study to be done in local setting to explore the potential predictors of mood components and functional recovery in post-stroke patients. The outcome of this study may serve a guide for management of post-stroke patients and reference for future studies.

This study aims to investigate positive emotion and depression in post-stroke patients and their association with functional recovery.

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CHAPTER 4: METHODOLOGY

4. Methodology

4.1 Study Type and Design

Cross-sectional study (data will be collected once only) from the subjects who are attending Rehabilitation Clinic and Occupational Therapy Outpatient Clinic in any one point of period between 6 to 12 weeks post stroke. The same subject will not be selected for the second time if he/she comes to the clinic (during the 6 to12 weeks period) after the first data collection.

4.2 Study Population and Setting

Post-stroke patients attending Rehabilitation Clinic and Occupational Therapy Clinic Hospital Pulau Pinang between 6-12 weeks after stroke during the period 31st October 2017 until 28th February 2018.

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4.2.1 Inclusion Criteria

- All post-stroke patients attending Rehabilitation Clinic and Occupational Therapy Clinic, between 6 to 12 weeks post-stroke.
- Stroke was diagnosed by neurologists during the previous admission.
- Age 18 and above
- Able to read and understand Malay and English.

4.2.2 Exclusion Criteria

- Previous neurological illness
- Previous mental illness
- Global aphasia and severe comprehension deficit
- Not consented to participate
- Patient that was already interviewed by investigator and data was collected earlier

4.3 Sample Size

The sample size was determined by the following formula:

$$n = \frac{t^2 \times p(1-p)}{m^2}$$

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$=1.96^2 x\ 0.12\ (1-0.12)$

0.05^2

$= 3.8416 x 0.12 x 0.88 / 0.0025$

$= 162$

Description:

- n = required sample size
- t = confidence level at 95% (standard value of 1.96)
- p = estimated prevalence of post-stroke depression at 3 months*
- m = margin of error at 5% (standard value of 0.05)

*Brodaty H, Withall A, Altendorf A, et al. Rates of depression at 3 and 15 months poststroke and their relationship with cognitive decline: the Sydney Stroke Study. Am J Geriatr Psychiatry. 2007;15:477–86

4.4 Study Duration and Timeline

- Data Collection: 5 months (from Oct 2017 to February 2018)

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4.5 Study Visits and Procedures and Instruments

- Data will be collected by the investigator. All post-stroke patients who are 6 to 12 weeks post-stroke attending Occupational Therapy Outpatient Clinic and Rehabilitation Clinic will be invited to participate in the study.
- Patients will then be given the Research Information and Patient Consent Form sheet to answer all the questionnaires.
- Participants will undergo a structured interview
- Instruments:

4.5.1 Modified Barthel Index (MBI)

- The MBI was developed by Shah et al. (1989) derived from the original 1965 Barthel's Index by Mahony and Barthel, a 10-questions self-reported questionnaire that measures physical disability based on ability to perform basic activities of daily living (ADL)(Mahoney & Barthel 1965).
- It is the most common instrument used to measure functional disability in stroke rehabilitation studies (Sangha et al. 2005).
- It assesses self-care (feeding, grooming, bathing, dressing, bowel and bladder care, and toilet use) and mobility (ambulation, transfers and stair climbing).
- The reliability of the MBI is 0.89, and it has a correlation of 0.91 with the Barthel score.

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- It is widely used by rehabilitation clinic and occupational therapy clinic in Malaysia to measure recovery.

4.5.2 (i)Montgomery-Asberg Depression Scale Self-Assessment (MADRS-S) (Bruno F, Nicholas M, 2009)

- A 9-items questionnaire to measure the core symptoms & cognitive features of depression
- It will measure degree & severity of depressive symptoms
- It is a self-rated scale
- It has 82% sensitivity and 75% specificity with good validity & reliability

(ii) Malay version of the Montgomery- Asberg Depression Rating Scale (MADRS-BM) (Yee A et al., 2015)

- This is the Malay version of MADRS-S
- It is translated and validated by Yee A et al., 2015 and demonstrated promising psychometric properties in terms of dimensionality, reliability, and validity that generally justifies its use in routine clinical practice in Malaysia
- It is a self-rated scale
- It has 78 % sensitivity and 86 % specificity.

4.5.3 (i) Positive Emotion Rating Scale (PERS) (Ng CG et al., 2016).

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- This scale is designed to measure positive emotion in the past one week
- It was developed and validated by Ng CG et al (2016).
- It is a self-rated scale
- It has 8 questions and scored on a 5 point Likert scale (1–5)
- It is a brief and easy to use scale with satisfactory validity and reliability for the measurement of positive emotion in depressed patients.
- It has a specificity of 0.73, sensitivity of 0.75, positive predictive value of 0.60 and negative predictive value of 0.78

(ii) The Malay Version Positive Emotion Rating Scale (PERS-M) *(*Mohamed FA, Ng CG, Ong LY, 2016)

- This scale is translated Malay version of PERS
- It is brief and easy to administer.
- It demonstrates satisfactory psychometric properties for local setting
- It has a sensitivity of 0.68, a specificity = 0.63, a positive predictive value of 0.49 and a negative predictive value of 0.79.

PERS and MADRS-S used have been obtained with permission from the principal authors. Both questionnaires are appropriately validated (in English and Malay) and used in previous studies.

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Other measures

Sociodemographic

- Age
- Gender
- Marital status
- Race
- Educational level

Clinical measure

- Medical co-morbidity
- Area of stroke
- Type of stroke
- Length of the previous stay in the ward
- MBI upon discharge from acute ward

Study Procedure:

- Patients who fulfill both the inclusion and exclusion criteria will be identified and included in this study
- They will be then provided with information and aim of the study
- Consent will be taken from those who agree to participate in this study

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- Their socio – demographic data and clinical data will be recorded
- Patients will be given self-rated MADRS and PERS to assess depression and positive emotion during that visit.
- MADRS-S was interpreted and the patients were categorized as absent of depression or presence of depression (according to the cut-off point of 4).
- PERS was interpreted, a cut-off point of 30 and above indicate good positive emotion. Patients with the score of below 30 were regarded to be having more prominent negative emotion.
- There is no follow up after that. (Cross-sectional study at that point of visit)
- MBI will be assessed by Occupational Therapist
- The MBI upon discharge from ward earlier will be obtained from Occupational Therapist and comparison will be made against current MBI. The score difference between earlier MBI (MBI-D) and current MBI (MBI-C) is recorded (the bigger difference indicates bigger improvement of function)
- MBI was also interpreted into different category of severity.

4.6 Statistical Analysis Plan

- All data collected were analysed using Statistical Packages for Social Science (SPSS) version 22.0 software.
- Bivariate analysis between positive emotion status, depressive status and MBI status with sociodemographic and clinical variables will be tested using statistical analysis (Chi-squared tests and Fisher exact tests for categorical variables as well as t-tests for parametric continuous variables and Mann

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Whitney tests for non-parametric continuous variables). Multiple logistic regression analyses will then be performed to explore significant variables with having positive emotion, non-depression status and independent MBI status.

- To assess the functional recovery, a bigger score different of MBI-Dishcarge and MBI-Current, indicates bigger improvement. The score difference is label as 'MBI (difference) score'. The association between different variables and functional recovery score will be tested using Mann-Whitney U test (for categorical variables) and Pearson's correlation analysis (for parametric data) or Spearman's correlation (for non-parametric data) for continuous variables. Multiple linear regression will then be performed for significant variables.

4.7 Ethical Consideration

- This study was registered with the National Medical Research Register (NMRR) of Ministry of Health.
- Ethics approval was obtained from Ministry of Health Research and Ethics Committee (MREC).
- All data collected will be confidential and used only for the purpose of this study.
- Purpose of the study and confidentiality explained to all participants before obtaining consent
- All study data recorded in papers will be kept in the principle investigator's locker, which is locked and located in his clinic. Only the principal investigator has the access to the locker and data.

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- All data was recorded and analyzed in principal investigator's laptop which is password protected. It can only be assessed by the principal investigator.
- All data recorded in paper or soft copies will be deleted and destroyed 5 years after the study completion.
- No study data will be returned or informed to subject. However, for those subjects who are interested to know the study outcome, his/her phone number will be taken. A summary of the research at the end of the study will be given out to them.
- There are no risks to participants. This study does not present any direct benefit to the participants as well. However, the study does provide a better understanding of the potential effect of emotion on functional recovery in post-stroke patients.

4.8 Conflict of Interest:

- The investigators declare they have no conflict of interest

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CHAPTER 5: RESULTS

5. 1 Demographic characteristics of post-stroke patients

A total of 136 patients who fulfilled the inclusion and exclusion criteria were consented to take part in the study. 10 patients did not agree to take part due to unable to understand Malay or English and due to lack of time.

The mean age of the patients was 60.9 years (SD±12.14). There were 89 male patients (65%) and 47 female patients (35%).

They were predominantly Chinese (63.2%) and married (73.5%). For educational level, patients with secondary education (44.9%) were slightly more than those with primary educational level (42.6%) and a minority of them have tertiary education level (12.5%). Table 5 shows the demographic data of the patients.

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Table 5.1: Demographic data of post-stroke patients

Variable	Frequency (n) or Mean	Percent (%)
Mean age ± SD (years)	60.9 ± 12.14	
Gender		
Male	89	65.4
Female	47	34.6
Ethnicity		
Malay	35	25.7
Chinese	86	63.2
Indian	14	10.7
Others	1	0.7
Marital Status		
Single	27	19.9
Married	100	73.5
Divorced/Widowed	9	6.6
Education level		
Primary education	58	42.6
Secondary Education	61	44.9

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Tertiary Education	17	12.5

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5.2 Clinical variables of the post-stroke patients

The number of patients recruited from Occupational Therapy Clinic and Rehabilitation Clinic was 118 (86%)and 18 (14%) respectively. 1 (0.7%) patient was only attending rehab clinic. Meanwhile, 62 patients (45.6%) only attend OT and 73 patients (53.7%) attending both rehab clinic and OT.

A majority of patients have two (45.6%) or three (42.6%) medical co-morbidities. The remaining of the patients have either one or more than three co-morbidities. The mean number of co-morbidity was 2.66 (SD ± 0.743). Hypertension showed the highest prevalence (77.2%) among stroke patients.

For the characteristic of stroke, ischemic stroke was more prominent (79.4%) compared to hemorrhagic stroke (20.6%). Left hemisphere (45.6%) was slightly more common than right hemisphere stroke (41.9%) and cerebellar stroke was relatively least common (12.5%).

The mean length of stay in acute medical ward during stroke was 5.66 days (SD ±3.58 days). The mean MBI upon discharge was 34 (SD ±16.4) which reflects the category of severe dependence in ADL functional ability (MBI 21-59). 92.6% of the patients (21.3% total dependence and 71.3% severe dependence) were dependent according to MBI (discharge) score. Only 7.4% of the patients were in assisted or total independence, all of them were in the category of moderate dependence.

Table 5.2 indicates the clinical variables of the post-stroke patients.

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Table 5.2 Clinical variables of the post-stroke patients

Variable	Frequency (n) or Mean	Percentage (%)
Number of comorbid medical condition		
1	1	0.7
2	62	45.6
3	58	42.6
4	12	8.8
5 or more	3	2.2
Mean number of co-morbidity± SD	2.66 ± 0.743	
Nature of stroke		
Ischemic	108	79.4%
Hemorrhagic	28	20.6%
Area of stroke		
Left Hemisphere	62	45.6
Right Hemisphere	57	41.9
Cerebellum	17	12.5

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Length of stay Mean day ± SD (days)	5.66 ± 3.58	
MBI score upon discharge Mean score ± SD	34.06 ± 16.40	
MBI score upon discharge according to category: Depedence (MBI: 0-59) Total dependence (MBI: 0-20) Severe dependence (MBI: 21-59) Assisted or total independence (MBI: 60-100) Moderate dependence (MBI: 60-90) Mild dependence (MBI: 91-99) Fully independence (MBI: 100)	126 29 97 10 10 0 0	92.6 21.3 71.3 7.4 7.4 0 0

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5.3 Positive emotion of post-stroke patients

The mean score of total PERS was 31.6 (SD ±6.6) which reflects high positive emotion (a score of 30 or more reflects high positive emotion).

Out of 136 patients, 89 (65.4%) have high positive emotion and 47 (34.6%) have low positive emotion (cut-off point: total PERS of 30).

Among the 8 items of PERS, the item which has the highest mean score (which reflects higher positive emotion on that item) was PERS 5, i.e. 4.53 (SD ±0.61). Meanwhile, PERS 3 and PERS 4 have the lowest mean score, i.e. 3.44.

Table 5.3 shows descriptive statistics of the positive emotion of the patients based on PERS score and 8 PERS items mean scores. Table 5.31 shows the mean scores of 8 components of PERS

Table 5.3 Positive emotion in post-stroke patients

Variables	Frequency (n)	Percent (%)
PERS ≧30 (Good PERS)	89	65.4
PERS <30 (Low PERS)	47	34.6

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Table 5.31 8 components of PERS

	Minimum	Maximum	Mean	Std. Deviation
PERS1 'I am able to enjoy my favourite drink and food'	2	5	3.70	0.961
PERS2 'I am able to enjoy looking at beautiful scenery or view'	2	5	4.42	0.766
PERS3 'I am looking forward for enjoyable activities'	1	5	3.44	1.160
PERS4 'I am able to enjoy my hobbies'	1	5	3.44	1.179
PERS5 'I am able to feel love from family or friends'	2	5	4.53	0.608
PERS6 'I am able to feel grateful for what I have'	2	5	4.41	0.856
PERS7 'I am able to feel energetic and lively'	1	5	3.55	1.246
PERS8 'I take pride in what I do'	2	5	4.22	0.875

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Among all demographic variables, none of them are significantly associated with having good positive emotion post-stroke. Table 5.32 shows the bivariate analysis of demographic data using Chi-squared analysis and Independent T-test.

Among all the clinical variables, patients with co-morbidity of less than 3 ($p=0.037$) and length of stay of less than 5 days during acute stroke ($p<0.001$) were significantly associated with having good positive emotion using Chi-squared analysis. Using Mann Whitney U Test, MBI score upon discharge ($p<0.001$) was significantly associated with PERS score as well. Table 5.33 showed the analysis of clinical data using Chi-squared analysis and Mann Whitney U test.

Multiple logistic regression analysis was performed to explore the relationship between the significant clinical variables (i.e. morbidity of less than 3, length of stay less than 5 days and MBI upon discharge). The analysis showed that the length of stay of less than 5 days was the only factor significantly associated with high positive emotion, in which length of stay of less than 5 days was 7.3 times higher to have high positive emotion ($p<0.001$). Table 5.34 showed the multiple logistic regression analysis as mentioned above.

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Table 5.32 Bivariate analysis of demographic factors associated with good positive emotion.

Variables	Good positive emotion n (%) or mean (s.d.)		χ^2 or t	p value	OR	95% CI	
	Yes (n=89)	No (n=47)				Lower	Upper
Age (years)	60.1 (12.18)	62.3 (12.03)	1.013[a]	0.69		-2.112	6.549
Gender Male Female	 63 (70.8) 26 (55.3)	 26 (29.2) 21 (44.7)	 3.254	 0.07	 0.51	 0.24	 1.065
Ethnicity Chinese Non-Chinese	 55 (64.0) 34 (68.0)	 31 (36.0) 16 (32.0)	 0.229	 0.63	 0.84	 0.399	 1.749
Spouse Yes No	 65 (65.0) 24 (66.7)	 35 (35.0) 12 (33.3)	 0.033	 0.857	 0.93	 0.415	 2.078

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Education							
≤ 6 years	38 (65.5)	20 (34.5)	0.002	0.987	0.99	0.486	2.032
> 6 years	51 (65.4)	27 (34.6)					

Notes: [a]Independent t-test

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Table 5.33 Bivariate analysis of clinical factors associated with good positive emotion.

Variables	Good positive emotion n (%) or mean (s.d.)		χ^2or U	p value	OR	95% CI	
	Yes (n=89)	No (n=47)				Lower	Upper
Less than 3 medical co-mobidities Yes No	47 (74.6) 42(57.5)	16(25.4) 31(42.5)	4.356	0.037*	0.46	0.222	0.960
Ishcemic stroke Hemorrhagic stroke	71 (65.7) 18 (64.3)	37(34.3) 10(35.7)	0.21	0.885	0.94	0.393	2.237
Area of stroke Left hemisphere Others	41 (67.2) 43 (57.3)	20(32.8) 32(42.7)	4.86	0.052	0.65	0.209	0.919

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Length of stay less than 5 days Yes No	 52(89.7) 37(47.4)	 6(10.3) 41(52.6)	26.22	<0.001**	0.11	0.040	0.271
MBI (discharge score)	78.89	48.82	1167[a]	<0.001**			

Notes: [a]Mann-Whitney test, *p<0.05, **p<0.01

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Table 5.34 Multiple logistic regression of demographic and clinical factors associated with good positive emotion

Variables	B	Standard error	Adjusted odds ratio	P value	95% Confidence Interval	
					Lower	Higher
Length of stay less than 5 days	1.995	0.504	7.354	<0.001**	2.741	19.733
Less than 3 medical Co-morbidities	0.689	0.419	1.991	0.1	0.876	4.526
MBI (discharge) score	0.031	0.017	1.031	0.071	0.997	1.066

Notes: **p<0.01

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5.4 Depressive status of patients

The mean total MADRS-S score for post-stroke patients was 3.11

Out of 136 patients, 104 (76.5%) have no depression and 32 (23.5%) have depression (total MADRS-S of 4 or more).

Among the 9 items of MADRS-S, the item that has the highest mean score (indicates the higher intensity of depressive symptom) was MADRS-S 6, i.e. 0.68 (SD ±0.54). Meanwhile, MADRS-S 9 had the lowest mean score, i.e. 0.11 (SD ±0.31).

Table 5.4 shows the depressive status and symptoms based on MADRS-S of the patients and Table 5.41 shows that the mean score of 9 items in MADRS-S.

Table 5.4 Depressive status in post stroke patients

	Frequency (n)	Percent (%)
NonDepressed (total MADRS-S <4)	104	76.5
Depressed (total MADRS-S ≧4)	32	23.5

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	Minimum	Maximum	Mean	Std. Deviation
MADRS1 (Mood)	.0	2.0	.474	.5247
MADRS2 (Feeling of unease)	.0	2.0	.290	.4852
MADRS3 (Sleep)	.0	2.0	.331	.5027
MADRS4 (Appetite)	.0	2.0	.386	.5091
MADRS5 (Ability to concentrate)	.0	2.0	.213	.4415
MADRS6 (Initiative)	.0	2.0	.676	.5359
MADRS7 (Environment Involvement)	.0	1.0	.393	.4651
MADRS8 (Pessimism)	.0	2.0	.250	.5055
MADRS9 (Zest for life)	.0	1.0	.110	.3144

Table 5.41 Mean score of 9 components in MADRS-S

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Among all demographic variables, none of them were significantly associated with having depression. Table 5.42 shows the analysis of demographic data using Chi-squared analysis and Independent T-test.

Among all the clinical variables, patients with co-morbidities of less than 2 ($p=0.002$) and length of stay of less than 5 days during stroke ($p<0.001$) were significantly associated with depression using Chi-squared analysis. MBI score upon discharge ($p=0.021$) was significantly associated with depression as well using Mann Whitney U test. Table 5.43 showed the analysis of clinical data using Chi-squared analysis and Mann Whitney U test.

Multiple logistic regression analysis was performed to explore the relationship between the significant clinical variables, such as morbidity of less than 2, length of stay less than 5 days and MBI upon discharge. The analysis showed that the length of stay of less than 5 days and co-morbidity less than 2 were the factors significantly associated with depression, in which length of stay of less than 5 days was 12.3 times less likely to have depression ($p<0.001$). Less than 2 co-morbidity is 4.3 times less likely to have depression. Table 5.44 showed the multiple logistic regression analysis as mentioned above.

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Table 5.42 Bivariate analysis of demographic factors associated with depression

Variables	Depression status n (%) or mean (s.d.)		χ^2 or t	p value	OR	95% CI	
	Depressed (n=32)	Non-depressed (n=104)				Lower	Upper
Age (years)	60.91 (11.743)	60.86 (12.320)	-0.02[a]	0.984		-4.924	4.823
Gender Male Female	 23 (25.8) 9 (19.1)	 66 (74.2) 38 (80.9)	0.766	0.381	0.68	0.285	1.619
Ethnicity Chinese Non-Chinese	 20 (23.3) 12 (24)	 66 (76.7) 38 (76)	0.01	0.921	0.96	0.423	2.178
Spouse Yes No	 25 (25) 7 (19.4)	 75 (75) 29 (80.6)	0.454	0.50	1.38	0.539	3.54

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Education							
≤ 6 years	16 (27.6)	42 (72.4)	0.925	0.336	0.68	0.306	1.502
> 6 years	12(20.5)	62(79.5)					

Notes: [a]Independent t-test

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Table 5.43 Bivariate analysis of clinical factors associated with depression

Variables	Depressive status n (%) or mean (s.d.)		χ^2or U	p value	OR	95% CI	
	Depressed (n=32)	Non-depressed (n=104)				Lower	Upper
Less than 3 medical co-mobidities Yes No	7(11.1) 25(34.2)	56(88.9) 48(65.8)	10.05	0.002**	4.17	1.656	10.48
Ishcemic stroke Hemorrhagic stroke	25(23.1) 7(25)	83(76.9) 21 (75)	0.042	0.837	1.11	0.422	2.905
Area of stroke Left hemisphere Others	16(26.2) 16(21.3)	45(73.8) 59(78.7)	0.448	0.503	0.76	0.345	1.688

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Length of stay less than 5 days Yes No	3 (5.2) 29(37.2)	55(94.8) 49(62.8)	18.94	<0.001**	10.9	3.11	37.85
MBI (discharge score)	54.47	72.82	1215[a]	0.021*			

Notes: [a]Mann-Whitney test, *p<0.05, **p<0.01

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Table 5.44 Multiple logistic regression of demographic and clinical factors associated with depression

Variables	B	Standard error	Adjusted odds ratio	P value	95% Confidence Interval	
					Lower	Higher
Length of stay less than 5 days	-2.515	0.708	0.081	<0.001**	0.020	0.324
Less than 3 medical Co-morbidities	-1.443	0.505	0.229	0.004**	0.085	0.617
MBI (discharge) score	0.008	0.018	1.008	0.647	0.973	1.045

Notes: **p<0.01

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5.5 Functional status in 6 to 12 weeks post-stroke.

The mean time of interview was 10.49 (SD± 1.83) weeks post-stroke.

For functional status post-stroke, the mean MBI (current) score during interview was 78.38 (SD ±19.31) which reflects moderate dependence category (under the category of assisted independence)

Bivariate analysis for factors associated with MBI (current) score shows that none of the demographic factors were significantly associated with MBI (current) score. For clinical factors, length of stay of less than 5 days was significantly associated higher MBI (currently) score using Mann Whitney U test. MBI (discharge) and the total PERS were significantly positively correlated with MBI (current) score, while the total MADRS-S score was significantly negatively correlated with MBI (current) score using Spearman's correlation. Table 5.5.1 shows bivariate analysis of demographic and clinical factors associated with MBI (current) score

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Table 5.5.1 Bivariate analysis of demographic and clinical factors with MBI (current) score

Variable	MBI (current) score		
	Mean Mean Rank	U or r	p value
Age		-0.135[a]	0.118
Gender Male Female	 68.5 68.5	 2091.5	 1.0
Ethnicity Chinese Non-Chinese	 50 86	 2071.5	 0.722
Spouse Yes No	 66.68 73.56	 1618.0	 0.367
Education ≤6 years >6 years	 58 78	 2156.0	 0.639

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Less than 3 medical co-morbidities Yes No	73.75 63.97	1969.0	0.147
Nature of stroke Ischemic stroke Hemorrhagic stroke	71.28 57.79	1212.0	0.105
Area of stroke Left hemiphere Others	71.75 65.85	2089	0.383
Length of stay less than 5 days Yes No	91.32 51.53	938.5	<0.001**
MBI (discharge) score		0.557[b]	<0.001**
Total PERS score		0.628[b]	<0.001**
Total MADRS-S		-0.553[b]	<0.001**

Notes: [a]Pearson's correlation coefficient; [b]Spearman's correlation coefficient;

*p<0.05; **P<0.01

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Multiple linear regression analysis for factors associated with MBI (current) score were done after adjusting for significant factors. Higher MBI (current) score was significantly associated with higher total PERS score ($p < 0.001$), higher MBI (discharge) score ($p<0.001$) and length of stay less than 5 days ($p=0.045$). Total MADRS-S score was not significantly associated with MBI (current) score ($p=0.156$). Table 5.52 shows multiple linear regression analysis of factors associated with higher ADL function based on MBI (current) score.

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Table 5.5.2 Multiple linear regression of significant factors associated with MBI (current) score

Variables	Bivariate analysis	Multiple linear regression[a]				
	p value	B	SE	β	p value	R^2
Length of stay less than 5 days	<0.001	-4.888	2.411	-0.126	0.045*	0.617
MBI (discharge) score	<0.001	0.503	0.069	0.428	<0.001**	
Total PERS score	<0.001	1.106	0.255	0.378	<0.001**	
Total MADRS-S Score	<0.001	-0.914	0.641	-0.122	0.156	

Notes: [a]Adjusted for significant factors; *p<0.05; **p<0.01

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5.6 Functional improvement in 6 to 12 weeks post-stroke based on mbi (difference) score

For functional recovery, the mean of MBI difference (or improvement) score was 45.04 (SD ±16.1) for all 136 patients.

On bivariate analysis of clinical and demographic factors associated with MBI improvement, patients with a partner (p= 0.035), less than 2 co-morbidity (0.044) and total PERS score ($p < 0.001$) were significantly associated with MBI difference. Age ($p<0.001$), education less than 6 years (p=0.003), MBI score upon discharge ($p<0.012$), total MADRS-S score ($p <0.001$) were significantly negatively correlated with MBI difference. (Table 5.6.1)

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Table 5.6.1 Bivariate analysis of demographic and clinical factors with MBI (difference) score

Variable	MBI (difference) score		
	Mean Mean Rank	U or r	p value
Age		-0.383[a]	<0.001[**]
Gender Male Female	 67.09 71.17	 1966	 0.565
Ethnicity Chinese Non-Chinese	 64.18 75.93	 1778.5	 0.093
Spouse Yes No	 80.36 64.23	 1373.0	 0.035[*]
Education ≤6 years >6 years	 56.8 77.2	 1583.5	 0.003[**]

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Less than 3 medical co-morbidities Yes No	 75.81 62.19	1839.0	0.044*
Nature of stroke Ischemic stroke Hemorrhagic stroke	 66.29 77.02	1273.5	0.199
Area of stroke Left hemisphere Others	 74.07 63.97	1948	0.137
Length of stay less than 5 days Yes No	 75.66 63.17	1846	0.067
MBI (discharge) score		-0.312[b]	<0.001**
Total PERS score		0.497[b]	<0.001**
Total MADRS-S		-0.429[b]	<0.001**

Notes: [a]Pearson's correlation coefficient; [b]Spearman's correlation coefficient;

*p<0.05; **P<0.01

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Multiple linear regression for factors associated with MBI improvement were done after adjusting for significant factors. Higher MBI difference was significantly associated with younger age (p<0.001), higher total PERS (p<0.001) and no partner (p=0.048). The total MADRS-S score was not significant (p=0.182) for this analysis. Table 5.6.2 shows multiple linear regression of factors associated with MBI difference.

Table 5.6.2 Multiple linear regression of factors significantly associated with MBI difference in bivariate analysis

Variables	Bivariate analysis	Multiple linear regression[a]				
	p value	B	SE	B	p value	R^2
Spouse	0.035	-4.888	2.411	-0.126	0.045*	0.617
Age	<0.001	-0.347	0.089	-0.261	<0.001**	
Less than 3 medical co-morbidities	0.044	0.089	2.067	0.003	0.805	
Education more than 6 years	0.003	2.423	2.210	0.074	0.189	

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MBI (discharge) score	<0.001	-0.392	0.062	-0.389	0.054	
Total PERS score	<0.001	1.178	0.232	0.481	<0.001**	
Total MADRS-S score	<0.001	-0.897	0.606	-0.143	0.141	

Notes: [a]Adjusted for significant factors; *p<0.05; **p<0.01

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5.7 Functional status in 6 to 12 weeks based on severity of stroke

Bivariate and multivariate analysis of demographic and clinical factors MBI (current) score base on stroke severity according to length of stay.

The previous analysis suggested that the length of stay is significantly associated with functional status, positive emotion and depression. One explanation for this is length of stay can reflect the stroke severity. The longer the stay the higher the severity. Thus, further analysis was done by dividing the subjects to two groups:

i) Length of stay less than 5 days represent mild stroke, n=58

ii) Length of stay of 5 days and more represent severe stroke, n=78

This is to reduce the confounding effect of the severity of stroke when assessing the association with post stroke function.

Bivariate analysis in mild stroke patients showed that only MBI (discharge) is associated with MBI (current) score and Total PERS score. For bivariate analysis in severe stroke patients, age, MBI (discharge) score, Total PERS score and Total MADRS-S score are associated with MBI (current) score.

Multiple linear regression analysis was done in analysis of significant factors in mild stroke patients. Higher MBI (current) score is associated with higher MBI (discharge) score ($p=0.004$) and higher Total PERS score ($p<0.001$).

Multiple linear regression analysis was done for factors associated with MBI (current) score in severe stroke patients after adjusting for significant factors. Higher MBI score was significantly associated with younger age ($p=0.032$), higher MBI (discharge) score ($p<0.001$) and higher Total PERS score ($p<0.001$).

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Table 5.7.1 showed bivariate analysis of demographic and clinical factors with MBI (current) score in mild stroke patients and table 5.7.2 showed analysis of demographic and clinical factors with MBI (current) score in severe stroke patients. Table 5.7.3 showed multiple linear regression analysis of significant factors associated with MBI (current) score in mild stroke patients and table 5.7.4 showed multiple linear regression analysis of significant factors associated with MBI (current) score in severe stroke patients

Table 5.7.1 Bivariate analysis of demographic and clinical factors with MBI (current) score in mild stroke patients, n=58

Variable	MBI (current) score (n=58)	
	U or r	p value
Age	-0.116[a]	0.385
Gender Male Female	310.5	.507
Ethnicity Chinese Non-Chinese	336.5	0.330

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Spouse Yes No	321.5	0.986
Education ≤6 years >6 years	419.5	0.994
Less than 3 medical co-morbidities Yes No	349.0	0.259
Nature of stroke Ischemic stroke Hemorrhagic stroke	114.0	0.273
Area of stroke Left hemiphere Others	368.5	0.413
MBI (discharge) score	0.502[b]	<0.001[**]
Total PERS score	0.305[b]	0.020[*]
Total MADRS-S	-0.075[b]	0.575

Notes: [a]Pearson's correlation coefficient; [b]Spearman's correlation coefficient;

[*]p<0.05; [**]P<0.01

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Table 5.7.2 Bivariate analysis of demographic and clinical factors with MBI (current) score in severe stroke patients, n=78

Variable	MBI (current) score	
	U or r	p value
Age	-0.251[a]	0.026[*]
Gender Male Female	615.5	0.281
Ethnicity Chinese Non-Chinese	612.5	0.360
Spouse Yes No	498.5	0.258
Education ≤6 years >6 years	574.5	0.133
Less than 3 medical		

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co-morbidities Yes No	497.5	0.013*
Nature of stroke Ischemic stroke Hemorrhagic stroke	611.0	0.956
Area of stroke Left hemiphere Others	603	0.157
MBI (discharge) score	0.580[b]	<0.001**
Total PERS score	0.576[b]	<0.001**
Total MADRS-S	-0.474[b]	<0.001**

Notes: [a]Pearson's correlation coefficient; [b]Spearman's correlation coefficient;

*p<0.05; **P<0.01

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Table 5.7.3 Multiple linear regression of significant factors associated with MBI (current) score in mild stroke patients (n=58)

Variables	Bivariate analysis	Multiple linear regression[a]				
	p value	B	SE	β	p value	R^2
MBI (discharge) score	<0.01	0.219	0.073	0.321	0.004**	0.671
Total PERS score	0.02	1.599	0.316	0.543	<0.001**	

Notes: [a]Adjusted for significant factors; *p<0.05; **p<0.01

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Table 5.7.4 Multiple linear regression of significant factors associated with MBI (current) score in severe stroke patients (n=78)

Variables	Bivariate analysis	Multiple linear regression[a]				
	p value	B	SE	β	p value	R^2
Age	0.026	-0.255	0.116	-0.153	0.032*	0.671
Less than 3 medical co-morbidities	0.013	-3.81	2.836	-0.097	0.183	
MBI (discharge) score	<0.001	0.819	0.121	0.490	<0.001**	
Total PERS score	<0.001	1.099	0.296	0.392	<0.001**	
Total MADRS-S Score	<0.001	-0.480	0.731	-0.656	0.514	

Notes: [a]Adjusted for significant factors; *p<0.05; **p<0.01

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CHAPTER 6 DISCUSSION

Stroke is a major health problem in Malaysia. According to Malaysia National Burden of Diseases Study 2000. It was ranked the third leading cause of death for male after coronary heart disease and pneumonia. It was the second leading cause of death in female after coronary heart disease. (Loo and Gan 2012). It was also ranked third most common cause of disability-adjusted life-years (DALYs) according to the Global Burden of Diseases, Injuries and Risk Factors Study (GBD) in 2010. Morbidity post-stroke produces substantial burden to post-stroke patients, caregivers, healthcare systems and providers. Functional disability is the main contribution to post-stroke morbidity. Post-stroke recovery directly affects functional ability of a post-stroke patient. It can be divided into neurological recovery and functional recovery. Neurological recovery is associated with stroke pathogenesis and lesion site; whereas functional recovery is influenced by external environment, continuity of rehabilitation, motivation and other psychosocial factors (Anderson et al 1974). The main aspect that was used over the past few years to measure functional recovery is ADL function. Due to its disease burden, the emotional aspect of post-stroke patients was studied broadly as well. They were mainly assessing the negative emotion or depression related to post-stroke patients.

This study provides an insight on the demographic and clinical data in post-stroke patients attending rehabilitation programme in Hospital Pulau Pinang. It also explored the other components of emotion, such as positive emotion, depression and functional status and recovery of post-stroke patients. Finally, it also explores the important predictors of depression, positive emotion, and functional recovery.

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6.1 Demographic characteristic of patients

The mean age of stroke for this study was 60.9 years with the SD ± 12.14. The minimum and maximum age were 25 and 85 respectively. Majority of the patients aged between 50 to 70 years old with the median of 60 and mode of 57. This finding is comparable to a review of 8 stroke studies in 2000-2014 which stated the mean age of stroke onset in Malaysia was between 54.6 to 62.6 years. (CW Kooi et al., 2016)

In terms of gender, male patients (65.4%) were more than female patients (34.6%). According to Cheah WK et al., 2016, the demographic characteristic of male stroke patients ranges from 53% to 60.5% after a review of 9 studies. It showed that stroke is more common in male. The male to female ratio of this study was 1.89 : 1. A systematic review of gender difference in stroke epidemiology (Peter A et al., 2009) included 9 studies on stroke prevalence, found that the male to female ratio ranged from 1.34 to 2.17. The same review also found that women stroke survivors were more severely ill and had higher 1-month case fatality compared to men. These may contribute to the smaller sample size for women in stroke studies.

In terms of ethnicity, Chinese patients were predominant with the percentage of 63.2%, followed by Malay 27.5%, Indian 10.7% and others 0.7%. The proportion of this finding was different from the real ethnicity proportion in Malaysia due to geographical variation in ethnic distribution in Penang. According Population Distribution and Basic Dermographic Characteristic Report 2010, the ethnic composition of Penang Island in 2010 was Chinese 53.07%, Malay 31.2%, Indians 8.98% and the remaining were others and non-Malaysian (Department of Statistics Malaysia, 2010). There was an early study done on stroke patients in Penang, which also showed a similar proportion of ethnicity where Chinese was 55.7%, Malay was

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28.9%, and Indian was 14.2% (Ong TZ and Raymond AA 2002). The above two findings showed the demographic characteristic of Penang which is in line with the demographic characteristic of this study.

Nearly three quarters of the patients (73.5%) were married. 19.9% of the patients were unmarried. The remaining 6.6% was either divorced or widowed. It was shown that married group was predominant compared to non-married/widowed/divorced. This characteristic was comparable to a local prospective study on post-stroke patients in 2013 (Ali MF et al., 2013) where married respondents comprised 84.8% and unmarried respondents was 15.2%.

Majority of the patients were either had primary education (42.6%) or up to secondary education (44.9%). Only 12.5% of them had tertiary education. This finding reflects that the majority of the patients recruited were educated up until secondary school level only. One of possible reasons for this finding was the population mean age was 60.9 years, which indicates they were likely receiving their primary and secondary education at 1960's. The low expectation on tertiary education during those early days could be the reason why most patients stopped at secondary education. Patients who were illiterate were excluded from the study.

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6.2 Clinical variables of patients.

Majority of the patients were recruited from Occupational Therapy Clinic(86%) compared to Rehabilitation Clinic as the patients who attended Occupational Therapy Clinic seemed to attend rehab clinic at the same time. The same patients who had been interviewed before would not be interviewed again if they were encountered after that interview. The findings showed that majority of patients attended both Rehabilitation Clinic and Occupational Therapy Clinic (53.7%). Only one patient (0.7%) attended only Rehabilitation Clinic and 62 patients (45.6%) attended only Occupational Therapy Clinic. The reason which the patient who attended only rehab clinic was his disability was too severe to be benefited from Occupational Therapy Clinic. For those that attended only Occupational Therapy Clinic, they were not referred to Rehabilitation Clinic upon discharge from acute ward as they were considered not to be in severe disability by the treating doctors.

The study did not include patients from Neurological Clinic as the patients with mild stroke severity were not given continuous follow-up at Hospital Pulau Pinang, instead, they were referred to primary care centres. In addition, follow-up appointment given to patients upon discharge can be as long as 4 months.

The reason for selection of patients in Occupational Therapy Clinic and Rehabilitation Clinic was to increase the chances to capture patients from all level of severity. However, this study was unable to recruit patients that did not come to follow-up due to various reasons (e.g. financial restrained, poor social support, low motivation for rehabilitation)

Majority of the patients had one (45.6%) or two (42.6%) co-morbidities other than stroke. The mean number of the co-morbid medical condition was 2.66 (SD ±

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0.74). This finding was comparable to the study done by SK Ostwald et al. (2006), which the mean number of co-morbidity was 2.38 (SD ± 0.85) in 97 post-stroke patients. The commonest co-morbid condition was hypertension (77.2%). This finding was comparable to previous studies. CW Kooi et al. (2016) did a review on local stroke studies and found that hypertension was the commonest condition associated with stroke, prevalence ranged from 53.2% to 76.1%. Prevalence of other studies were Ali MF et al., 2013 i.e. 89.1% (local study) and Ong TZ and Raymond AA, 2002 i.e., 71.5%.

The nature of stroke in this study showed that ischemic stroke was prominent (79.4%) compared to hemorrhagic stroke. In a prospective study (n=246) for stroke patients in Hospital Pulau Pinang over a one-year period, 74.8% were ischemic and 25.2% hemorrhagic in origin (Ong TZ and Raymond AA, 2002). 14 Two other larger local studies reproduced the same findings where the ischemic stroke was reported to range from 73.3% to 79.9% (Neelamegam M et al., 2013; Nazifah SN et al., 2012).

In terms of area of stroke, left hemisphere stroke (45.6%) was slightly more common compared to right hemisphere stroke (41.9%). Meanwhile, cerebellum and others were 12.5%. This result was comparable to the findings of a local study, AH Sulaiman et al. (2002), which showed that left hemisphere stroke was 42%, right hemisphere was 40% and others were 18%. Generally, evidences suggest that left-sided stroke is more common compared to right-sided stroke. However, there was no convincing evidence to suggest the reason behind this. One large study (n=1252) (Portegies ML et al., 2015) suggested that left-sided stroke is more prevalence as it is more often recognized. The study showed that symptoms of left-sided stroke were more severe and easier to be recognized, compared to symptoms of right-sided stroke which were mild such as hemineglect and spatial disorientation.

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For the length of stay in the acute neurological ward, the mean length was 5.66 days (SD ±3.58 days). This finding is similar to the finding of Azlin et al., 2012, which was 6.4 ± 3.1 days. It was a study done to assess cost in medical wards.

In terms of MBI score upon discharge, the mean score was 34.06 (SD ± 16.40) and the median was 30 (IQR=15). The MBI was divided into two categories, dependence and independence according to the original MBI recommendation, as below

1. Dependence, which includes:

a) Total dependence (MBI score 0-20)

b) Severe dependence (MBI score 21-59)

2. Independence:

a) Assisted independence

   i. Moderately dependence (MBI score 60-90)

   ii. Mildly dependence (MBI score 91-99)

b) Fully independence

   i. Fully independence (MBI score 100)

The patients' mean and median score from this study were both categorized into dependence (severe) category. Compared to other studies, the MBI mean score of this study was intermediate. Khoo KH and Lee J, (2014) did a prospective study on patients admitted to rehabilitation ward post-acute stroke and the mean MBI score upon admission was 41.3(SD ± 24.6). Another study explore the length of stay and its

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predictors, found out that the mean MBI score was 11.1 (SD ± 12.0) (KC Chang et al., 2002). The intermediate finding can be explained by 2 reasons. The first reference study measured MBI upon admission to rehabilitation ward. This may take a few days to weeks after the onset of stroke which at that time the patient's ADL function may recover partially due to the time factor. The second reference study measured MBI within 24 hours from the onset of stroke. The MBI score was lowest during the first day of stroke due to the severe neurological deficit. For this study, the MBI score was measured upon discharge from the acute neurological ward. It ranged from 1 day to 21 days. However, the mean length of stay was around five to six days for this study. Thus, patient's ADL function upon discharge (MBI score) in this study was likely to be intermediate compared to above 2 reference studies.

Another aspect that is worth to highlight is 92.6% of the patients were still dependent upon discharge from the acute neurological ward. This showed that majority of the patients still required full assistant to manage their daily activities upon discharge from the ward. This disability was a burden for the patient and also the caretaker.

In this study all subjects were selected based on convenient sampling due to time restriction. The severity of a stroke should be measured by National Institutes of Health Stroke Scale (NIHSS) during ward stay (acute phase). However, in Hospital P. Pinang, NIHSS was no longer measured in all patients due to administrative reason. For this study, MBI score upon discharge was used to measure functional impairment severity instead. It was shown in Table 5.2 the proportion in each severity category. In previous local studies, all patients, other than severe aphasia/comprehension problems, were included in the study regardless of severity, to ensure generalizability (AH Sulaiman et al., 2002; Glamcevski MT and Tan CT, 2000). Ideally, a prospective

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study that recruits the similar proportion of patients with different degree of severity of stroke will be good to measure functional outcome, positive emotions or depression. This study tried to enhance the significant effect of factors associated with functional recovery by using multiple linear regression analysis.

6.3 Positive emotion of post-stroke patients

For this study, PERS was used as it was simple and easy to use scale with satisfactory validity and reliability for the measurement of positive emotion (Ng CG et al., 2016). PERS was developed to be used to measure positive emotions in all dimensions of depressed patients. It was being used in this study because there is no standardized positive emotions scale available to be used in post-stroke patients. Only 2 studies overseas were found to assess post-stroke patients using the four positive emotion items of Center for Epidemiologic Scale for Depression (CES-D) (GV Ostir et al., 2008 and GS Seale et al., 2010). PERS was used instead as it was a standardized and easy-to-use scale. It was also the only scale developed in local setting to measure positive emotions for clinical and research purposes.

PERS was developed and the cut-off point of 30 and above was considered to have good positive emotions that is equivalent to a control or non-depressed adult, with sensitivity of 0.75, specificity of 0.73, positive predictive value of 0.60 and negative predictive value of 0.78. Score of below 30 reflects a low positive emotion that comparable to a depressed person (Ng CG et al., 2016).

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The mean score of total PERS in this study was 31.6 (SD ± 6.6) and the median was 33 (IQR = 10). Patients with good PERS was 65.4% compared to low PERS 34.6%. There was no previous study of stroke patients using PERS. However, two studies were found to measure positive emotions in post-stroke patients using components of positive emotion in Center for Epidemiologic Studies - Depression (CES-D) scale (GV Ostir et al., 2008 and GS Seale et al., 2010). Both studies found that the prevalence of patients who have low positive emotion 3 months after discharge were 29.7% and 29.2% respectively. These findings were comparable to low positive emotion (34.6%) in this study. Although this study did not measure the initial positive emotion, nor the change of positive emotion over time, assumption was made that patients included in the study has normal positive emotion before the stroke as previous depressive illness was included as one of the exclusion criteria.

Among the components of PERS, PERS Question 3 'I am looking forward for enjoyable activities' and PERS Question 4 'I am able to enjoy my hobbies' had the lowest mean score, 3.44 (SD ± 1.160 and 1.179 respectively) and a median score of 3 (IQR = 1). A low score in these two items was likely due to functional disability after stroke hindering patients from doing enjoyable activities or hobbies. At the other extreme, PERS 5 ('I am able to feel love from family or friends') had the highest mean score, 4.53 ± 0.68 and a median score of 5, IQR = 1. This showed that majority of the post-stroke patients in this study still have positive emotion towards family members and friends although they have lost interest and energy in doing activities (PERS 3, 4, 7). This is most likely attributed to functional disability.

In this study, the association between demographic or clinical factors with good positive emotion or low positive emotion was also analyzed using bivariate analysis. The dependent variable of positive emotion was divided into 2 categories, i.e. good

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positive emotion and low positive emotion with the cut-off point of 30 and above being the good positive emotion.

The bivariate analysis showed that the length of stay of less than 5 days, less than 3 co-morbidities and MBI score upon discharge were significantly associated with good positive emotion (Table 5.31 and Table 5.32). Multiple logistic analysis was subsequently performed with the 3 significant variables above and found out that the length of stay is the only significant predictor indicating that patients with the length of stay less than 5 days were 7.3 times more likely to have good positive emotion.

There were 2 studies on positive emotion on post-stroke patients (GV Ostir et al., 2008 and GS Seale et al., 2010). Both studies showed that high functional status upon discharge, using Functional Independence Measure (FIM) instrument is a strong predictor of good positive emotion upon follow-up in 3 months. In this study, MBI score upon discharge is used instead of FIM, but it showed significant association with good PERS in bivariate analysis. Positive emotion is a dynamic process in stroke (GS Seale et al., 2010). After the crisis of having stroke, patients were more likely to feel negative emotion when they were coping with the sudden loss of function. However, positive emotion will change over time depending on multiple factors. This finding suggests that good function upon discharge from ward is one of the significant factors associated with good positive emotion later during follow-up.

Less than three co-morbid medical conditions was also significantly associated with good positive emotion during follow-up. Patients with multiple medical conditions, especially those with a heart condition and complications of diabetes will have restricted lifestyle and function. They would likely to feel distress anticipating the adjustment needed in their work, life and dream. Some even developed psychiatric

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disorders during the moment of distress (Jane T and Brian K, 2000). A prospective study of general medical admissions found that 13% of men and 17% of women had an affective disorder (Mayou R et al., 1991). In order to adjust to multiple medical conditions, often, patients would develop negative emotion and even depression if their distress is not well addressed.

In this study, the shorter length of stay (less than 5 days) is 7.3 times more likely to have good positive emotion during follow-up by multiple logistic regression analysis. It was a strong predictor of positive emotion. Although it was not demonstrated in previous 2 studies on positive emotion in stroke patients (GS Seale et al., 2010), there was evidence showing that the longer the hospital stay, the higher the risk of depression. Saeed S et al. (2016) did a prospective study in surgical ward using Hospital Anxiety and Depression Scale (HADS) during admission and on the second week of admission. It showed that depression is four times more prevalent in the second week compared to during admission. This showed that the longer the hospital stay, more depressive and anxiety symptoms will occur which will possibly compromise the positive emotion of the patients. There were also studies that linked prolonged hospital stay with depression. This will be explained in the section discussing on bivariate analysis of depression with other factors later.

Another possible explanation is that the shorter length of stay usually reflects a milder severity of stroke. This results in less disability upon discharge, hence more optimism and positive emotions the patient has.

There is also the possibility that patients with good positive emotions during the time of assessment had good baseline positive emotions during the stroke. The broaden and build hypothesis suggested that by having positive emotion, patients

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were able to develop a good coping mechanism when facing with stressful events such as being diagnosed with chronic ailment and being hospitalized (Thompson, 1991; Folkman, 1997; Frederickson, 2003; Spacapan & Zinn et al., 2004). This shorten the length of stay. Good positive emotions that is associated with less co-morbid condition and less MBI (discharge) can also be explained by this theory, where good positive emotions offset the harmful effects of negative emotions which in turn, improves these physical conditions.

In this study, there were a few confounding factors that would have affected the PERS score. Firstly, the time of interview was scheduled at 6 to 12 weeks. There was no study on the trend of positive emotions after stroke in the past. However, there was a study showed that the depression rates vary with different stages post-stroke. Monica A et al. (1993) conducted a prospective study and showed that PSD is higher during acute phase of stroke and decreased from 3 months to 12 months. It increased again at 3 years. Positive emotion is a dynamic process that correlate with depressive mood. Thus, different point of assessment may showed different PERS scores. Another possible confounding factor was the age. The mean age of this study was 61 years. It showed majority of the patients were older adults. According to GD Santorelli et al. (2016), majority of the older adults reacts to loss with greater negativity than younger adults. They may have less positive emotion after stroke compared to younger adults. The severity of functional impairment after stroke was another confounding factor that need to be addressed in future studies. This study consisted of 71.3% of patients with severe dependence upon discharge. As severity of disability affects positive emotions. Ideally, the future research should compare the same number of patients in each category in a prospective study.

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6.4 Depressive status in post-stroke patients.

The depressive symptoms were measured using the Montgomery- Asberg Depression Rating Scale Self (MADRS-S) Assessment. The total score of 4 and above reflects the likelihood of depression.

The mean score of total MADRS-S in this study was 3.11 (SD ± 2.572) and the median score was 2.75 (IQR = 2.5). The prevalence of non-depressed patient was 76.5% compared to 23.5% depressed patients. The finding on prevalence of post stroke depression (PSD) was in the range of the prevalence PSD in a literature review done by Stefano Paolucci in 2008. The prevalence ranged from 12% to 61%. The variation was due to difficulty standardizing the study population, the timing of the assessment, assessment tool used and the complexity of recognizing PSD. The prevalence of PSD in this study, i.e. 23.5%, could be considered to be intermediate compared to two local studies on depression. They are AH Sulaiman et al.,2002 (n=50) with the prevalence of 36% and Glamcevski MT, Tan CT, 2000 (n=90) with the prevalence of 15%. According to Stefano Paolucci in 2008, in the hospital-based studies for PSD, the frequencies were 36% for acute, 32% for medium-term and 34% for long-term. Prevalence in this study showed slightly lesser. This can be explained by the population of this study attended rehabilitation facilities which may be a protective factor for depression. Another possible explanation for this is those patients who were depressed were less likely to attend rehabilitation activities or follow-up compared to non-depressed group and were less likely to be included in this study. Among the 9 components of MADRS-S, it was found that the MADRS-S 6 (initiative) had the highest mean score, i.e. 0.676 (SD ± 0.536) with the median of 1 (IQR=1). This finding showed that post-stroke patients had lesser initiative in doing

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tasks. Functional disability may most likely be the cause. The second highest mean score was MADRS-S 1 (mood). Meanwhile, MADRS-S 9 (Zest of life) had the lowest mean score, 0.11 (SD ± 0.314) with the median of 0 (IQR= 0). This finding suggests that post stroke patients may have higher impairment in initiating tasks or mood. However, it did not influence patients to think of giving up on their lives.

Bivariate analysis was done to explore the association between demographic and clinical factors associated with depressed patients. The similar factors that associated with good positive emotion length of stay less than 5 days, less than 3 co-morbidities and MBI score on discharge have significantly negatively correlate with depressed patients. Multiple logistic regression analysis was done on the significant variables and it showed that length of stay 5 days or more and 3 or more co-morbidities were 12.3 times and 4.3 times respectively more likely to have depression.

Prolonged length of stay in hospital is linked to depression. However, the relationship is complex and bilateral. Saeed S et al. (2016) in his study concluded that patients in the surgical ward had 4-fold increase in risk of depression at 2 weeks compared to during admission. However, in the same study, those with high score in Hospital Anxiety and Depression Scale (HADS) also had prolonged hospital stay. Verbosky LA et al. (1993) studied on patients who were admitted to the medical and surgical ward. She found that those depressed patients had length of stay 10 days longer than those who were not depressed. The treated depressed patient also showed shorter length of stay compared to untreated depressed patients. Thus, depression and length of stay are linked, however, it can be linked both ways. For this study, the patients that were recruited had no previous history of depression prior to stroke onset. Therefore, it is likely that the length of stay of 5 days or more was a strong predictor of depression and not the other way round.

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Co-morbid medical conditions of 3 or more also associated with depression (adjusted odd ratio of 4.3). This finding showed that co-morbid medical conditions is a strong predictor of PSD. Patients with multiple chronic medical illnesses like diabetes mellitus and coronary heart disease have two to threefold higher rates of developing major depressive disorder compared to primary care patients without chronic illnesses (Ali S et al., 2006, Spijkerman T et al., 2005). The relationship can be bilateral. The biological changes of the multiple chronic medical illnesses and their complications would predispose depressive episodes. On the other hand, the depressive symptoms may also increase medical symptom burden, medical costs, functional impairment, non-compliant to treatment, and increased risk of mortality and morbidity (Wayne JK, 2011). Thus, early recognition, proper treatment and monitoring of both psychiatric and medical conditions are vital to ensure both conditions are well controlled and not affecting one another. For post-stroke patients with multiple medical co-morbidities, a proper mental health screening should be done to prevent unrecognized PSD.

Another factor associated with PSD was MBI score upon discharge. The poorer ADL function upon discharge is associated with PSD. This finding replicates the findings of Tamara RZ et al. (2014) which concluded that PSD patients' functional disability was more significantly affected before and after rehabilitation. However, it was not significant in multiple logistic regression analysis with 2 other significant factors (length of stay of 5 of more days and 3 or more co-morbidities)

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6.5 Functional status (base on MBI (current) score) at 6 to 12 weeks in post-stroke patient

For this study, the mean interview time was 10.49 weeks (SD ± 1.83) post stroke, with the median of 11 weeks (IQR=3). The post stroke patients recruited were categorized under chronic stroke, i.e. more than 3 weeks (Allen LM et al., 2012). One of the inclusion criteria of this study was to recruit patients who were six to 12 weeks post stroke as there were studies showed that 80% of the recovery was complete by 6 weeks and little recovery occur after 12 weeks post stroke. (Newman M, 1972 and Derick TW et al., 1985)

The mean MBI (current) score was 78.38 (SD ± 19.31), with the median of 85 (IQR = 30). This mean MBI score at 3 months replicates the finding of a study in Korea (Lee KB et al., 2015), which the mean MBI score at 3 months for post-stroke patients was 77.15 ± 17.67. The median MBI score of this study was also comparable to a local study (Ali MF et al., 2013) which the median MBI score was 85 (IQR=42) at 3 months post-stroke. The mean MBI (current) score of 78.38 showed that most patients had reached assisted independence (moderate dependence).

In bivariate analysis, the significant factors associated with MBI (current) score were the length of stay less than 5 days, MBI (discharge) score, total PERS score and total MADRS-S score. The total MADRS-S score was negatively correlated with MBI (current) score, but the rest of the significant factors were positively correlated with MBI (current) score.

Significant factors were further explored with multiple linear regression and found that the length of stay of less than 5 days, MBI discharge score and total PERS have remained to be significantly correlated with MBI (current) score. Apart from the

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length of stay less than 5 days was negatively correlated with MBI current score, the other two variables were positively correlated with MBI (current) score. However, the total MADRS-S is not statistically significant in multiple linear regression.

This result replicates the previous study (Seale et al., 2010) which the total Functional Independence Measure (FIM) score at 3 months post stroke (for this study, MBI was used), was significantly associated with FIM at discharge and increased positive emotion over the time. However, length of stay was not shown to be significant in this referenced study.

This finding also showed that when compared to total MADRS-S score, total PERS score is a stronger predictor of MBI (current) score (ADL functional status) 3 months post stroke. The higher the total PERS score during follow-up, the more likely that a patient has higher functional recovery.

The length of stay less than 5 days is a strong predictor of good functional status during follow-up as well. It can be explained as it was strongly associated with positive emotion in earlier finding (bivariate analysis of clinical factor associated with positive emotion). It can also be explained as the longer the length of stay, it reflects the more complications and difficulties in treatment in the ward. This morbid condition affects function recovery.

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6.6 Functional recovery in post-stroke patients using MBI (difference) score

In this study, the MBI (difference) score (i.e. MBI (current) - MBI (discharge) was measured to assess the recovery score. The mean of the MBI (difference score) was 45.04 (SD ±16.1) with the median of 45 (IQR = 24). This finding is comparable to a local study (Ali MF et al., 2013) which measured the mean change of MBI from discharge to 3 months follow-up. The MBI mean change was 45.2 ± 27. Another Korean study (Jihong P et al., 2016) measured the mean MBI change from 3weeks after the onset stroke to 3 months after that. The mean difference of MBI was 32.55 ± 23.59. This reference study had lesser MBI score improvement as the initial MBI score was measured at the 3 weeks after onset of stroke.

The bivariate analysis was done to assess demographic and clinical factors that associated with MBI (difference) score. The factors that significantly positively correlated with high MBI (difference) score were patient with a spouse, education more than 6 years, co-morbid less than three and high total PERS score. The factors that significantly negatively correlated with high MBI (difference) score were age, MBI (discharge) score and total MADRS-S score.

In this study, the higher the MBI (difference) score was assumed to have a good functional recovery. However, there was one exception in this scenario, eg.: those patients who had high MBI (discharge) score, could achieve good recovery by only a little score improvement, as the maximum score for MBI is 100. For example, the first patient had MBI (discharge) of 15 and achieved MBI (current) 65 during the interview. He has a MBI (difference) of 50. The second patient had MBI (discharge) of 65 and achieved MBI (current) of 100 during the interview. He has a MBI (difference) of 35. The MBI (difference) of the second patient is lesser although the

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patient had achieved full recovery. This scenario well explained the negative correlation of MBI (discharge) with MBI (difference), where the lower score upon discharge probably had more score for improvement. However, this is not always the case as the lower MBI (discharge) is significantly correlated with lower functional status (MBI current) in earlier bivariate analysis.

Age was also significantly associated with MBI (difference) score. The finding showed that the younger the age, the better the functional recovery. Seale et al. (2010), the previous study on positive emotion in stroke patients also found the significant negative correlation between the age and functional recovery. There was also a study suggested that post-stroke cognitive impairment increases exponentially after the age of 65 years old. (Jia HS et al., 2014). The cognitive impairment is a strong predictor of functional outcome for stroke patients. The possibility of cognitive impairment at older post-stroke patient hindering functional recovery is the possible explanation for the above finding.

Patients with a spouse were also associated with good functional recovery. This finding replicates Seale et al.'s study (2010) which found that married patients are significantly associated with a good functional score after 3 months. According to TA Glass et al., (1993) perceived social support was a strong predictor of functional status for patients. Spouses are assumed to be the main social support for the patients and widowed or divorced patients were more likely to have low perceived social support, hence the poor functional outcome.

Co-morbidity of less than 3, higher total PERS score and lesser total MADRS-S score were also associated with good functional recovery. This finding has also replicates the finding of Seale et al. (2010). Patients with comorbid diseases were

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shown to have a negative correlation with the functional outcome (Karatepe AG et al., 2008). Another study has also shown co-morbid conditions were associated with disability in ADL in hypertensive patients (Jiahui Q and Xiaohui R, 2016)

Under the most stressful and difficult conditions, positive emotion is important for survival and rehabilitation (Folkman S et al., 2000; Viney LL et al., 1989; Westbrook MT, Viney LL, 1982; Mossey JM et al.,1989). Positive emotion also fosters physical health, which is vital for functional recovery (Fredrickson, 2001). In this study, high PERS score was strongly associated with good functional status and high functional recovery at 6 to 12 weeks. The possible hypothesis for this is good positive emotions shorten length of stay, lessen complications/co-morbid conditions and also the improves functional status upon discharge (3 significant factors associated with PERS), hence improves functional recovery. Also, other factors that possibly correlate with good positive emotions such as increased motivation and energy to go for rehabilitation facilities, more adherence to rehabilitation schedule, better adherence with medications, more keen to have lifestyle changes and less stressful moments that will not aggravate the hypertension, may also contribute to good functional outcome.

Meanwhile, depression is well known by various studies on its negative impact on functional outcome (Robinson RG, 2006). In this study, the total MADRS-S is negatively correlated with high functional recovery only in bivariate analysis.

In multiple linear regression analysis, patients with a spouse, total PERS score and age, were significantly associated with MBI (difference) score after adjustment of significant factors. This showed that those three factors were stronger predictors of

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good functional recovery or improvement compared to less than 3 co-morbid conditions, MBI (discharge) score, and total MADRS-S score.

6.7 Functional status in 6 to 12 weeks post stroke based on stroke severity

In this study, there was no measurement of stroke severity using standardized scale like National Institute of Health Stroke Scale (NIHSS). It was due to the stroke unit in hospital of this study did not regularly conduct this assessment. Due to this limitation, another potential factor in predicting the severity of stroke is length of stay. According to Chang KC et al., 2002, NIHSS score was a good predictor of length of stay. The higher the score, the longer the stay. Hence, the subjects of this study were further divided into 2 groups:

i) Length of stay of less than 5 days: mild stroke (n=58)

ii) Length of stay of 5 days or more: severe stroke (n=78)

Further analyses were done to explore the association of the predictors for functional status after eliminating the potential confounding effect (severity of stroke).

For patients with mild stroke based on length of stay, only MBI (discharge) score and total PERS score were significantly associated with current functional score in bivariate analysis and multiple linear regression.

For patients with severe stroke based on length of stay, age, less than 3 comorbidity, total PERS score, total MADRS-S score and MBI (discharge) score were significantly associated with MBI (current) score. However, only age, total PERS score and MBI (discharge) score were associated with MBI (current) score after adjusting the significant factors in multiple linear regression analysis.

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The above result showed that the MBI (discharge) score and total PERS score were both consistent in associating with functional score upon follow up in 6 to 12 weeks regardless of stroke severity.

Another important finding was age was only significantly associated with current functional score in severe stroke patients but not mild stroke patients. This interesting finding suggests that in severe stroke, old patients with severe stroke may have difficulty to achieve good function in 6 to 12 weeks compared to old patients with mild stroke.

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CHAPTER 7: LIMITATIONS AND STRENGHTS

7.1 Limitations

This study has some limitations that needed to be addressed. The limitations include:

1. The sample size of this study was only 136 (84%) of the determined sample size of 162 due to time restriction. This affects the power of the study. However, it had the better a sample size if compared to previous local studies on stroke and post-stroke depression which were 88 and 50 respectively. (MT Glamcevski et al., 2002 and AH Sulaiman et al., 2002).

2. Convenient sampling instead of random sampling was used in this study due to time restriction. This may affect the generalizability of the result to the general population.

3. This study was confined to one particular urban hospital in northern Malaysia with predominantly Chinese patients, although it is one of the largest hospitals in northern Malaysia. This may not reflect the real socio-demographic profile of the Malaysian Population.

4. Being a cross-sectional study, the association between positive emotion, depression and functional status could be determined. However, the causal relationship of this factors could not be established.

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5. This study did not include those patients who were unable to read and understand Malay or English language. Thus, it had excluded most illiterate patients and Chinese patients who only studied the Chinese language in the early days. It also did not include patients who did not attend rehabilitation services.

6. Self-rated questionnaires used in this study were self-reported and prone to risk of bias. Some patients may not be keen to report the severity of their symptoms in order to be socially acceptable.

7. There are possible confounding factors that may affect the outcomes (positive emotions) of the study looking at the current study population's age group, severity of functional disability during discharge and time of assessment. (Explained earlier in the section of discussion)

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7. 2 Strengths

Besides limitations, there were also several strengths of this study.

1. This is the first study in the local setting to look at positive emotion in post-stroke populations. Therefore, the information obtained from this study could provide a baseline data for future studies. It also provides knowledge about positive emotion in post-stroke patients.

2. There was no missing data as all participants managed to complete all questionnaire. All data were analyzed with no missing data.

3. Multivariate analysis was done in this study to strengthen the association after adjusting the other significant factors of bivariate analysis.

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CHAPTER 8: CONCLUSION AND RECOMMENDATIONS

8.1 Conclusion

1. Stroke is a major health problem in Malaysia which leads to substantial disease burden to the country. Post-stroke depression in Malaysian studies was as high as 36% and it was thought to be one of the strong predictors of poor functional outcome in post-stroke patients. This study explored the positive emotion in post-stroke patients and its association with functional recovery.

2. The demographic and clinical data were mainly comparable to previous studies. The majority (92.6%) of post-stroke patients that were discharged from acute neurological ward were still dependent according to MBI score.

3. The mean score of total PERS at six to 12 weeks was 31.6 which indicates good positive emotion. PERS 3 and PERS 4 (which are related to activities and hobbies) were lowest in mean score. PERS 5 (which is related gratitude feeling towards friends and family) was highest in mean score. 34.6% of the patients experience low positive emotion, i.e. PERS < 30. Bivariate analysis showed that the length of stay of less than 5 days, less than 3 medical co-morbidities and MBI (discharge) score were associated with good positive emotion. Multiple logistic regression only showed length of stay of less than 5 days associated with 7.3 times more like to have good positive emotion.

4. The prevalence of depression based on MADRS-S was 23.5%. The length of stay of 5 days or more, medical co-morbidities of 3 or more and MBI (discharge) score were significantly associated with depression in bivariate analysis. Multiple logistic regression showed the length of stay of 5 days or more was 12.3 times likely to have

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depression and 3 medical co-morbidities or more was 4.3 times more likely to have depression.

5. Both depression and positive emotion shared the same significant predictors. However, length of stay predicts depression more than positive emotion.

6. Bivariate analysis was done to assess factors associated with functional independence using MBI (current) and functional recovery using MBI (difference).

The factors associated with functional independence were the length of stay of less than 5 days, total PERS score, total MADRS-S score(negative correlation) and MBI(discharge). Multiple linear regression for all four significant variables showed that other than total MADRS-S score, the rest were significant. The factors associated with functional recovery were patient with a spouse, education more than 6 years, less than 3 medical co-morbidities, total PERS score, age(negative correlation), MBI(discharge) (negative correlation) and total MADRS-S (negative correlation). Multiple linear regression showed total PERS, Spouse, age were significantly associated with functional recovery.

7. Total PERS was a stronger predictor of both functional independence score and functional recovery compared to total MADRS-S in multiple linear regression.

8. Total PERS was consistent in predicting functional status post stroke irrespective of stroke severity

9. The assessment of positive emotion in post-stroke patients is vital, based on the study as it is a strong predictor of functional outcome.

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8.2 Recommendation:

Based on the findings of this study, several recommendations for future studies are:

1. A study conducted using a randomized method and multiple centers to improve the generalizability of the study findings to the general population.

2. A study using both clinician-rated questionnaires and self-reported questionnaires would be better to avoid the bias of self-reported questionnaire.

3. Positive emotions screening should be considered in post-stroke patients upon discharge and during follow-ups, in order to detect those groups that are at risk. Early intervention (such as medication or positive psychotherapy) can be provided if poor positive emotions is detected early to improve functional outcome.

4. All post stroke patients should be evaluated for PERS, especially for those who have long ward stay, 3 or more medical co-morbidities and low MBI upon discharge (total and severe dependence, i.e. MBI less than 50). It is advised to assess PERS upon discharge from medical ward (from previous studies- GV Ostir et al., 2008 and GS Seale et al., 2010) and during around 6-12weeks post stroke (from this study and GV Ostir et al., 2008 and GS Seale et al., 2010) as low positive emotion in this period will affect functional recovery. It can be done by occupational therapists or doctors who follow-up the patients as it is self-rated, brief and easy to be carried out. Those post-stroke patients who have low PERS score can be referred to clinical psychologist or psychiatrist for early intervention, such as medications or positive psychology to improve outcome of recovery.

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5. Positive emotion screening can be expanded to other chronic medical illness that will affect functional disability which prompt treatment may be helpful in the groups that are at risk.

6. Positive emotions is associated with milder functional severity of stroke upon discharge, lesser co-morbidity medical conditions and even stronger association with shorter length of stay. Future cohort studies are needed to determine the direction of association.

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