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# Medication adherence in stroke patients in Brunei Darussalam Public Hospital: the cross-sectional study associated with chronic diseases, life style and potential barriers

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## Abstract

**Objectives** Medication nonadherence is a growing concern globally, and little is known about the adherence of stroke patients. To know the proportion of adherence and nonadherent stroke patients to their medication. To identify factors associated with adherence and nonadherence in stroke patients.

**Methods** A cross-sectional study for the 76 eligible stroke patient ≥18 years old recruited from outpatient stroke clinic from Brunei Neuroscience Stroke and Stroke Rehabilitation Centre (BNSRC). Medication adherence was measured by self-administered scoring. Fisher's exact test was applied to identify associated factors with adherence and nonadherence.

**Key findings** 10.5% of the participants was not adherent to their medication in a self-reported questionnaire. With the use of Fisher's exact test, adherence is associated with exercise ($P = 0.034$), knowledge on hypertensive medications ($P < 0.001$), hyperlipidemia medications ($P = 0.001$), diabetes medications ($P < 0.001$) and stroke medication ($P = 0.004$), avoid side effects of medications ($P = 0.028$), felt depressed or sad ($P = 0.001$).

**Conclusions** The high adherence rates in this study may be due to the good facilities of Brunei healthcare system, patients' increased concerns about their health, good education provided regarding their medications and family members in reminding them to take their medications.

**Keywords** adherence; adverse drug reactions; dispensing; prescriptions

## Introduction

Stroke accounts for about 11% of total worldwide mortality which is the second leading global cause of death after heart disease.[1] Stroke is often co-morbid with other medical conditions, especially hypertension, diabetes mellitus, hyperlipidaemia, atrial fibrillation and heart failure. These comorbidities further increase the risk of developing first time stroke or a recurrent stroke. The overall possibility of recurrent stroke is tremendous, with about 30–43% of people likely to have one within a period of 5 years.[2] Therefore, it is crucial to seek for pharmacological therapy to keep these comorbidities well under control.

However, medication nonadherence is a worldwide challenge faced by many health professionals. Some studies have shown that up to half of the patients stop taking their prescribed medications 1–2 years after their stroke incident.[3,4] These high rates of nonadherence are influenced by multiple factors such as patient's cognitive characteristics, behavioural factors, social support and environmental-related factors.[5] The consideration of these factors will give us a clearer insight into the understanding of nonadherence.

Patients who have a clearer understanding and information of their treatment instil a behaviour of voluntary adherence. Motivation interviewing is encouraged, and it offers effective strategies for improving behavioural change and eradicating negative perception towards healthcare system and the effects of medications.[6] Once patients have all the

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necessary information and motivation, the last key piece that determines adherence is ability, whether or not patients have the ability to follow the instruction in taking their medications. As of so far, even though there are wide variety of methods to measure medication adherence, however, there is currently no gold standard in measuring it. Each method has its own advantages and limitations.[7]

## Methods

### Study and recruitments

The study was a cross-sectional study conducted in the adult stroke patients. The source population were patients who attended the stroke outpatient clinic at Brunei Neurosciences Stroke and Rehabilitation Centre (BNSRC) during the study duration. Caregivers can also sign the consent form on behalf of the participants if they wish to take part in the study. Participants were interviewed by the researcher one at a time in an empty clinical room, and informed consent was taken after participants had fully understood the participant information sheet which was given to them. Those who agreed to participate in the study were given a self-administered structured questionnaire by the researcher to fill in their sociodemographic, medical condition and medication profiles.

The research was approved by the joint committee of Institute of Health Sciences Research Ethics Committee, Universiti Brunei Darussalam, and Medical and Health Research Ethics Committee (MHREC), Ministry of Health, Brunei.

### Data analysis

The questionnaire consists of 40 questions and was made simple. Both English and Malay language version of questionnaires were available. The questionnaire was answered by ticking available answer options and fill in the blanks. The questionnaire was divided into Section A and B. Section A involves in asking about sociodemographic and lifestyle information of the patient while Section B involves in asking about patient's medical condition and medication profile including their adherence and personal experiences with their medications and reasons behind missing or not taking their medications. In section B, the questionnaire was modified based on 'Morisky scale of adherence' and 'adherence scale Culig' to suit the healthcare system in Brunei Darussalam.[8,9] Self-administered score from this questionnaire was created by the researchers to grade medication adherence. A pilot study was done on six stroke participants, and they were able to understand the questionnaire.

Twenty-two questions were used in an attempt to evaluate medication adherence and nonadherence among patients, and every answer was given a certain scoring (see Table 1). More points are given for questions that the researcher thinks was of more value. Higher marks of adherence score indicate higher medication adherence. The maximum points that patients can score were 36 and cut-off point marked for adherent and nonadherent is 70% of the total points (25.2 points). Patient scoring 25.2 or more are categorised as adherent whereas those scoring less than that was considered not adherent.

### Statistical analysis

The researcher has entered the collected data and analysed it using IBM SPSS statistics (version 23.0; for Windows). The statistical analysis includes the proportion of stroke patient who was adherent and nonadherent to their

**Table 1** Scoring system for medication adherences in the questionnaire

| Question number (in questionnaire) | Description | Scoring |
|---|---|---|
| 17 | Only proper name of medications is considered eligible and cross-check with question 16 to know if they are able to name all their medications | Able to name none = 0 marks;<br>Able to name ≥1 = 1 mark;<br>Able to name all = 2 marks |
| 20–21 | Split into four sub-questions | Yes/No = 1 mark;<br>Don't know = 0 marks.<br>A total of 4 marks for each question |
| 22 | Split into four sub-questions | Yes = 2 marks;<br>No = 0 marks;<br>Total of 8 marks |
| 23–25 | – | Yes = 1 mark;<br>No = marks;<br>A total of 1 mark for each question |
| 26–40 | – | Never = 1 mark;<br>1 = 0.75 marks;<br>2–4 = 0.5 marks;<br>≥5 = 0 marks.<br>A total of 15 marks was obtainable |

Highest possible score: 36 points; Adherent: ≥25.2 points; Non-adherent: <25.2 points.
Please refer Data S1 for the questionnaire.

**Table 2** (A) Characteristics of participants according status of medication adherence and its association with adherence. (B) Lifestyle information about the participants and its association with adherence

**(A)**

| Sociodemographic factors | Mean (SD) | Overall *n* (%) | Adherence *n* (%) | Non-adherence *n* (%) | *P*-value* |
|---|---|---|---|---|---|
| Age (year) | 58.14 (±12.1) | 76 (100.0) | 68 (89.5) | 8 (10.5) | – |
| Gender | | | | | |
| Male | | 53 (69.7) | 46 (86.8) | 7 (13.2) | 0.422 |
| Female | | 23 (30.3) | 22 (95.7) | 1 (4.3) | |
| Ethnicity | | | | | |
| Malay | | 57 (75.0) | 53 (93.0) | 4 (7.0) | 0.102 |
| Non-Malay | | 19 (25.0) | 15 (78.9) | 4 (21.1) | |
| Education | | | | | |
| Primary education and lower | | 25 (32.9) | 20 (80.0) | 5 (20.0) | 0.106 |
| High school and higher education | | 51 (67.1) | 48 (94.1) | 3 (5.9) | |
| Employment | | | | | |
| Working | | 27 (35.5) | 24 (88.9) | 3 (11.1) | 1.000 |
| Not working | | 49 (64.5) | 44 (89.8) | 5 (10.2) | |

**(B)**

| Lifestyle factors | Overall *n* (%) | Adherence *n* (%) | Non- adherence *n* (%) | *P*-value* |
|---|---|---|---|---|
| Exercise | | | | |
| Yes | 68 (89.5) | 63 (92.6) | 5 (7.4) | 0.034 |
| No | 8 (10.5) | 5 (62.5) | 3 (37.5) | |
| Amount of fats in diet | | | | |
| Low | 19 (25.0) | 17 (89.5) | 2 (10.5) | 1.000 |
| Moderate and higher | 57 (75.0) | 51 (89.5) | 6 (10.5) | |
| History of smoking | | | | |
| Yes | 31 (40.8) | 25 (80.6) | 6 (19.4) | 0.057 |
| No | 45 (59.2) | 43 (95.6) | 2 (4.4) | |
| Still smoking | | | | |
| Yes | 8 (10.5) | 6 (75.0) | 2 (25.0) | 0.197 |
| No | 68 (89.5) | 62 (91.2) | 6 (8.8) | |
| Alcohol consumption | | | | |
| Yes | 7 (9.2) | 5 (71.4) | 2 (28.6) | 0.156 |
| No | 69 (90.8) | 63 (91.3) | 6 (8.7) | |

*Fisher's exact.

medication. Fisher's exact test was carried out to identify associated factors with medication adherence and nonadherence. Two sided-test for all hypothesis test was used, and $P < 0.050$ will be considered statistically significant.

## Results

From the study it was found that the mean age of participants was 58.14 (±12.1) years old, 69.7% were male, and a majority of participants were Malay (75.0%), attended high school and higher education (67.1%) and not working (64.5%). Overall, 10.5% of the participants were nonadherent to their medications. Higher adherence rates were observed in females (95.7%), Malay (93.0%) and those who attended high school and had higher education (94.1%). As shown in Table 2A, the prevalence of adherence between the sociodemographic data has no significant difference ($P \geq 0.05$). Therefore, there was no association between adherence and participants' sociodemographic data.

The prevalence of adherence between those who exercise and do not exercise is significantly different ($P = 0.034$). Therefore, there is a significant association between adherence and exercise. The result showed that those who exercise are more likely to be adherent, where out of the 68 participants who exercise, 63 (92.6%) of them are adherent to their medications whereas 5 (7.4%) of them were nonadherent to their medications. However, as shown in Table 3, the prevalence of adherence to other lifestyle factors was not significantly different ($P \geq 0.05$). Hence, there was no association between adherence and other lifestyle factors (Table 2B).

A majority of the patient have comorbidities such as hypertension (88.2%), hyperlipidemia (81.6%) and diabetes mellitus (46.1%). About 77.6% of the patients had their last stroke attack more than 6 months ago, and 81.6% of them were only hospitalised once due to stroke. The result in Table 4 shows that there is no significant association between adherence and comorbidities and their last stroke occurrence

**Table 3** Medical conditions of the participants and its association with adherence

| Medical condition | Overall *n* (%) | Adherence *n* (%) | Non-adherence *n* (%) | *P*-value* |
|---|---|---|---|---|
| Types of stroke | | | | |
| Haemorrhagic | 8 (10.5) | 8 (100.0) | 0 (0.0) | – |
| Ischaemic | 17 (22.4) | 16 (94.1) | 1 (5.9) | |
| Transient ischaemic | 10 (13.2) | 9 (90.0) | 1 (10.0) | |
| Don't know | 41 (53.9) | 35 (85.4) | 6 (14.6) | |
| Co-morbidities | | | | |
| Hypertension | | | | |
| Yes | 67 (88.2) | 61 (91.0) | 6 (9.0) | 0.239 |
| No | 9 (11.8) | 7 (77.8) | 2 (22.2) | |
| Hyperlipidemia | | | | |
| Yes | 62 (81.6) | 55 (88.7) | 7 (11.3) | 0.544 |
| No | 14 (18.4) | 13 (92.9) | 1 (7.1) | |
| Diabetes mellitus | | | | |
| Yes | 35 (46.1) | 34 (97.1) | 1 (2.9) | 0.063 |
| No | 41 (53.9) | 34 (82.9) | 7 (17.1) | |
| Family history of stroke | | | | |
| Yes | 25 (32.9) | 22 (88.0) | 3 (12.0) | 1.000 |
| No | 51 (67.1) | 46 (90.2) | 5 (9.8) | |
| Number of family member(s) with history of stroke | | | | |
| 1 | 22 (91.7) | 20 (90.9) | 2 (9.1) | – |
| 2 | 2 (8.3) | 2 (100.0) | 0 (0.0) | |
| Last occurrence of stroke ($n$ = 75)† | | | | |
| Within last 6 months | 17 (22.4) | 16 (94.1) | 1 (5.9) | 0.675 |
| More than 6 months | 59 (77.6) | 52 (88.1) | 7 (11.9) | |
| Number of times hospitalised due to stroke ($n$ = 75)† | | | | |
| Never | 2 (2.6) | 2 (100.0) | 0 (0.0) | – |
| Once | 62 (81.6) | 59 (95.2) | 3 (4.8) | |
| 2–3 times | 7 (9.2) | 6 (85.7) | 1 (14.3) | |
| 4–6 times | 0 (0.0) | 0 (0.0) | 0 (0.0) | |
| 7 or more | 3 (3.9) | 1 (33.3) | 2 (66.7) | |
| Don't know | 2 (2.6) | 0 (0.0) | 2 (100.0) | |

*Fisher's exact test.
†Missing data.

($P \geq 0.05$; Table 3). From the results of Table 4, we can see that patients taking less medications are more adherent. Among the 11 participants who were taking only 2–3 medications, 10 (90.9%) of them were considered adherent. In contrast, there are 16 patients who took more than eight medications and among them, there were only 14 (87.5%) of them were considered adherent. There are more participants who have knowledge on their medications than those who do not have knowledge. The prevalence of adherence between those who have knowledge about their hypertensive ($P < 0.001$), hyperlipidemia ($P = 0.001$), diabetes ($P < 0.001$), stroke medication ($P = 0.004$) and those who did not was significantly different. Therefore, there was a significant association between knowledge and adherence. We can also see that majority of the patients are aware of the benefits of the medications especially those who are adherent.

### Potential barriers factors to nonadherence: Hospital's, doctor's and patient's

In the hospital barrier, patients missed their medication ≤1 in a year. There are only 3 (3.9%) who missed their medications ≥2 in a year were due to shortage of medicine supply and 1 (1.3%) missed their medication ≥2 in a year were due to long waiting time in the hospital. In the doctor's barrier, it is shown that most patients missed their medication only ≤1 in a year. There are only 3 (3.9%) participants who missed their medication ≥2 in a year, and the reason for it was that their doctors always change their medication and are not aware of the benefits of the medicine, whereas in the patient's barrier result (Table 4S) it is shown that their missed medications ≤1 in a year mainly due 'to avoid the side effects of medications' and 'felt depressed or sad'. There was an association between 'to avoid side effects of medication' and medication nonadherence ($P = 0.028$). Out of 76 participants, 73 (96.1%) participants reported that they missed their medications ≤1 in a year, just to avoid side effects of medications.

## Discussion

To summarise the significant findings of this study, the factors associated with the degree of adherence were exercise, patient's knowledge about their medication, depression and frequent prescription changes. The findings of this study show that people who exercise are more

**Table 4** Medication profile of the participants and its association with adherence

| Medication profile | Overall *n* (%) | Adherence *n* (%) | Non-adherence *n* (%) | *P*-value* |
|---|---|---|---|---|
| Number of medications taking ($n$ = 75)† | | | | |
| 2–3 | 11 (14.7) | 10 (90.9) | 1 (9.1) | – |
| 4–5 | 28 (37.3) | 25 (89.3) | 3 (10.7) | |
| 6–7 | 20 (26.6) | 18 (90.0) | 2 (10.0) | |
| ≥8 | 16 (21.3) | 14 (87.5) | 2 (12.5) | |
| Self-remind to take medications ($n$ = 75)† | | | | |
| Yes | 30 (60.0) | 28 (93.3) | 2 (6.7) | 0.303 |
| No | 45 (40.0) | 39 (86.7) | 6 (13.3) | |
| Knowledges about medications (benefits) | | | | |
| Hypertensive medications | | | | |
| Yes | 55 (72.4) | 55 (100.0) | 0 (0.0) | <0.001 |
| No | 21 (27.6) | 13 (61.9) | 8 (38.1) | |
| Hyperlipidemia medications | | | | |
| Yes | 54 (71.1) | 53 (98.1) | 1 (1.9) | 0.001 |
| No | 22 (28.9) | 15 (68.2) | 7 (31.8) | |
| Diabetes mellitus medications | | | | |
| Yes | 47 (61.8) | 47 (100.0) | 0 (0.0) | <0.001 |
| No | 29 (38.2) | 21 (72.4) | 8 (27.6) | |
| Stroke or heart medications | | | | |
| Yes | 47 (61.8) | 46 (97.9) | 1 (2.1) | 0.004 |
| No | 29 (38.2) | 22 (75.9) | 7 (24.1) | |

*Fisher's exact test.
†Missing data.

likely to be adherent to their medication. From a study of the meta-analytic review of 3777 studies, it has shown that higher adherence was associated with stronger perceptions of the necessity of treatment.[10] Furthermore, there is growing evidence that exercise has an influence on the function of central nervous system and mental health enhancement. A few studies have shown that physical exercise may improve cognitive skills and reduce the risk of dementia.[11,12] By slowing down the ageing of memory, patients are less likely to be forgetful about their medications. Research has also shown that exercise improves depression associated symptoms as exercise stimulate the release of hormones such as serotonin, dopamine and norepinephrine, which have the same chemical effects as antidepressant.[13]

In epidemiological studies, about 30% of stroke patients develop depression either during the early or late stage after stroke.[14] The causes of depression after stroke may be multifactorial including neurobiological change and psychological factor. Depression of origin caused by neurobiological changes is classified as a poststroke depression. Studies have suggested that large brain lesions in the critical areas such as left frontal lobe and basal ganglia may have interrupted the pathway of mood control, resulting in depression.[15] After an incidence of stroke, patients may be presented with neurological deficit where they are unable to perform tasks that they would normally be able to do. This can lead to intense emotional reactions as they are unable to cope with sudden changes in their environment and would have to rely on their caregivers.[16] Premorbid factors, for example, sociodemographic characteristics such as financial strain, marital status and alcohol abuse may also increase the intensity of psychological reactions to stroke.[17] The association we found between depression and nonadherence are also demonstrated in another study that has shown that depressed patients are 1.76 times more likely to be nonadherent than nondepressed patient.[18] Therefore, it is of great importance to find out patients who are depressed and explore more about the underlying cause of it. Interventions such as counselling, antidepressant treatment and exercise may help to improve depression.

In addition, referring back to Table 4 from this study, majority of the stroke patients who know about the benefits of their medications were adherent. These results correlate well with previous studies which have shown that patients who have higher knowledge score in their medications tend to be more adherent.[19–21] Good counselling services improve patient's knowledge about their medications, by educating them on the correct method of taking medications, and discussing about their concern as well as belief regarding their medication which helps to enhance their adherences.

The findings of this study in the different barriers showed that nonadherence is associated with avoidance of side effects of drugs. A recent study on the side effects of antihypertensive medications showed that 34.5% of the participants who experienced side effects became nonadherent to their antihypertensive treatment. Therefore, it is important that health professional disclosure of full information regarding common side effects of their medications to the patient and educating them on how their medications are beneficial to them. Health professional should encourage patients to discuss any problems encountered with their medications so that they can come up with suitable management plans for both parties.

## Conclusion

It is found that there is an association between patients' nonadherence and doctors who frequently change their prescribed medication, especially when prescribing additional medications for them. The increased number of medications contribute to increasing complexity of a treatment regimen, and empirical studies have provided evidence that medication regimens that are very complex are related to a decrease in medication adherence It is important that doctors do not over-prescribe unnecessary medications and use simplified medication regimen and consider nonpharmacological intervention such as lifestyle changes as primary or secondary prevention.

## Declarations

### Conflict of interest

The Author(s) declare(s) that they have no conflicts of interest to disclose.

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### Authors' contributions

Rajan and Sheba David designed the study, analysed the data and drafted the paper. Yeng Kwong Han and Norazieda analysed the data and drafted the paper. All Authors state that they had complete access to the study data that support the publication.

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## Supporting Information

Additional Supporting Information may be found in the online version of this article at the publisher's web-site:

**Data S1.** Supporting information on medication adherence in stroke patients.