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Assessment Of Healthcare Performance: Knowledge, Attitude, Behavioral Characteristics of Patients and Spatial Distribution of PHC's In Sepahijala District, Tripura, India

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Abstract- ***Healthcare utilization is a critical determinant of population health, reflecting both accessibility and equity in healthcare systems. This study explores healthcare utilization patterns and socio-economic factors influencing knowledge, attitude, and behavioural access to healthcare in Sepahijala District, Tripura, a predominantly rural area. The district of Sepahijala is located in the southwest extreme in the state of Tripura, India. The study involved both primary and secondary data collection. A total of 300 respondents have been contacted by questionnaire survey method based on the stratified random sampling method in all 7 blocks of the district. The techniques used are nearest neighbor analysis to find out the spatial distribution of PHC. This polygon method shows the PHC service area for the spatial distance of the study area.The findings highlight significant healthcare access disparities based on age, gender, income, and education levels. While most respondents expressed satisfaction with services provided by primary health centres (PHCs), persistent challenges such as inadequate medication availability, long waiting times, and poor transportation infrastructure were reported. Health access and utilization factors, socioeconomic factors, patient perception, and the surrounding environment are the primary determinants for health care in the Sepahijal district, Tripura.***

Index Terms- ***PHC-Patients Characteristic - Nearest Neighbor Analysis - Thiessen polygon- Automatic Linear Modeling.***

I. INTRODUCTION

Access to healthcare services is extremely limited in many rural areas and backward sections of the country. There is a major urban-rural divide in terms of the availability of healthcare skewed towards metropolitan areas [1, 2, 3, 4]. Access is vital, but people's perceptions of what the facility offers regarding medical care and whether it is worthwhile to use it are also important in determining their motivation to use healthcare facilities [5,6,7,8].Effective PHC can only be administered if health facilities are well-equipped, adequately staffed, and have the necessary infrastructure, critical medicines, and commodities [9,10,11]. Measuringthe quality of the PHC system from patients' perspectives has been acknowledged as a critical step toward determining areas for improvement and evaluating the impact of change [12, 13]. Patient happiness has long been seen as a significant factor in assessing health outcomes and quality of care [14, 15, 16, 17]. The growing importance of consumerism in society emphasizes the critical role patient attitudes play in health planning and delivery[18,19,20,21]. Extended waiting time, the impression that medical staff lack understanding, poor interaction, and inadequate amenities are just a few of the things that might negatively affect patients' happiness and rural qualities [22,23].An attempt was made to investigate the existing healthcare delivery [24,25,26].The rural background of the district of Sepahijala, the causes of its system,lines how efficient it is in providing health services, as well as the level of patient satisfaction [27,28,29].In this context, the present study provides a research contribution related to the healthcare delivery system. As a result, the current study must leverage its importance at the local level to investigate the spatial distribution of health facilities and assess the interrelationship

between disease prevalence rates and socioeconomic, environmental, and cultural aspects.

The study is an attempt to analyze the healthcare delivery system and the perception of patients with the satisfaction level in the primary health centre in Sipahijala district, Tripura. Assessing the views of patients and satisfaction levels in primary healthcare settings is critical for developing a healthcare system that truly satisfies the needs of the local population [30,32,32,33] .When patients feel listened to, valued, and appreciated, they are far more inclined to participate actively in their health treatment, resulting in better health results [34,35,36]. This study intends to highlight patient voices, provide insights into how they were treated, and discover opportunities for improvement in healthcare [37,38,39] .Geographers used the nearest neighbour analysis to analyze the spatial distribution of something over any region of space [40,41] .Nearest neighbour technique to understand the spatial distributional patterns of public healthcare centres [42,43,44]. Research conducted earlier has demonstrated that the health of individuals is influenced by environmental and socioeconomic factors, traffic patterns, or family circumstances to determine the level at which each micro-level health centre provides services effectively and efficiently [45, 46, 47, 48].

This study was conducted with the main objective of analysing the spatial distribution of the PHC and its location pattern. To analyze PHC accessibility and its efficiency. To analyze the patient perception and satisfaction level of people who avail themselves of these health care systems.

II.STUDY AREA

The district of Sepahijala is located in the southwest extreme in the state of Tripura, India. The district occupies an area of 1043.04 sq·km with a population of 542,731, and it lies between 25°07" & 25°41"N latitude and 91°21" & 92°09" E longitude (Fig.1). Approximately 12% of the district is covered by minor steep ranges of the Baramura, while the remaining 88% is mostly plain, bordering Bangladesh on the west and south. According to the Health Statistics in Tripura 2019-2020, Sepahijala has 15 PHCs and 147 sub-centres.

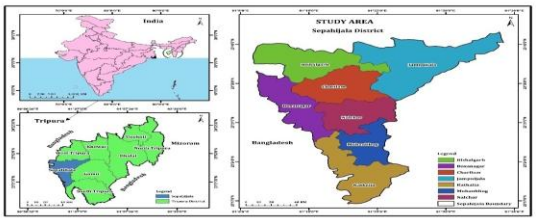

Fig 1 Location of Study area

III.METHODOLOGY

A. Research Design

The information has been gathered from primary and secondary sources to meet the specified goals. The data on the PHC location, patients' environment, socioeconomic characteristics, etc. were analyzed using appropriate statistical techniques such as multivariate analysis, known as Factor analysis

B. Source of Information

The primary data is collected by administering a questionnaire to the patients at all selected PHC centres in 7 blocks of Sipahijiala district. The information collected through the questionnaire includes 42 variables are derived and included variables are derived and variables are age, gender, education level, family size, occupation, income level, health care, and socioeconomic status etc..The demographic and social variables for the Sipahijala district were obtained from the Statistical Handbook of Tripura. The study's health statistical data and various other related healthcare information were collected from the district medical office in the study area.

C. Techniques Used

The primary survey was based on the method of stratified random sampling, and a total of 300 samples were collected. A Z-score is a statistical measurement of a score's relationship to the mean of a group of scores. A Z-score of 0 means the score is the same as the mean. A Z-score is positive or negative, indicating whether it is above or below the mean and by how many standard deviations. The help of the Z score matrix, which is derived by using the SPSS statistical packages.

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The following formula is
Z score = $(x - \bar{x})/\sigma$

Where,
- x = Standardized random variable
- $\bar{x}$ = Mean
- σ = Standard deviation.

Nearest-neighbour analysis was used to analyze and understand the distribution pattern of the PHC's. Nearest neighbour analysis: we will input the formula,
Rn = 2Ď √ (N/A)
Rn is the nearest neighbour index.
D = the average distance between each point and its nearest neighbour
n = the number of points under study
A = the size of the area under study
Thiessen polygon method shows the PHC service area for the spatial distance of each PHC.

IV. RESULT

D. Distribution Pattern of PHC

The impact of geographic distance has a distinct influence on the socio-economic groups and the variation in the moment pattern, age structure, and choice of mode of transportation [49, 50,51] . It is relevant to note that the analysis of the geographic distance from the residence as one of the important determinants characterizing a particular type of utilization pattern and it influence on the PHC. The patients who live nearer the health centre are more likely to use the services efficiently, and if the centres are provided with an adequate number of health services and such infrastructure facility. (Fig 2) With the health manpower resources and good transportation, the PHC are bound to be used efficiently. The location efficiency of the Primary healthcare centres in the study thus helps towards a general understanding of the health facility locations through a series of examinations of utilization patterns of the respondents. The spatial distribution of PHC's in this district are located randomly. The Z score value of the analysis of the majority of the PHCs are randomly distributed against the cluster or dispersed.

Fig 2 Location of Primary Health Centre in Sepahijala District

E. Patients' Socioeconomic and Health Characteristics

The patients' socioeconomic backgrounds were examined to see why the utilization pattern varies. Through the administration of questions about age, sex, mother tongue, religion, educational background, marital status, family size, occupation, and income, a primary survey is used to gather information about the socioeconomic circumstances of the respondents [52, 53, 54] . A Z-score may be positive or negative; a positive score indicates the score is above the mean, and a negative score indicates it is below the mean of patients' performance. In the contents of the interpretation, the z-score value is given in the bracket. Standard deviation (or σ) is a measure of how dispersed the data is from the mean. A low or small standard deviation indicates data are clustered tightly around the mean, and a high or large standard deviation indicates data are more spread out. (Table 1) Of the 300 respondents taken for the study, 8% (-1.0) are living in huts, while 34.0% (0.02) are in mud houses and 58% are in concrete houses (0.98). There is strong evidence characterizing housing's relationship to health. Housing stability, quality, safety, and affordability all affect health outcomes, as do the physical and social characteristics of neighbourhoods.

People with more education are more likely to learn about health and health risks, improving their literacy and comprehension of what can be complex issues critical to their well-being . The educational status of respondents is (-0.39. 2% are illiterate (-0.06). 24% have primary education (-0.66). 36% have a high school education and (-0.78) 38% have others. The respondents said that the habit of smoking (-0.23) was 20%, alcohol (-1.00) 4%, betelnut chewing with tobacco (-0.14) 22%, and none of the habits (0.138) 54% services. Alcohol consumed in excess over several years can produce alcoholic cardiomyopathy,

in which alcohol acts as a toxin to weaken the heart muscle directly and hence may improve with abstention [55] . Cigarette smoking is also a strong risk factor for congestive heart failure in the general population [56].

The respondents also stated that they go to the hospital by bus (-.26) 20%, by two-wheeler (1.12) 46%, by cycle (-1.2) 2%, and by other means (0.37) 32.0%. Transportation impacts health through various pathways . It can benefit health by creating access to healthcare, providing mobility independence, and supporting physical activity, or it can harm health through exposure to injury, air pollution, and noise (56). The source of water from the hand pump is 28% (0.21), the water supply 40% (1.06), the well 6% (-0.134), and other sources 26% (0.07). Contaminated water and poor sanitation are linked to the transmission of diseases such as cholera, diarrhoea, dysentery, hepatitis A, typhoid, and polio. Absent, inadequate, or inappropriately managed water and sanitation services expose individuals to preventable health risks.

Table 1 Z score value in the socioeconomic and health care of the respondent

Category	Variable	%	Z Score	Min	Max	Mean	SD
	Hut	8	-1				
	Mud	34	0.02	8	58	33.33	25
House	Concrete	58	0.98				
	Illiterate	2	-1.39				
	Primary school	24	-0.06	2	8	25	16.53
	High school	36	0.66				
Education Status	Others	38	0.78				
	Smoking	20	-0.23				
	Alcohol	4	-1				
	Betel nut chewing with tobacco	22	-0.14	4	54	25	20.94
Habit of People	None	54	1.38				
	Bus	20	-0.26				
	Two-wheeler	46	1.12				
	Cycle	2	-1.2	2	46	25	18.65
Mode of Transport	Others	32	0.37				
	Hand Pump	28	0.21				
	Water Supply	40	1.06				
	well	6	-1.34	6	40	25	14.09
Sources of Water	Others	26	0.07				
	R.S <5000	30	0.02				
	5000-10000	24	0.21	20	26	23.33	3.05
	10000-15000	26	0.87				
Monthly Income	>15000	20	-1.09				
	< 100	46	0.74				
	100 – 300	40	0.39	14	46	33.33	17
Spent on Transportation	300-500	14	-1.13				
	Mints < 15	28	0.41				
	15 - 30	32	1.08	18	32	25	5.97
	30 - 45	24	-0.25				
Time Taken	> 45	18	-1.25				
	< 5	16	-0.42				
Distance in KM	10-May	46	1.4				

	15-Oct	22	-0.06	8	46	23	16.37
	>15	8	-0.91				
	Mints < 15	16	-0.42				
	15 - 30	56	1.48	10	56	25	20.94
	30-45	18	-0.33				
Waiting Time	>45	10	-0.71				
	Fever	24	0.21				
	Diabetes	8	-0.64				
	Hyper tension	2	-0.96	2	50	20	18.7
	Head Ache	16	-0.21				
Disease	Pain & Others	50	1.6				
	Very good	35	0.09				
	Good	50	0.94	15	50	33.33	17.55
Satisfaction Level	Bad	15	-1.04				

The money spent on travel expenses is Rs 500 from the house to the PHC centre. The respondents reveal that the maximum Rs less than 100 rupees is 46% (1.12) and the minimum spent 14% (-1.13) is Rs 300-500. An important consideration is that economic resources may also be affected by the stock of health . The time taken to reach the PHC is 15-30 minutes (32% or 1.08), and the minimum is more than 45 minutes (18% or -1.25). The distance between the house and PHC (5-10 km) is the maximum for respondents (46% or 1.40). Waiting time in the PHC: 56% (1.48) of respondents is 15-30 minutes; 10% (-0.71) are more than 45 minutes. The current study also displays the difference between the network-based transportation mode to the conditions of many areas in rural Sepahijala District, where people from a long distance to a shorter distance may walk in any other direction to reach primary healthcare centres without requiring the transport facilities demanded by the network model.

Ensuring that services are within a reasonable travelling distance is essential to promote health and reduce mortality , with studies showing an increase in infant mortality and age-standard rates of death with increasing geographical remoteness [57]. The patients in the study area have fever (-0.071) 10%, diabetes (-0.64) 8.0%, hypertension (-0.96) 0.2%, headache (-0.21) 16.0%, pain and other (1.60) 50%, they also revealed that the hospitals are delivering well (0.94) 50.0%, very good (0.09) 35%, and bad (-1.04) 15%.

V. DISCUSSION

The distribution of PHCs in the Sepahijala district is located mostly in the centre and north of the district, and very few are located in the southern parts of the district. 3 PHCs are located in the northern region, and 3 PHCs are located in the centre of the district; the other 2 PHCs are found in the southern region of the Sepahijala district (Fig. 3). The district of Jampuijala occupies a large area, and it consists mostly of a rural region and often faces challenges such as limited access to healthcare facilities and transportation issues.

The Nearest Neighbor Analysis examines how something is distributed or spread out over a certain area. It gives a numerical value that indicates how regularly spaced or clustered a set of points is. To determine whether the spatial frequency of something observed is comparable with other areas, researchers utilize nearest-neighbor analysis. So to analyze the distribution of PHCs using the nearest neighbor analysis, we will input the formula

$Rn = 2Ď \sqrt{(N/A)}$

Therefore,

$Rn=2\times10.02\times\sqrt{(8/1642.18)}$

$Rn=1.42$

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Table 2 Distance between Primary Health Centers

Sl. No	PHC NAME	NEAREST PHC	Distance in Km
1	Microsapara	Dhanpur	13.767
2	Dhanpur	Motinagar	11.926
3	Motinagar	Kamalnagar	4.647
4	Kamalnagar	Motinagar	4.647
5	Lalsingmura	Kamalnagar	9.682
6	Dayarampara	Lalsingmura	11.548
7	Jampuijala	Dayarampara	12.08
8	Madhupur	Lalsingmura	11.866
Average(d)=10.02038			

Table 2 is used to observe the randomness pattern of the nearest neighbour analysis. The pattern of the distribution can be either cluster, random, or uniform according to the randomness value we get. Since the randomness value of the PHCs is 1.42, it means that the PHCs are randomly distributed over the study area. Using nearest neighbour analysis, the study found that the PHC's in the Sepahijala district are randomly distributed, with a randomness index of 1.42. This random distribution suggests a planned approach to healthcare service delivery, ensuring that PHC's are evenly spread to cover the population effectively. Despite the uniformity, there are opportunities to enhance healthcare access further, especially in the southern parts of the district. The analysis highlights the importance of continuous assessment and strategic planning in healthcare infrastructure to address the evolving needs of the population and improve overall healthcare delivery.

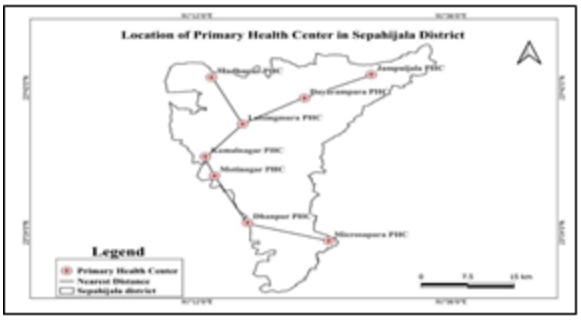

Fig 3. Spatial Distribution of PHC in Sepahijala District

F. Primary Health care Centres service areas – Thiessen Polygon

The analysis of the Thiessen polygon (Fig 4) reveals that the service areas appear to be larger in the northeastern part of the district. The location of Lalsingmura, Dayarampara, and Jampuijala PHC is not accessed by transport facilities, which tends to attract more patients as there is no health centre available in the immediate vicinity. Similarly, the extent of service areas is again larger in the southeastern and southwestern parts. It is significant to note that the concentration of more Primary Healthcare Centres is in the western part of the district compared to the eastern part of the region, particularly in the western part, like Motinagar, Kamalnagar PHCs, and Madhupur PHC, etc. It is also observed that the spatial gaps between these centres are efficient in terms of their health service distribution to the surrounding rural population at minimum distances.

Perhaps the most substantial limitation stems from the eastern border of terrain features, particularly in the mountain track. The edge effect occurs when the study area is defined by a border which does not prevent travel across the border. In the context of measuring accessibility and availability to health services, the impact of the edge problem can be decreased by increasing the size of the study area. The costs of geocoding calculating consumer travel times are also increased as the size of the study area increases. Some PHC's have a limited range of facilities and perform a smaller range of services. A few PHC's, usually larger, have highly specialized treatment facilities and personnel and can handle unusual and difficult cases.

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The various methods of regionalization of health service areas of PHC's bring out an important fact that medical services in an area must be evaluated about the actual population served. In addition, the knowledge of the pattern of consumer movement for medical care is an essential prerequisite to the delineation of medical service areas. It can also be emphasized that healthcare research must come forward to analyze the functional relationship in an attempt to regionalize the health service areas. The effect of distance on medical care utilization forms an important concern in rural areas. Distance and its effect confirmed the validity of the inverse care law in the vast majority of cases. According to this law, the availability of good care tends to vary inversely with the need for it in the population served. This is revealed in the present study in many of the cases of consumer travel patterns for a particular general health service as well as for special health care services.

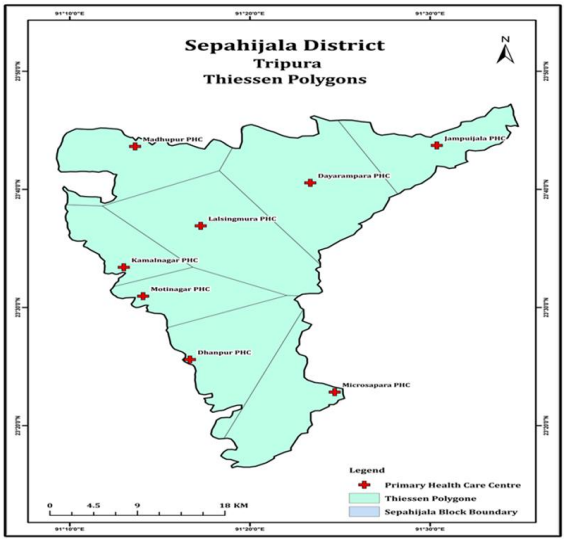

Fig 4 Location performance of PHC in the Sepahijala district

This highlights the fact that mobility decreases with an increase in age, thus proving the hypothesis that old age groups are more likely to use local facilities. The different utilization of special health care services of higher order can be accomplished by the differences in social status of respondents, differences in service availability and accessibility, age differences and also different service types. This point of view is confirmed in the present study while analyzing the consumer movement for special health care utilization. Jampuijala PHC, Dhanpur PHC, and Microsapara PHC indicate their inefficient locations in terms of their geographical inaccessibility. Similarly, Lalsingmurap HC, Kamalnagar PHC, and Motinagar PHC are found to be more efficient, and this is indicated by the utilization of residents and also by the size of the service areas.

G. Automatic linear modelling (ALM)

Automatic linear modelling (ALM) is preferred for analyzing data sets due to its simplicity in analyzing data and interpreting the results and its ability to present results visually and provide more detailed information, especially when studying large complex data sets. Patients' housing type, education status, habit, mode of transport, education, income, spending on time taken to PHC, wait time in disease, disease frequency, satisfaction level, and sub-variables are each converted to standardised data in the form of a Z-score revalue. e. (Table 1).

The respondents of the variable denoted as a dependent variable with related Z scores of each variable are independent variables. It will be beneficial to use automatic linear modelling, especially in analyzing massive and complex data sets, to investigate the relationship between one continuous dependent and more predictors and determine the factors that affect the response or target variable. At the same time, it will also be possible to evaluate the effect of each predictor with a more detailed response. The values given in the residuals model are identified (Fig. 5).

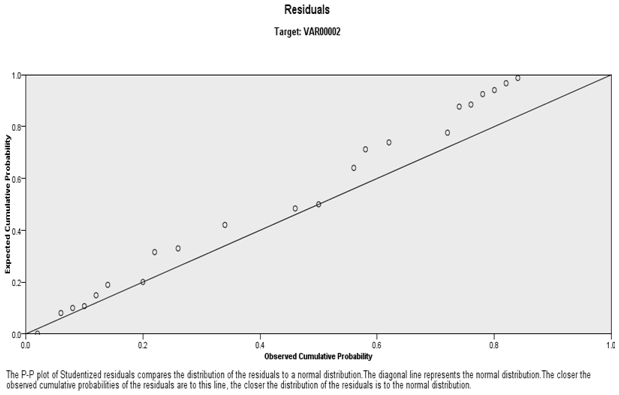

Fig 5 Residuals Model

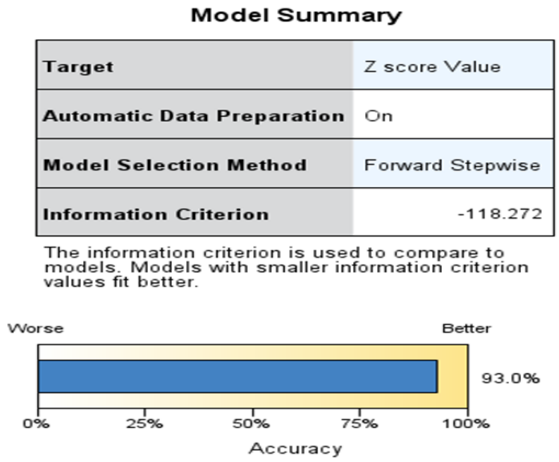

Fig 6. Automatic Linear Model display about Patients' Knowledge Behaviour, and attitude performance

Finally, of the ALM progress in that analysis, the accuracy of the model is 93.0% better performance of the patient's response (Fig. 6). However, the usage of ALM provides more detailed information, simplicity in analyzing data and interpreting the results, and patient performance in Sepahijala district, Tripura. ALM can be efficiently used to investigate the relationship between a patient's response and more predictors with different measurement scales.

VI. CONCLUSION

The placement and construction of housing settlements is the most basic way in which human-disease contact occurs. Social and behavioural resources and tools are therefore increasingly recognized as relevant to the management of communicable diseases in each PHC. Uneducated people and household water containers are the main determinants of infectious disease. According to ALM, there is a strong link in the overall knowledge, attitude, and behaviour of patients having an impact on health care and disease. In particular, improved awareness of hygiene and sanitation, particularly among women, may be important in reducing infectious diseases among children. The healthcare delivery systems are an unavoidable part of modern society. The health care of the people is mainly concerned with the differences in environment and way of life in various geographical areas. The patients who live nearest to the health centre are more likely to use the services efficiently.If the centres are provided with an adequate number of health services and infrastructure facilities as well as health manpower resources and good transportation. Those PHC's are bound to be used efficiently. This pattern ensures that densely populated and accessible regions receive adequate healthcare coverage. However, the distribution also reflects the district's diverse geography and demographics, accommodating rural populations that face transportation challenges. The placement of PHC's in larger subdivisions like Jampuijala and Kathalia, with adequate distances between them, aims to improve healthcare accessibility and reduce the travel burden for residents. It is stressed that future studies must, therefore, represent an integrated approach linking service areas to the measurement of locational efficiency and the hierarchical distribution of healthcare locations.

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Ethical Approval: Ethical approval is not required

Human or Animal rights: This article does not contain my studies with human participants or animals performed by any of the authors, since only the primary and Secondary data collected at various centre's are used in the study.

Consent to Publish Declaration: "Consent to Publish declaration not applicable "

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