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ORIGINAL RESEARCH

Medications Adherence and Associated Factors Among Patients with Stroke in Iraq

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Purpose: Stroke poses significant challenges to affected individuals, their families, and healthcare systems, with adherence to medications being a pivotal determinant of health outcomes. In this study, we aim to evaluate the medication adherence of stroke patients living in Iraq, and explore how patients' demographic and clinical details relate to their adherence levels. Furthermore, we seek to assess the self-care practices used by stroke patients and their adherence to them.

Patients and Methods: We carried out a cross-sectional correlational study conducted from November 2022 to April 2023, stroke patients diagnosed in seven hospitals across Baghdad and Al-Mothanna governorate were recruited, with diagnoses confirmed by physicians and senior neurologists using MRI and/or CT scans. Patients' adherence to medications, demographic data, clinical characteristics, and self-care activities were analyzed using descriptive statistics and regression analyses.

Results: Of the 200 participants, mean age was 58.27 years, with males constituting 53.5%. About 40.5% had a hemorrhagic stroke, and 59.5% an ischemic stroke. The mean adherence score was 13.36 (SD= 4.658) out of a possible 28. Factors significantly correlated with medication adherence included age, monthly income, time since having a stroke, and education level. Adherence was also significantly linked to having diabetes mellitus or high blood pressure. The assessment of participants' self-care activities and medication adherence revealed that responses to questions about healthcare habits varied, with "None" being the most common response for most items. Notably, we found no significant association between adherence and factors such as gender, marital status, living place, and smoking status.

Conclusion: Medication adherence remains suboptimal among stroke patients in Iraq. Various demographic and clinical factors play a role in influencing adherence. The conformity to medication regimens and factors associated with it among individuals who have suffered a stroke in Iraq is vital.

Keywords: stroke, medication adherence, self-care activities, demographics, Iraq

Introduction

Stroke is the second most common cause of fatality and the third most common cause of death and disability combined worldwide,[1] leaving patients with functional or neurological deficits, and hindering both patients' and their families' quality of life.[2] Cardioembolic and atherothrombotic stroke represent ischemic infarct subtypes associated with the highest in-hospital mortality rates. Patients with these subtypes typically have a poorer short-term prognosis compared to other ischemic stroke subtypes.[3]

The cognitive decline in stroke patients has been linked to diminished daily activities. Primary goals of rehabilitation and recovery for stroke survivors of working age involve reentering the workforce and sustaining employment. Anticipating functional capacities during the early stages of recovery allows for the timely initiation of healthcare interventions, with the goal of providing support to the client as they progress through the rehabilitation process.[4] Achieving high subjective well-being and life satisfaction after a stroke depends in a significant way on a successful return to work.[5,6]

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For patients, their families, and society, stroke-related costs are enormous, and its rising frequency poses a significant problem for health policymakers.[7] The approximate worldwide expense associated with stroke exceeds US$721 billion, constituting 0.66% of the global GDP.[1]

The management of reversible risk factors including diabetes, hyperlipidemia, atrial fibrillation, smoking, and hypertension can contribute to decreased morbidity and mortality, while simultaneously increasing the quality of life. Diabetic patients are documented to face a threefold higher risk of stroke when compared to individuals without diabetes,[8,9] and the presence of both diabetes and hypertension is considered to dramatically increase the risk.[10] Multimorbidity is linked to polypharmacy which increases the risk of non-adherence,[11] and pharmacists can have a positive role in improving patient's management.[12,13] Research conducted by Gallacher et al revealed a notably higher prevalence of multimorbidity and polypharmacy among individuals diagnosed with stroke compared to those without, resulting in decreased levels of medication adherence.[14,15] Previous studies underscore the need for robust, evidence-based, and obligatory health education initiatives on a population scale. These programs are critical for boosting stroke awareness, especially among vulnerable groups such as individuals with chronic diseases, the elderly, those with lower educational levels, and the general public.[16]

Following a healthy routine and habits such as maintaining a good diet and performing exercises on regular basis decreases complications in stroke patients.[17,18] Furthermore, research has suggested that self-management empower patients to effectively oversee their health and modify their attitudes and behaviors.[19] A meta-analysis on self-management in stroke patients also revealed that such interventions can enhance the quality of life, life routine, and medication adherence in stroke patients within the community.[20,21]

Despite its crucial role in promoting better health and preventing recurrent strokes, adherence among stroke patients is reportedly below the desired level.[22–24] Earlier studies indicated that adherence levels in stroke patients were below 50%.[25] Additionally, previous studies found that patients who initiated antihypertensive drugs post-stroke often discontinued the medication after a year of onset.[26] Hence, assessing patients' medication adherence becomes imperative to formulate appropriate strategies for managing stroke patients, thereby enhancing health outcomes and quality of life.[27] Evaluating patients' compliance with self-care activities is also essential for stroke patients to achieve an improved quality of life.

The aim of this study is to assess the medication adherence of stroke patients residing in Iraq, exploring the connections between patients' demographic and clinical information alongside their adherence levels. The secondary objective involves evaluating the self-care activities adopted by stroke patients and their adherence to them.

Materials and Methods

Research Design and Participant Criteria

Using a cross sectional correlational methodology, during the study period, patients who were diagnosed with a stroke were recruited from seven hospitals in both Baghdad, the capital governorate of Iraq, and Al-Mothanna governorate in the south of the country. Patients were accessed within medical floors, neurology outpatient units, and physiotherapy centers during the period from November 2022 to April 2023. All patients received a diagnosis confirmed and approved by the physician, and the senior neurologist at the hospital. Magnetic resonance imaging (MRI) and/or computerized tomography (CT) scans were requisitioned for patient diagnosis.

Patients eligible for this study met the following inclusion criteria: (1) Iraqi natives; (2) aged 18 or older; (3) treated for ischemic or hemorrhagic stroke within the past month or longer; (4) had mild to moderate functional impairments; (5) could read and understand Arabic, (6) provided informed consent. Data collection involved patients directly completing the self-reported questionnaire, as it could not be filled out by proxy. Patients with major cognitive or verbal impairments, such as dementia, were excluded due to potential inaccuracies in their responses and caregivers' conclusions. Patients with moderate aphasia (dysphasia) confirmed by their attending clinicians were included. Exclusion criteria also applied to patients with a history of drug abuse, depression, dependency on daily living activities, or comorbidities that could negatively affect their assessed outcomes including adherence, such as serious illnesses like cancer and chronic renal failure. Prior to participating, individuals were informed about the study's goals. Submission of their data was taken as their informed consent.

Ethical Clearance

Ethical authorization (# 2540–2542, dated 25th September 2022) was taken from the Institutional Review Board (IRB) committees at the following hospitals: Neurosurgery teaching hospital in Baghdad, Dr. Saad Al-Witry Neuroscience Hospital, Baghdad Health Directorate - Al-Karkh, Kadhimiya Educational Hospital, Yarmouk Teaching Hospital, General directorate of the Medical City, and Baghdad Teaching Hospital. Prior to participating in the study, all enrolled patients were provided with detailed information about the study's objectives and were assured that their participation was entirely voluntary and risk-free, and were required to provide written informed consent. To ensure confidentiality, each patient was assigned a unique code number. This study was done in concordance with the Declaration of Helsinki.

Development and Collection of Study Questionnaire

The questionnaire used in this study was employed in interviewing the study subjects, it contained four main sections: (1) Queries regarding the socio-demographic features of patients encompassed gender, age, marital status, educational level, place of residence, family total income, and work status. Furthermore, information pertaining to previous surgeries, elevated blood sugar or blood pressure levels, and any prior diagnoses of chronic conditions was solicited. (2) Assessment of patients' adherence to medications using the adherence questionnaire. (3) Assessment of patients' adherence to self-care activities. (4) Patients' medical data such as their medications, drug dosages, and therapeutic regimens taken before the incidence of stroke. These data were collected using the patients' words in addition to verifications from the hospital medical records.

Patients were asked about their adherence behaviors, recalling the four weeks preceding the stroke incident and hospitalization. A validated questionnaire, adapted from previous studies, was employed.[13,28] The adherence questionnaire encompassed 7 items, covering aspects such as: "Do you forget to take your medication?", "Do you stop your medication from time to time?", "Do you stop your medication when you feel better?", "Do you stop your medication when you feel worse after taking your medication?", "Do you stop your medication due to side effects you believe is due to taking your medication?", "Do you fail to follow your pharmacist advice?", and "How often a week you do not take your medication (you forget or stop)?". Responses were assessed using a five-point scale (0 for "never" to 4 for "always"). The adherence total score spanned from zero to 28, with lower scores indicating better adherence. Subsequently, patients were classified into categories based on their adherence level: high adherence (score = 0), medium adherence (score = 1 to 14), low adherence (score = 15 to 21), or non-adherent (score = 22 to 28). Finally, patients were inquired about the reasons for not taking their medications.

As for the self-activities questionnaire, which was taken from a published validated source.[13] The questionnaire contained 5 questions: "On how many days a week did you follow a healthy diet?", "On how many days a week did you eat 5 or more portions of vegetables and/or fruits?", "On how many days a week did you skip eating food that contains high amount of fat (eg, Full-fat milk and red meat)?", "On how many days a week did you perform continuous exercise for more than 30 minutes?", and "On how many a week did you perform special type of sport eg, walking?".

However, patients previously diagnosed with diabetes mellitus were asked three more questions: "On how many days a week did you measure your blood glucose level?", "On how many days a week did you check your feet?", and "On how many days a week did you checked your shoes?".[29] The respondents used a seven-point Likert scale, ranging from one to seven times, to answer the questions. The self-care adherence score, out of 35 points, was then computed, with higher ratings signifying greater self-care adherence.

Sample Size Determination

Utilizing G*Power 3.1.9.2 software (2014), the calculation of the sample size was conducted. With a power of 0.80, a significance level (α) set at 0.05, and an effect size of 0.15 for multiple linear regression analysis, the minimum required sample size was identified as 135 participants. To accommodate a potential dropout rate of 20%, the study aimed to enroll a minimum of 162 participants.

Statistical Analyses

The coding and entry of collected data into the analytic data sheet were executed using Statistical Package for the Social Sciences (SPSS), Version 25.0 (IBM Corp., Armonk, New York, USA). All assumptions for multiple linear regression were thoroughly assessed. Pearson's Chi-Square test was employed for the analysis of categorical variables, and results were presented as frequency percentages. Statistical significance was defined as p-values less than 0.05.

This study examined two dependent variables: scores related to medication adherence and self-care adherence. The independent variables encompassed demographic and clinical outcomes data. Two separate multiple linear regression analyses were performed to identify predictors for these dependent variables—adherence to medication score (Model A) and self-care adherence score (Model B). The relationships between the dependent variables and independent variables, including age, gender (female and male), marital status (single, married, divorced, and widowed), place of residence (city and rural), educational status (intermediate, secondary, diploma, bachelor's degree, and postgraduate degree), monthly family income (low income, intermediate income, high income), smoking status (smoking and not smoking), working status (working and not working), and living status (living alone, with family, or with husband's family), were investigated.

Results

The present study enlisted a total of 200 participants. The study participants' age ranged from 28 to 92, with a mean age of 58.27 years (SD= 12.35). Slightly over half of the participants were males (n= 107), and approximately 70.0% were married (n= 139). With regards to participants' living conditions, 60.0% were living in city areas, with the majority living with their families (n= 168). Only 3.5% of participants hold a bachelor's or postgraduate degree (Table 1).

Table 1 Demographic Characteristics of the Study Participants (N= 200)

Parameter	n (%)
Gender	
Female	93 (46.5)
Male	107 (53.5)
Marital status	
Single	3 (1.5)
Married	139 (69.5)
Divorced	14 (7.0)
Widowed	44 (22.0)
Place of residence	
City (urban areas)	120 (60.0)
Rural areas	80 (40.0)
Living status	
Alone	3 (1.5)
With the family	168 (84.0)
With husband's family	29 (14.5)
Educational level	
Illiterate	36 (18.0)
Elementary	63 (31.5)
Preparatory	26 (13.0)
Secondary	19 (9.5)
Diploma	22 (11.0)
Bachelor's degree	27 (13.5)
Postgraduate degree (Master's or Ph.D.)	7 (3.5)

(*Continued*)

Table 1 (Continued).

Parameter	n (%)
Working status	
Yes	52 (25.7)
No	110 (55.1)
Retired	38 (19.1)
Sufficient monthly income	
Yes	117 (58.5)
No	83 (41.5)
History of having surgery	
Yes	71 (35.5)
No	129 (64.5)
Type of stroke	
Hemorrhagic stroke	81 (40.5)
Ischemic stroke	119 (59.5)
How long have you had a stroke?	
Less than one month	45 (22.5)
From 1–3 months	45 (22.5)
From 3–6 months	46 (23.0)
More than 6 months	64 (32.0)
History of having high blood pressure	
Yes	160 (80.0)
No	40 (20.0)
History of having diabetes mellitus	
Yes	103 (51.5)
No	97 (48.5)
Previous blood sugar assessment	
Was not performed recently	131 (75.7)
Performed recently	42 (24.3)
Smoking status	
Smoker	55 (27.7)
Non-smoker	145 (72.3)

About one-quarter of the study participants were employed (n= 52). The mean monthly income of the participants was 914,425.0 Iraqi Dinars (SD= 1,020,255.8). The reported income ranged from a minimum of 150,000.00 to a maximum of 9,750,000.0 Iraqi Dinar. Almost 59.0% of the participants expressed satisfaction with their income (Table 1).

With regards to previous surgery, 35.5% reported having undergone surgical procedures before (n= 71). Out of the participants, 40.5% had a hemorrhagic stroke (n= 81), while 59.5% had an ischemic stroke (n= 119). A stroke has affected 45 participants within the previous month, 22.5% within the previous three months, 23.0% within the previous six months, and 32.0% within the last six months (Table 1).

Regarding medical history, 51.5% have diabetes mellitus, whereas a higher percentage of the participants (80.0%) suffer from high blood pressure. More than 70.0% of the participants were non-smokers (Table 1). On the other hand, of the smokers (n=55), 86.3% smoke cigarettes (n= 47), 2.7% smoke Shisha (n= 2), and 11.0% smoke both (n= 6).

Evaluating patients' adherence to their medications revealed that 17.5% of the patients often/always forget to take their medications, whereas 19.0% often/always stop taking their medications from time to time. Additional items regarding discontinuation of medication revealed that 33.5% of patients frequently or always cease taking their medications when they experience improvement, 38.0% often or always discontinue medications when they feel worse after taking them, and 38.0% often or always stop taking medications due to side effects (Table 2).

Regarding adherence to pharmacists' advice, 39.5% of the patients stated that they always/often follow pharmacists' advice, compared to 35.0% of patients who indicated that they sometimes do so. On the other hand, 25.5% of the patient

Table 2 Patients' Self-Reported Adherence to Their Medications (N= 200)

Item	Never (0) n (%)	Rarely (1) n (%)	Sometimes (2) n (%)	Often (3) n (%)	Always (4) n (%)
1. Have you ever missed taking your medication?	16 (8.0)	58 (29.0)	91 (45.5)	26 (13.0)	9 (4.5)
2. Have you intermittently discontinued your medication?	27 (13.5)	55 (27.5)	80 (40.0)	27 (13.5)	11 (5.5)
3. Do you discontinue your medication when you experience an improvement in your condition?	29 (14.5)	45 (22.5)	59 (29.5)	43 (21.5)	24 (12.0)
4. Do you discontinue your medication when you experience worsening symptoms after taking it?	37 (18.5)	51 (25.5)	36 (18.0)	45 (22.5)	31 (15.5)
5. Do you stop your medication due to side effects you believe is due to taking your medication?	21 (10.5)	41 (20.5)	62 (31.0)	38 (19.0)	38 (19.0)
6. Do you cease taking your medication because you attribute certain side effects to it?	8 (4.0)	43 (21.5)	70 (35.0)	45 (22.5)	34 (17.0)
7. How frequently do you miss or discontinue taking your medication in a week?	20 (10.0)	80 (40.0)	61 (30.5)	35 (17.5)	4 (2.0)

reported that they rarely/never follow the pharmacists' advice. In response to the question of how frequently patients forget or stop taking their medications in a particular week, half of the patients stated that they never/rarely (50.0%) forgot or stopped their medications (Table 2).

The patients' mean adherence score to medication, on a scale of 28, was 13.36 (SD= 4.658), with a minimum score of two, and a maximum score of 24. Assessing the scores from a different perspective, 59.5% of the patients demonstrated a medium adherence level (n= 119), 34.5% had a low adherence level (n= 69), and 6.0% of the patients were classified as non-adherent (n= 12).

Assessing possible reasons that prevent patients from taking their medications always or often revealed that the cost of medication is a barrier for 20.0% of patients (Table 3), followed by unsuitable medication time (19.0%), forgetfulness (16.5%), managing a high number of medications (9.0%), medication complications and side effects (5.5%), and medication dislike (5.5%), as well as infective medication (5.5%).

The most commonly taken medications among the study participants were Rivaroxaban; to decrease the risk of stroke and blood clots), Acetylsalicylic acid; an antiplatelet agent, Clopidogrel; a platelet inhibitor, and Heparin; an anticoagulant that prevents the formation of blood clots.

Participants in the study utilized various antihypertensive medications, including Verapamil hydrochloride, a calcium antagonist, Amlodipine, a calcium channel blocker, Captopril, an angiotensin-converting enzyme inhibitor, Losartan and Valsartan, angiotensin II receptor blockers, Bisoprolol and Labetalol, beta-blockers, Furosemide, a loop diuretic, Spironolactone, a potasium-sparing diuretic, Methyldopa, centrally-acting alpha-2 adrenergic agonist, as well as Lisinopril and Enalapril, angiotensin-converting enzyme inhibitors.

Table 3 Reasons Preventing Patients' from Taking Their Medication

Reason	Never n (%)	Rarely n (%)	Sometimes n (%)	Often n (%)	Always n (%)
Medication price	25 (12.5)	68 (34.0)	67 (33.5)	27 (13.5)	13 (6.5)
Unsuitable medication time	42 (21.0)	42 (21.0)	78 (39.0)	25 (12.5)	13 (6.5)
Forgetfulness	53 (26.5)	75 (37.5)	39 (19.5)	22 (11.0)	11 (5.5)
Medication dislike	55 (27.5)	63 (31.5)	72 (36.0)	6 (3.0)	4 (2.0)
Infective medication	88 (44.0)	55 (27.5)	47 (23.5)	5 (2.5)	5 (2.5)
Medication complications and side effects	94 (47.0)	63 (31.5)	32 (16.0)	7 (3.5)	4 (2.0)
High number of medications (polypharmacy)	103 (51.5)	46 (23.0)	33 (16.5)	10 (5.0)	8 (4.0)

The medications employed for managing elevated blood sugar levels associated with type 2 diabetes included Metformin, an oral antidiabetic medication, Atorvastatin, HMG CoA reductase inhibitors used to reduce low-density lipoprotein (LDL) in blood, raise high-density lipoprotein (HDL), and lower triglycerides, glimepiride, a sulphonylurea agent, Sitagliptin, a dipeptidyl peptidase-4 (DPP-4) inhibitor, along with insulin lente and insulin soluble adjusted based on blood sugar readings.

The examination of the relationship between medication adherence and participants' demographic characteristics unveiled a noteworthy correlation between medication adherence and participants' age (p-value <0.001), monthly income (p-value= 0.002), time since having a stroke (p-value= 0.042), and education level (p-value= 0.004). Participants with a higher education level reported elevated levels of adherence.

A significant correlation between adherence to medications and having diabetes mellitus (p-value= 0.007) was identified. Among the 103 participants diagnosed with diabetes mellitus, 55 exhibited a medium adherence level, 45 exhibited a low adherence level, and 3 were non-adherent (compared to 64, 24, and 9 participants, respectively, who did not have diabetes mellitus). Similarly, a significant correlation was found between adherence to medications and having high blood pressure (p-value <0.001). Of the 160 participants diagnosed with high blood pressure, 103 participants exhibited a medium adherence level, 54 exhibited a low adherence level, and 4 participants were non-adherent (compared to 16, 16, and 8 participants, respectively, who did not have high blood pressure).

Conversely, no significant correlation was found between adherence to medications and participants' gender (p-value= 0.403), marital status (p-value= 0.765), living place (p-value= 0.888), the people that the participant live with (p-value= 0.948), employment status (p-value= 0.179), history of previous surgery (p-value= 0.970), type of stroke (p-value= 0.519), smoking status (p-value= 0.178), and smoking type (p-value= 0.391).

Assessing participants' self-care activities revealed that the highest reported responses in each item were "None" for item 1 "On how many days a week did you follow a healthy diet?" (19.0%), "Four times" for item 2 "On how many days a week did you eat five or more portions of vegetables and/or fruits?" (22.0%), "Two times" for item 3 "On how many days a week did you skip eating food that contains high amount of fat (eg, Full-fat milk and red meat)?" (23.0%), "None" for item 4 "On how many days a week did you perform continuous exercise for more than 30 minutes?" (24.5%), and "None" for item 5 "On how many a week did you perform special type of sport eg, walking?" (35.5%). The participants' responses are shown in Table 4. The mean for the first five items were as follows: 3.33 (SD= 2.31), 3.74 (SD= 1.87). 2.57 (SD= 1.96), 2.67 (SD= 2.12), and 1.86 (SD= 1.30).

Table 4 Assessment of Participants' Self-Care Activities (N= 200)

Statement	None n (%)	One Time n (%)	Two Times n (%)	Three Times n (%)	Four Times n (%)	Five Times n (%)	Six Times n (%)	Seven Times n (%)
On how many days a week did you follow a healthy diet?	38 (19.0)	9 (4.5)	29 (14.5)	31 (15.5)	25 (12.5)	28 (14.0)	15 (7.5)	25 (12.5)
On how many days a week did you eat five or more portions of vegetables and/or fruits?	10 (5.0)	14 (7.0)	25 (12.5)	43 (21.5)	44 (22.0)	26 (13.0)	17 (8.5)	21 (10.5)
How many days per week did you abstain from consuming high-fat foods (eg, full-fat milk and red meat)?	34 (17.0)	30 (15.0)	46 (23.0)	33 (16.5)	20 (10.0)	19 (9.5)	8 (4.0)	10 (5.0)
On how many days a week did you perform continuous exercise for more than 30 minutes?	49 (24.5)	15 (7.5)	33 (16.5)	36 (18.0)	24 (12.0)	19 (9.5)	14 (7.0)	10 (5.0)
How many days per week did you engage in a specific type of physical activity, such as walking?	71 (35.5)	25 (12.5)	39 (19.5)	29 (14.5)	15 (7.5)	11 (5.5)	3 (1.5)	7 (3.5)
How frequently did you check your blood glucose levels per week?*	13 (12.6)	8 (7.8)	14 (13.6)	9 (8.7)	11 (10.7)	12 (11.7)	8 (7.8)	28 (27.2)
How often did you inspect your feet per week?*	18 (17.5)	14 (13.6)	18 (17.5)	8 (7.8)	15 (14.6)	6 (5.8)	6 (5.8)	18 (17.5)
How frequently did you examine your shoes per week?*	45 (43.7)	12 (11.7)	9 (8.7)	11 (10.7)	15 (14.6)	3 (2.9)	1 (1.0)	7 (6.8)

Note: *Only for participants with diabetes (n= 103).

Regarding participants with diabetes (n= 103), 27.2% responded with "Seven times" when they were asked, "On how many days a week did you measure your blood glucose level?", and 17.5% responded also with "Seven times" when they were asked "On how many days a week did you check your feet?". On the other hand, a high percentage of participants (43.7%) responded with "None" when they were asked "On how many days a week did you check your shoes?" (Table 4).

Multiple linear regression analysis of factors affecting adherence to medication score showed that participants' age, place of residency, sufficient monthly income, type of stroke, time passed since the stroke, and history of having high blood pressure significantly affected the adherence score (Table 5, Model A). Findings indicted that higher adherence scores (lower adherence) were associated with older participants (Beta= 0.180, P-value= 0.011), living in rural areas (versus living in the city), individuals with sufficient monthly income (Beta= 0.215, P-value= 0.002), those who experienced haemorrhagic stroke (Beta= -0.162, P-value= 0.022), individuals with a longer period since their stroke (Beta= 0.114, P-value= 0.109), and those without a history of high blood pressure (Beta= -0.150, P-value= 0.034).

Table 5 Assessment of Factors Affecting Adherence to Medication Score (Model A) and Self-Care Score (Model B) Among the Study Participants (N= 200)

Parameter	Adherence to Medication Score (Model A)		Self-care Score (Model B)	
	Beta	P-value[#]	Beta	P-value[$]
Age	0.180	**0.011**[^]	0.224	**0.002***
Gender • Female • Male	Reference −0.019	0.793	–	–
Marital status • Single • Other (married, widowed, or divorced)	Reference <0.001	0.999	–	–
Place of residence • City • Rural area	Reference 0.087	**0.221**[^]	0.043	0.528
Living status • Alone • With others	Reference −0.27	0.701	–	–
Education level • < Bachelor's degree • ≥ Bachelor's degree	Reference −0.018	0.797	–	–
Working status • Yes • No	Reference 0.033	0.646	–	–
Sufficient monthly income • No • Yes	Reference 0.215	**0.002**[^]	0.161	**0.019***
History of having surgery • No • Yes	Reference −0.015	0.834	–	–
Type of stroke • Hemorrhagic stroke • Ischemic stroke	Reference −0.162	**0.022**[^]	−0.174	**0.012***

(*Continued*)

Table 5 (Continued).

Parameter	Adherence to Medication Score (Model A)		Self-care Score (Model B)	
	Beta	P-value[#]	Beta	P-value[$]
Time passed since stroke • ≤ 3 months • > 3 months	Reference 0.114	**0.109^**	0.108	**0.119***
History of having high blood pressure • No • Yes	Reference −0.150	**0.034^**	−0.211	**0.003***
History of having diabetes mellitus • No • Yes	Reference 0.022	0.756		

Notes: [#]Using simple linear regression. [$]Using multiple linear regression. ^Eligible for entry in multiple linear regression (significant at 0.25 significance level). *Significant at 0.05 significance level, significant p-values were marked in bold.

Factors affecting self-care score for the first five questions revealed that participants' age, sufficient monthly income, type of stroke, time passed since the stroke, and history of having high blood pressure significantly affected the self-care score (Table 5, Model B). Accordingly, the findings indicted that higher self-care scores were associated with older participants (Beta= 0.224, P-value= 0.002), individuals with sufficient monthly income (Beta= 0.161, P-value= 0.019), those who experienced haemorrhagic stroke (Beta= −0.174, P-value= 0.012), individuals with a longer period since their stroke (Beta= 0.108, P-value= 0.119), and those without a history of high blood pressure (Beta= −0.211, P-value= 0.003).

Discussion

Stroke stands as the second most common cause of death globally and the third most significant contributor to death and disability.[1] It induces functional and neurological impairments, impacting the quality of life for both patients and their families.[2] Cognitive decline is associated with reduced daily functioning in stroke patients. Manageable risk factors, including diabetes, hyperlipidemia, atrial fibrillation, smoking, and hypertension, can mitigate morbidity and mortality, particularly in individuals with diabetes who face a threefold higher risk of stroke.[8] The presence of diabetes and hypertension elevates the stroke risk due to multimorbidity and potential non-adherence to medication.[10]

To our knowledge, this cross-sectional study represents the initial attempt to assess medication adherence and self-care activities in stroke survivors in Iraq. Despite the recognized importance of stroke medications for preventing and managing recurrent strokes, adherence rates are often suboptimal.[18] Our study aligns with this observation, revealing that medium adherence, low adherence, and non-adherence accounted for 59.5%, 34.5%, and 6.0%, respectively. However, variations in follow-up durations and adherence assessment methods across studies hinder a direct comparison of findings.[30]

In this study, sociodemographic variables were found to influence adherence levels, consistent with prior research.[31] Significantly better adherence scores were observed in older patients compared to their younger counterparts, and individuals with a higher monthly income exhibited superior adherence in contrast to those with lower income. Additionally, participants with a more extended period since their stroke reported higher adherence. This observation could potentially be attributed to the notion that a higher income facilitates improved access to healthcare providers and facilities.[32]

The obstacles to adherence reported by patients in our study encompassed medication costs, inconvenient timing of medication, forgetfulness, managing a high number of medications (polypharmacy), medication complications and side effects, and a dislike for the medication. This aligns with earlier findings indicating that the most prevalent causes for non-adherence in stroke patients include concerns about side effects,[33] a general aversion to medications,[34] and forgetfulness in taking prescribed medication.[17] Moreover, polypharmacy has been identified as a contributor to non-adherence, thereby increasing the risk of adverse cardiovascular events.[35] Despite variations in healthcare systems,

socioeconomic factors, and cultural contexts across countries, the factors contributing to noncompliance remain consistent.

Among the prevalent concerns regarding stroke survivors, educational level emerged as a predictor of medication non-adherence. Our data revealed that patients with higher education were less likely to be non-adherent. These findings align with previous studies suggesting a positive association between higher education levels and adherence.[36–38] This correlation may be attributed to individuals with higher educational levels harboring fewer negative views about medications, consequently enhancing medication adherence.[39] Therefore, strategies aimed at improving medication adherence among stroke survivors should consider educational level factors. It is noteworthy that the average duration of education for stroke patients was significantly shorter in individuals under the age of 65 compared to those over the age of 65.[40] These Results underscore the significance of educational level as a substantial barrier to medication adherence interventions in older adult stroke patients.

Regarding self-care activities in stroke patients, our study identified factors associated with higher self-care scores, including older participants, individuals with an adequate monthly income, those who experienced a hemorrhagic stroke, those with a longer duration since their stroke, and those without a history of high blood pressure. Previous research has established correlations between patients' age, gender, and marital status and favorable self-care behaviors.[41–44] Additionally, due to updated criteria for diagnosing hypertension, more patients are now identified early, enabling them to benefit from lifestyle modifications and early medical intervention.[45,46]

In our study, patients were administered direct oral anticoagulants, the primary treatment for atrial fibrillation when combined with an additional stroke risk factor. A comprehensive examination of randomized controlled trials involving individuals with atrial fibrillation demonstrated that adjusted doses of oral anticoagulants were remarkably effective in preventing strokes.[47] Furthermore, a retrospective cohort analysis utilizing the US MarketScan claims databases assessed adherence to anticoagulant medications in patients with non-valvular atrial fibrillation. The findings revealed that heightened adherence to specific anticoagulants correlated with a reduced incidence of stroke. Consequently, strict adherence to these medications is imperative to maximize treatment benefits and achieve optimal efficacy.[48]

The paramount strength of this study lies in its provision of essential insights into the prevalence and factors associated with medication non-adherence among older adult stroke survivors in Iraq, utilizing standardized rating scales. Additionally, our findings contribute to a deeper comprehension of medication non-adherence in this population, serving as a foundation for interventions aimed at enhancing adherence.

However, this study is not without limitations. Firstly, because data on medication compliance was gathered in the months preceding the survey, the potential for recall bias cannot be entirely eliminated. This introduces the possibility of inaccurate assessments of medication non-adherence prevalence. Secondly, the data relied on self-reported medication adherence behaviors, a factor that could result in over- or under-reporting by participants. Thirdly, the study's cross-sectional nature means that correlation between medication non-adherence and risk factors should not be interpreted as causal relationships. Lastly, we included patients with comorbidities such as diabetes mellitus and hypertension, which could have influenced patients' adherence to medications in general.

A recommendation for further research that could focus on investigating medication adherence among patients with lacunar infarcts compared to those with non-lacunar infarcts. Given the distinct pathophysiology, prognosis, and clinical features of lacunar strokes compared to other acute ischemic cerebrovascular diseases, such research could provide valuable insights into tailored interventions and management strategies for optimizing medication adherence in this particular settings.[49] Understanding the unique challenges and factors influencing medication adherence in patients with lacunar strokes could ultimately contribute to improved outcomes and personalized care in stroke management.

Conclusion

To sum up, our study investigated medication adherence levels among stroke patients in Iraq and assessed the self-care activities embraced by these individuals, along with their adherence to these practices. Our findings unveiled a noteworthy correlation between medication adherence and participant age, monthly income, time elapsed since the stroke, educational levels, and the daily number of prescribed medications. This emphasizes the need for additional

research in different countries to delve into the prevalence and factors associated with medication non-adherence among stroke survivors.

Data Sharing Statement

The datasets employed and/or analyzed in the current study are available from the corresponding author upon a reasonable request.

Ethical Approval

Ethical authorization (# 2540-2542, dated 25th September 2022) was obtained from the Institutional Review Board (IRB) committees at the selected hospitals. Before joining the study, every enrolled patient received comprehensive information regarding the study's objectives and was obligated to furnish written informed consent. To maintain confidentiality, each patient was assigned a distinct code number.

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Disclosure

The authors report no conflicts of interest in this work.

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