Original paper

Pre-Hospital Delay and Patient Knowledge in Acute Cerebrovascular Accidents at Kenyatta National Hospital, Nairobi, Kenya

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Abstract

Background: Stroke is a leading cause of death and disability worldwide. In Kenya, stroke is the third leading cause of death, and the burden of the disease is increasing due to the aging population and the increasing prevalence of risk factors such as hypertension, diabetes, and smoking. Prehospital delay is a major contributor to poor outcomes in stroke patients. Knowledge about stroke and its symptoms is essential in reducing prehospital delay and improving outcomes in stroke patients.

Objectives: The main objective of this study was to investigate the factors influencing prehospital delay of acute stroke patients at Kenyatta National Hospital by the end of 2022 using a cross-section survey of 50 patients to identify the main influencers of presentation time, including patient and community factors, healthcare system factors and stroke-related factors.

Methods: After random sampling, this cross-sectional study involved 50 acute stroke patients who presented to the neurology ward (7B) and Intensive Care Units (ICU) at Kenyatta National Hospital (KNH). Data was collected using a structured questionnaire. Data was analyzed using Statistical Package for Social Sciences (SPSS) version 24. Univariate analysis was conducted using the student t-test or the Wilcoxon –Mann-Whiney test for continuous variables and using Chi-square or Fisher's exact test for categorical variables for the subgroup analyses, such as comparison between patient arrival at a first hospital within 4.5 hours and after 4.5 hours. The results were presented in the form of tables.

Results: The study involved predominantly female patients (62%), married (62%), and had National Hospital Insurance Fund (NHIF) hospital cost coverage. The majority of patients were non-smokers, had no history of stroke, and patients' families had no history of stroke. The median time interval was approximately 4.25 hours. The majority of the patients (66%) had poor knowledge of stroke risk factors and stroke warning signs and symptoms (62%). Certain social demographic characteristics, such as age, education, and marital status, were associated with the timing of patient presentations to the hospital. The study found that patients with better knowledge of warning symptoms were likelier to present to the hospital on time. At the same time, there was no significant association between knowledge of stroke risk factors and timely presentation.

Conclusion: Most of the patients managed to arrive at the hospital on time. The study highlights a concerning gap in knowledge regarding stroke risk factors and warning signs. Certain social demographic characteristics (age, education, and marital status) exhibited statistically significant associations with timely hospital presentation. Knowledge concerning warning symptoms had significant associations with the timing of hospital presentations. The study did not establish a significant substantial link between knowledge of stroke risk factors and the timing of patient presentations.

Key words: Median time interval, Knowledge of stroke, Delays in the presentation, Acute stroke

Introduction

Stroke is the second leading cause of death worldwide and a major cause of disability. Statistics in 2019 show that there are over 17 million new strokes each year. Over 25 years, 1 in 4 people will have a stroke in their lifetime. The global burden of stroke is increasing, with 8% of all first-ever strokes occurring in Africa[1]. According to the World Health Organisation (WHO), low- and middle-income countries bear the heaviest (86%) global stroke burden, with 5% of the 30 million stroke survivors worldwide living in Africa[2]. African countries

are undergoing an epidemiological transition characterized by socio-demographic and lifestyle changes, resulting in increased risk factors and the burden of cerebrovascular disease.

Modifiable factors vary and can be divided into lifestyle behavior and medical factors. There are diverse modifiable stroke risk factors, including hypertension, smoking, diabetes mellitus, hyperlipidemia, physical inactivity, and excessive alcohol consumption[4]. The most remarkable non-modifiable risk factor of cerebrovascular accidents is age, as every decade after 55 years old, the risk factor increases double for both men and women[5]. In Norway, approximately 15,000 strokes are expected annually, of whom 11,000 are first-ever strokes, and the risk of stroke is higher for men than women[6].

In the North Trøndelag Health Survey, the prevalence of stroke was 18.5 per 1000. In the age groups below 50 years, the prevalence was approximately 2 per 1000, increasing to 108 per 1000 in the age group over 80 years, underlining the fact that stroke is mainly a disease among the elderly[7]. Furthermore, race and ethnicity are known as risk of stroke. African Americans and Hispanics have a higher ratio than Caucasians[3]. Family history is also a noteworthy risk factor, especially if a family member has had a stroke before. Genetic susceptibility, as well as family environment and lifestyle, have been proven to raise the risk of stroke[8].

A prospective study was conducted during the 12 months ending December 2012 in the Department of Neurology, Malabar Institute of Medical Sciences, Kerala, and found that the median delay from onset of symptoms to hospital arrival was 12 hours. The mean time taken to consult a local doctor after the onset of stroke was 3 hours. The mean distance that patients had to travel was 31km. Univariate analysis showed that female patients had shorter prehospital delays. The study did not find age ≥60 years as a significant factor for early arrival. The univariate analysis showed that those with higher educational status and those from the city had shorter prehospital delays. The majority of the patients were living in a nuclear family, but family type did not affect the arrival of stroke patients[9]. Jin et al[10] reported that female patients aged over 65 years were more likely to arrive early than younger patients and males.

The few studies on stroke in Africa provide a glimpse of poor health outcomes associated with the disease. For instance, inpatient stroke mortality by day 30 has been reported at 43.2% in Ghana[11], 33.3% in Tanzania[12], 23.2% in Cameroon[13], and 19.3% in the Democratic Republic of Congo[14]. The 6-month stroke mortality rate in South Africa is 23%[15]. Stroke occurrence in sub-Saharan Africa has been associated with poor health outcomes. Mortality rate ranges from 5- 27% in hospitals and 23.4- 26.7% in 1 month[16]. In a prospective, cross-sectional study in Morocco on prehospital delay and associated factors, the median time from symptom onset to hospital arrival was 6 hours. The study showed that illiteracy, waiting for symptoms to disappear, deciding to go directly to the hospital (patient behavior), bystander's knowledge that stroke is a disease requiring urgent care within a limited therapeutic window, and direct admission without reference were independently associated with a late arrival (>4.5hours) of patients with acute ischemic stroke. Patient behavior, bystander knowledge, and direct admission to a competent hospital for stroke care are modifiable risk factors potentially useful for reducing onset-to-door time and increasing the implementation rates of acute stroke therapies[17].

A prospective multicenter cohort study among stroke patients on stroke distribution patterns and characteristics in Kenya's leading public health tertiary institutions (Kenyatta National Hospital and Moi Teaching and Referral Hospital) revealed that overall, ischemic stroke accounted for 55.6% of the stroke cases, with women being the most affected (57.5%). The mortality rate at day 10 was 18.0% at KNH and 15.5% at MTRH and higher in the haemorrhagic cases (20.3%). The most common vascular risk factors were hypertension at 77.3% (males: 75.7%; females: 78.5%), smoking at 16.1% (males: 26.6%; females: 8.3%), and diabetes at 14.9% (males: 15.7%; females: 14.4%)[18].

One of the factors to maximize the efficiency of intervention in acute ischemic stroke is minimizing the delay in treatment, especially within the time the stroke attacks until being taken to the ED[19]. Lack of knowledge about stroke risk factors and early symptom warnings is one of the factors that cause the delay in bringing the patient to the ED[20], resulting in losing the chance to provide effective treatment. Family members must understand the early symptoms warning of stroke through education so that they can respond to stroke attack by directly taking the patient to the ED[21].

Early identification of the modifiable risk factors is extremely important because they play a role in intervention strategies to prevent and reduce these factors and can successively reduce cerebrovascular accidents in the future. This study

aimed to determine the median time interval from symptom onset to presentation, the knowledge of stroke patients concerning stroke symptoms and risk factors, and the factors associated with delays in the presentation of acute stroke patients.

Materials and methods

The study adopted a descriptive cross-sectional design and was conducted at Kenyatta National Hospital (KNH), Neurology ward (7B), and the HDU/ICU over two months. The study population was all patients diagnosed with acute stroke admitted in the neurology ward (7B) or Intensive Care Units (ICU), next of kin, or significant others/companions at the time of the stroke occurrence at KNH.

The study included patients admitted with stroke and were able to talk and answer the questions in the questionnaire, next of kin, significant others / companions who were with the patient within 72 hours after the occurrence of stroke in the case where the patient was not able to talk/answer the questions in the questionnaire and who was ≥18 years and patients / next of kin who gave informed consent for the study. The study excluded patients who were not able to answer the questions in the questionnaire, next of kin, significant others / companions who were not with the patient within 72 hours after the occurrence of stroke in the case where the patient was not able to talk / answer the questions in the questionnaire and patients who were unable to speak and whose next of kin / significant others / companions were not available to answer the questions in the questionnaire.

The sample size of 50 was determined using the Fisher's formula. The study used a simple random sampling procedure. Data was collected using a structured interview questionnaire.

Data was collected on the timing as the dependent variable, and other hand, the independent variables were social demographic factors and knowledge of stroke symptoms and risk factors.

Timing was measured as time interval from symptom onset to presentation at KNH (on time for ≤4.5 hours, late for >4.5 hours. Knowledge of stroke symptoms and risk factors was identified as good, fair, or poor.

Informed consent was sought from study participants. The participants were allowed to ask questions and to withdraw from the study without penalty or loss of benefits if they chose to. Their confidentiality was protected by using codes and serializing the questionnaires. No identifying information was disclosed in the analysis. Ethical approval for the study was obtained from KNH and the University of Nairobi Ethics and Review Committee. Permission was also obtained from KNH management.

Statistical analysis: The researcher cleaned filled questionnaires to ensure completeness, accuracy, and consistency. The worksheet was checked for typing errors, missing data, and outliers and cleaned. Data was analyzed using Statistical Package for Social Sciences (SPSS) version 24. Continuous variables such as age and distance covered were expressed as mean with standard deviations. Categorical variables such as stroke knowledge analysis were done with frequencies and percentages. Univariate analysis was conducted using a t-test or for continuous variables and using Chi-square or Fisher's exact test for categorical variables for the subgroup analyses, such as a comparison between patient arrival at a first hospital within 4.5 hours and after 4.5 hours. The results were presented in the form of tables. The presentation of qualitative data was done using themes and verbatim reporting.

Results

Patients characteristics: The study was conducted between July 2023 and September 2023, during which 50 patients were recruited. The social demographic information of the 50 acute stroke patients is presented in Table 1. Over half of the study respondents (62%) were female, close to a third of the respondents (32%) were between 51-60 years of age and the majority, 31(62%) were married. Most, 22 (44%), had secondary education, over half (56%) had NHIF cover, and 23 (46%) patients were not aware of chronic illnesses. Over three-quarters of the patients, 40(80%) were non-smokers, and a greater majority of the patients (82%) had no history of stroke or the patient's families (84%). Table 1 shows the patients' characteristics.

Table 1: Patient characteristics

Factors	Frequency (n=50)	Proportion (%)
Gender		
Male	19	38
Female	31	62
Age in years		
31 - 40	7	14
41 - 50	10	20
51 - 60	16	32
61 - 70	12	24
Over 70	5	10
Residence (location)		
Marital status		
Married	31	62
Single	2	4
Divorced/Separated	8	16
Widowed	9	18
Education		
No formal education	2	4
Primary	19	38
Secondary	22	44
Tertiary	7	14
Hospital cost cover		
Cash	21	42
Private insurance	1	2
NHIF	28	56
Patient living arrangement (alone)		
Yes	19	38
No	31	62
Chronic illness		
Hypertension	22	44
Diabetes mellitus	3	6
Heart disease	2	4
Other	2	4
Don't know	23	46
Patient smoking		
Yes	10	20
No	40	80
Cigarette sticks per day		
1-5	2	4
6-10	3	6
More than 10	5	10
Years of smoking		
6-10	2	4
Over 10	8	16

	Frequency	Proportion
Patient's history of stroke		
Yes	9	18
No	41	82
Family history of stroke		16
Yes	8	16
No	42	84

Table 2 shows the type of stroke. Over half of the patients (58%) had ischemic stroke and 42% had haemorrhagic stroke.

Table 2: Type of stroke

Type	Frequency (n)	Proportion %
Ischemic	29	58
Haemorrhagic	21	42
Total	50	100

Table 3 shows the time interval from symptom onset to hospital presentation. The median was the average of the 25th and 26th values in the sorted list.

Table 3: Median time interval from symptom onset to hospital presentation

Time interval (Hours)	Frequency	Proportion (%)
Less than 2	25	50
2 – 4.5	5	10
4.5 – 6	7	14
6 – 12	2	4
Over 12	11	22

The median time interval was approximately 4.25 hours.

Presentation to hospital: The findings on presentation to the hospital show that 30 (60%) patients presented to the hospital on time, while 20 (40%) patients presented late. Of the 50 patients, 20 (40%) used a Taxi cab to transport them to the first hospital, and 17 (34%) used a private car. The distance from where the stroke occurred to the first hospital was less than 15 km for most patients (72%). Table 4 shows the time of presentation to the hospital, distance, and mode of transport.

Table 4: Time of presentation to hospital, distance, and mode of transport

Time from symptom onset/recognition to arrival at first hospital		Frequency	Proportion (%)
On time (hours)	Less than 2	25	50
	2 – 4.5	5	10
Late (hours)	4.5 – 6	7	14
	6 – 12	2	4
	Over 12	11	22
Mode of transport to the first hospital			
Ambulance		4	8
Private car		17	34
Public transport		3	6
Taxi cab		20	40
Other		6	12
Distance from the place of occurrence of stroke to the first hospital (Km)			
Less than 15		36	72
15- 50		9	18
Over 50		5	10

Most patients regarded the distance as short (68%), and most (72%) did not experience any traffic on the way to the hospital. For some patients, the vehicle was not readily available (60%). The majority of the patients (70%) did not recognize the symptoms, with some waiting to see if symptoms would resolve (43%), and the others had nobody available immediately to help (28%). Table 5 shows the reasons for the time taken to the first hospital.

Table 5: Reasons for time then taken to the first hospital

		Frequency	Proportion (%)
Distance to hospital	Short	34	68
	Long	16	32
Availability of vehicle	Readily available	20	40
	Not readily available	30	60
Traffic snarl ups	No traffic	36	72
	Traffic present	14	28
Recognition of symptoms	Early recognition	15	30
	Wait and see if symptoms will resolve	21	43
	Nobody available immediately to help patient	14	28

Forty-two (84%) patients had medical interventions / investigations done at the first hospital. It took over one day for 11 (22%) patients in the first hospital before being referred to KNH, 9 (18%) did not know how long it took, 4 (8%) took 12 hours - a day, while 2 (4%) took less than 6 hours. This shows that most patients were late for the intervention offered at KNH since most took more than 6 hours to present to KNH.

Of the 50 patients, 21 (42%) took less than 2 hours to get KNH after referral, 11 (22%) took 2 – 4.5 hours, and over 4.5 hours for the rest.

The distance between the first hospital and KNH was less than 15 km for 21 (42%) patients, 15- 50 km for 20 (40%) patients, and over 50 Km for 9 (18%).

The most common modes of transport from the first hospital to KNH for patients were ambulances for 15 (30%) and private cars for 13 (26%) patients. Table 6 shows the medical intervention, time to KNH, distance, and mode of transport.

Table 6: Medical interventions, Time to KNH, distance, and mode of transport

		Frequency	Proportion (%)
Medical interventions / investigations done at the first hospital	Yes	42	84
	No	8	16
Period in the first hospital before being referred to KNH	Less than 6 hours	24	48
	6 – 12 hours	2	4
	12 hours- 1 day	4	8
	Over 1 day	11	22
	Don't Know	9	18
Time to get KNH after referral	Less than 2 hours	21	42
	2 – 4.5 hours	11	22
	4.5 – 6 hours	8	16
	6 – 12 hours	2	4
	Over 12 hours	8	16
Distance between the first hospital and KNH	Less than 15Km	21	42
	15- 50Km	20	40
	Over 50Km	9	18

Mode of transport from first hospital to KNH	Ambulance	15	30
	Private car	13	26
	Public transport	4	8
	Taxi cabs	16	32
	Others	2	4

Knowledge of stroke: Twenty-five patients (50%) knew that stroke affects the brain, 44% indicated stroke affects multiple organs, and twenty-six (52%) did not understand the term 'stroke.' Table 7 shows the patients' knowledge of stroke.

Table 7: Knowledge of stroke

Knowledge of stroke		Frequency	Proportion (%)
Organ affected by stroke	Brain	25	50
	Affects multiple organs	22	44
	Don't know	3	6
Understanding of the term 'stroke'	Blood clot in the brain	4	8
	Bleeding into the brain	3	6
	Circulation problem in the brain	6	12
	Other	11	22
	Don't know	26	52
Knowledge of risk factors of stroke	Poor	33	66.0
	Fair	13	26.0
	Good	4	8.0
Knowledge of warning signs	Poor	31	62.0
	Fair	10	20.0
	Good	9	18.0
Knowledge medications/treatment to reduce the extent and effects of stroke	Yes	2	4
	No	48	96
Period to administer main treatment drug for stroke after stroke onset	Hypertension medications	2	4
	Don't know	50	100

Over half of the respondents (66%) had poor knowledge of stroke risk factors. Over half of the respondents (62%) had poor knowledge of stroke warning signs. Almost all the patients (96%) had no knowledge of medications / treatment to reduce the extent and effects of stroke. None of the patients knew the period to administer the main treatment drug for stroke after stroke onset.

Factors associated with delays in presentation of acute stroke patients using statistical methods: A significant majority (80%) of the patients over 70 years presented on time, suggesting a strong likelihood of punctuality in this age group. A higher percentage (68.4%) of males presented on time, indicating relatively good punctuality among males. Most (68.4%) of individuals with primary education presented on time. Most (71%) of married individuals presented on time, suggesting a good punctuality rate in this marital status category. The majority (73.3%) of individuals living with relatives presented on time, indicating a good punctuality rate in this living arrangement. Table 8 shows association between certain social demographic factors and time of presentation.

Table 8: Association between certain social demographic factors and time of presentation

		On time (n)	(%)	Late (n)	(%)
Age (years)	31 - 40	4	57.1	3	42.9
	41 - 50	5	50	5	50
	51 - 60	10	62.5	6	37.5
	61 - 70	7	58.3	5	41.7
	Over 70	4	80	1	20
Gender	Male	13	68.4	6	31.6
	Female	17	54.8	14	45.2
Education	No formal education	2	100	0	0
	Primary	13	68.4	6	31.6
	Secondary	12	54.5	10	57.1
	Tertiary	3	42.9	4	57.1
Marital status	Married	22	71	9	29
	Single	1	50	1	50
	Divorced/ Separated	3	37.5	5	62.5
	Widowed	4	44.4	5	55.6
Living Arrangement	Alone	8	26.7	11	55
	With relatives	22	73.3	9	45

Sixty six point seven percent of individuals with good knowledge of stroke symptoms / warning signs presented on time, indicating a relatively higher punctuality rate. All (100%) individuals with good knowledge of stroke risk factors presented on time, indicating a perfect punctuality rate. Table 9 shows the association between knowledge and time of presentation.

Table 9: Association between knowledge and time of presentation

		On time (n)	(%)	Late (n)	(%)
Stroke symptoms/warning signs	Poor knowledge	20	64.5	11	35.5
	Fair knowledge	4	40	6	60
	Good knowledge	6	66.7	3	33.3
Stroke risk factors	Poor knowledge	19	57.6	14	42.4
	Fair knowledge	7	53.8	6	46.2
	Good knowledge	4	100	0	0

Sixty percent of individuals with ischemic stroke presented on time, while 40% of individuals with haemorrhagic stroke presented on time, indicating a lower punctuality rate compared to ischemic stroke. Table 10 shows the association between the stroke type and the presentation time.

Table 10: Association between type of stroke and time of presentation

		On time (n)	(%)	Late (n)	(%)
Type	Ischemic	18	60	11	55
	Haemorrhagic	12	40	9	45

Discussion

The median time interval from symptom onset to presentation: The study provides insights into when patients arrive at the first hospital after symptom onset or recognition. The majority, 30 (60%) patients, presented to the hospital on time. In contrast, 20 (40%) patients arrived late. In terms of distance, the majority of patients, 36 (72%) patients, traveled less than 15 kilometers from the site of the stroke occurrence to the first hospital. The study found that the median time interval from symptom onset to hospital presentation is approximately 4.25 hours. The study found an even lesser median time than the observations of a prospective, cross-sectional study conducted in Morocco that explored prehospital delays and their associated factors. This Moroccan study reported a longer median time of 6 hours between symptom onset and hospital arrival[17]. The slight variation in these median times could be attributed to many factors, including differences in healthcare systems, awareness levels, geographical accessibility, and cultural perceptions. However, together, these findings emphasize the importance of prompt medical intervention for stroke patients.

Knowledge of stroke patients concerning stroke symptoms and risk factors: In the study, the majority of the patients (66%) had poor knowledge of stroke risk factors, with a few (26%) with fair knowledge and only four with good knowledge. Stress and hypertension were identified as the most common risk factors, as indicated by 40% and 34% of the patients, respectively. The study concurs with other studies, such as a study in Iran, where hypertension and stress were the most frequently identified risk factors (recognized by 83.7% and 75.8%, respectively. In addition, the majority of the patients (62%) had poor knowledge of stroke warning signs and symptoms, with a few (20%) with fair knowledge and only nine with good knowledge. The findings contrast with the study in Iran, where the knowledge of warning signs was moderately good, as identified by 65% of the patients[22]. Almost all the patients (96%) did not know medications / treatment to reduce the extent and effects of stroke, and only two (4%) knew medications/treatment to reduce the extent and impact of stroke. The two indicted hypertension medications. None of the patients knew the period to administer the main treatment drug for stroke after stroke onset.

Factors associated with delays in presentation of acute stroke patients: Certain social demographic factors, such as age, education, and marital status, are associated with the timing of patient presentations to the hospital. These associations are statistically significant for most age groups, education levels, and married and single marital statuses. The findings further support the establishment by Ashraf *et al*[9] that higher educational status tends to have shorter prehospital delays. The study found that older patients were more likely to arrive on time than young patients. Similar findings were observed by Jin *et al*[10] in China, where elderly patients were more likely to arrive early than younger patients.

These associations were statistically insignificant for separated patients and widowed patients. The association between gender and time of presentation was not significant. In the same vein, the Genentech Stroke Presentation Survey[23] and a study by Kothari *et al*[24] on delays to presentation found no association between gender and prehospital delay. In the current study, patients living with relatives were more likely to present to the hospital on time than patients living alone, and the association between the living arrangement and presentation time was statistically significant. However, in contrast, a similar study in India found no association between patients' living arrangements and the arrival of stroke patients[9]. The current study found that patients with better knowledge of warning symptoms were likelier to present to the hospital on time. At the same time, there was no significant association between knowledge of stroke risk factors and timely presentation. This may be attributed to the findings that most patients needed a greater understanding of the stroke risk factors. The associations between knowledge of warning symptoms and presentation time were statistically significant, indicating that patients with better knowledge were more likely to seek medical attention promptly. The findings corroborate the sentiments by Philip-Ephraim *et al*[20] that lack of knowledge about stroke early symptom warning is one of the factors that causes the delay in taking the patient to the hospital.

Study limitations

Participants may have provided responses that they perceived as socially desirable rather than accurately reflecting their knowledge or actions. This bias may affect the accuracy of self-reported

information. A single hospital's (KNH) findings may need to be more generalizable to other settings or populations. The characteristics of patients and healthcare systems can vary, impacting the study's external validity.

Conclusion

In conclusion, the median time interval from symptom onset to hospital presentation was approximately 4.25 hours. This shows a majority of patients with acute stroke reach the hospital in time to be considered for treatment with thrombolysis for those with ischemic stroke. The study also highlights a concerning gap in knowledge regarding stroke risk factors and warning signs. Punctuality tends to vary across demographic factors. Notably, age and living arrangements have some influence, with older individuals and those living with relatives demonstrating better punctuality. Education and gender also show some variations, with individuals with lower education levels and females exhibiting slightly lower punctuality. Marital status does not display a clear pattern, but married individuals tend to have a higher punctuality rate. Patients with a better knowledge of warning symptoms and risk factors were more inclined to seek medical attention promptly.

There is a need for extensive educational campaigns to improve public awareness and understanding of stroke-related information, collaboration with emergency medical services to promote their utilization, particularly among patients who arrive by private vehicle or taxi, and also the need to address geographical barriers that impact timely hospital presentation, especially for patients living farther away from medical facilities. Healthcare professionals, including primary care providers and emergency department staff, should be trained to recognize stroke symptoms and initiate appropriate care promptly. Standardized protocols for assessing stroke patients should be prompted, and initiating time-sensitive interventions. There is a need to tailor interventions for groups with suboptimal timely presentation, such as men, separated individuals, and widowed patients, to address their unique challenges or barriers.

Conflicts of interest

The authors declare no conflict of interest.

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