

## Correlation of the Index of Activities of Daily Living (Index of ADOH) with the Functional Independence Measure (FIM) in Older Adults

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### Abstract

**Background:** Index of Activities of Daily Oral Hygiene is correlated with Barthel Index, showing high discriminant capacity for dependency in manipulating oral self-care aids. Due to the reciprocation of disease, there is a need to correlate the Index of Daily Oral Hygiene with the Functional Independence Measure, a measure that integrates dentistry with other medical indices and the purpose of this study.

**Methods:** For this cross-sectional study, a convenience sample of 73 nursing home residents, informed consents using the inclusion criterion of 65 years of age (VAWLA IRC, HS VA, PCC2001-121877) were obtained, and subjects were categorized into dentate and non-dentate groups. Attrition and post-hoc power calculations were reported. One assessor completed all assessments for the primary two assessment instruments, along with chart review for additional medical indices, and completion of resident oral self-care behavior questionnaire. Pearson *r* correlations (dentate group), confidence intervals using Fisher's Norma transformation ( $p=0.05$ ) and Spearman correlation (non-dentate), *r<sub>s</sub>* correlation statistic with confidence interval, and *t*-statistic ( $p.05$ ) were reported.

**Results:** Significant correlations for dentate subject ADOH dependency was associated with FIM when decrements or dependencies were found in upper body functions:  $r = -0.35$ , CI  $-0.63$  to  $0.00$  ( $p=0.05$ ) to  $r = -0.049$ , CI  $-0.73$  to  $-0.13$  ( $p=0.01$ ). For non-dentate subjects, ADOH dependency had a strong inverse relationship with ADL dependency:  $r_s = -0.75$ , CI  $-0.93$  to  $-0.73$  ( $p=0.008$ ) to  $r_s = -0.093$ , CI  $-0.98$  to  $-0.73$  ( $p=0.0001$ ). In non-dentate subjects, ADL was not associated with upper body strength and tasks involved in oral self-care behaviors for denture maintenance

**Conclusions:** In dentate individuals, ADOH dependency is associated with functional decrements and significantly correlated with FIM dependency. In non-dentate individuals, ADOH dependency was not associated with FIM/ADL dependency. Thus, denture wearers can be dependent in FIM/ADL upper body function yet independent in maintaining denture, oral self-care behaviors.

**Keywords:** Older people; Atypical presentation; Delirium; Acute abdomen; Cystitis

### Introduction

Previous studies have shown that optimum oral self-care is associated with reduced rates of caries, diseases of the periodontium, and deleterious oral conditions [1-4]. However older institutionalized adults either by their own behaviors, institutional neglect, or functional decrements demonstrate poor oral self-care practices [5,6]. For example, decrements in hand functions limit rehabilitation and have been shown to play a primary determinant in accomplishing oral hygiene goals [7]. The Index of the Activities of Oral Hygiene (ADOH) [8,9] was developed to measure, on an ordinal scale, patient ability to manipulate oral hygiene aids. In a previous study [10], the Barthel Index scores for high discriminant capacity to identify dependency in manipulating aids used in oral self-care were significantly correlated with that of Index of ADOH scores in a population of institutionalized older adults. This validation further showed that the benefit of the Index of ADOH over Barthel was that the levels of dependency

associated with each aid could be identified and related to their respective oral hygiene task.

Further, dependency in the ability to maintain oral health may result in periodontal inflammation and other oral diseases. Inflammation arising from the lack of optimum oral self-care has shown a reciprocation effect, an effect in which oral disease has an association with specific systematic diseases, and conversely [11,12]. Thus, there is a need to test the Index of ADOH against measures that incorporate medical indices. The Functional Independence Measure (FIM) is considered the gold standard for assessing basic activities of daily living, along with using motor and socio-cognitive scales. FIM instrument is an 18-item scale of which 13 items correspond to the Barthel Index and 5 to cognitive assessments. Thus, FIM may assist healthcare personnel by providing a common assessment instrument that is consistent over many, interrelated disciplines.

The purpose of this study is to find correlations between the Index of ADOH and Functional Independence Measure for dependency in manipulating the aids of oral self-care.

## Materials and Methods

In this cross-sectional study, a convenience sample of 73 study subjects were recruited for whom informed consents were obtained from either the patient, patient's guardian, or legal surrogate. The inclusion criterion was 65 years of age or older. The study was conducted at the Nursing Home Unit of the Veterans Administration Campus, West Los Angeles, California (VAWLA), a 150 bed facility with rehabilitative services and average length of stays: short term, rehabilitation, or palliative care, 3 to 6 months; and custodial care, 6 months to 12 years. The study administrator and attending dentist was then, Dr. Diane McLain, under Human Subjects Approval (VAWLA IRC, HS VA, PCC2001-121877). There was no study follow-up except for that provided by the attending dentist when treatment need was apparent.

### Use of Index of ADOH in comparison to FIM

In quantifying dependence, ADOH scores are inversely related to FIM scores. As ADOH scores increase to imply dependence, FIM scores increase to imply independence. To demonstrate ADOH dependency and FIM dependency, the scores would need to be inversely related. For oral self-care behaviors, daily routine behavior scores of oral self-care also increase implying independence, again an inverse relationship to ADOH scores.

### Assessor

One Assessor completed all assessments, accomplished data collection and input using Microsoft Excel®, Version 2007. Assessments included that of the Index of ADOH, FIM [13], Indices of Basic and Instrumental Activities of Daily Living and Tinetti Gait and Balance Assessment Tool [14], medical and mental Folstein Mini-Mental Examination [15], Yesavage Geriatric Depression Scale [16] indices, and questionnaire for oral self-care behaviors (Figure 1). All assessments, except ADOH and FIM, were completed by chart review. Due to medical procedures or patient vigor, assessments were not completed in any sequence. Patient attrition occurred due to transfer, discharge, or death, resulting in a dataset size of 68, 68 complete subject data points available for analysis.

### Analysis

The software package Analyze-it®, Version 2.12 [17] was used to perform the analyses. Analyze-it® is an add-on statistical package for Microsoft Excel®. Subjects were not randomized but separated into two datasets corresponding their dentate status: dentate individuals (n=43), and non-dentate, (n=25). For the dentate dataset (n>30 data points), Pearson r correlations, confidence intervals were calculated using Fisher's Norma transformation, and p-values (p=0.05) were reported. For the non-dentate dataset (n<30 data points), Spearman correlation, rs correlation statistic with confidence interval, and t-statistic (p=0.05) were reported. For both datasets, a significant p-value (p=0.05) implied that the ADOH total score was significantly correlated to the tested dependent variable. Post-hoc power analyses (clinically relevant difference between scores) and calculations (sample size) were completed (p=0.05) on both subsets.

## Results

Descriptive comparisons between subjects in the study sample included patient age, race, gender, education attained, income levels,

and present and previous dental insurance coverage (Table 1). Health status measures included medical and functional measures. On average, subjects had 6.6 medical diagnoses. Most subjects were partially sighted (76%), 80% eyeglass wearers. A slight majority had hearing deficits (51%). While all subjects of the dentate subset had teeth, 59% (n=29) wore a partial removable denture.

DATE: _____		EXAMINER: _____		
PATIENT LAST NAME: _____		FIRST NAME: _____		
CHART (ACCOUNT) NUMBER: _____				
THIS QUESTIONNAIRE WAS ANSWERED BY THE (CHECK THE CORRECT RESPONSE):				
PATIENT		SUPERVISING NURSE		
PLEASE CHECK THE APPROPRIATE COLUMN OR RESPONSE TO THE FOLLOWING QUESTIONS POSED TO THE SUBJECT OR THE SUPERVISING NURSE:				
1. Do you (or patient) have any of your real teeth?				
Yes _____	If Yes, skip to Questions #7-9			
No _____	If No, skip Questions #2-7			
2. Who cleans your teeth?				
No one _____	Self (Patient) _____			
Staff _____	Spouse _____			
Relative _____	Friend _____			
Other _____	Please specify _____			
DAILY _____	SOMETIMES _____	NEVER _____		
3. How often do you (or helper) floss your teeth?				
4. How often do you (or helper) brush your teeth?				
5. How often do you (or helper) apply fluoride gel to your teeth?				
6. How often do you (or helper) use oral rinses?				
7. Do you have a denture or partial?				
Yes _____				
No _____				
8. Who cleans your dentures?				
No one _____	Self (Patient) _____			
Staff _____	Spouse _____			
Relative _____	Friend _____			
Other _____	Please specify _____			
DAILY _____	SOMETIMES _____	NEVER _____		
9. How often do you (or helper) brush your dentures?				
10. Do you (or patient) soak your dentures at night?				
11. Do you (or patient) have a regular dentist?				
Yes _____				
No _____				
12. What were your visits for?				
Emergency care only _____				
Routine and scheduled care _____				
13. How often did you (or patient) receive dental care as a child?				
Yes _____				
No _____				
14. How often did you (or patient) receive instructions from the dentist on how to:				
Floss your teeth	Every 6 mos _____	Every 1-2 yrs _____	Greater than 2 yrs _____	Never _____
Brush your teeth	_____	_____	_____	_____
Apply topical gel fluoride	_____	_____	_____	_____
Use oral rinses	_____	_____	_____	_____

Figure 1: The Index of Activities of Daily Oral Hygiene: Questionnaire.

Functional measures included activities (ADLs) and instrumental activities of daily living (IADLs). On average, subjects demonstrated mean ADL score of 2.4 (CI 1.6 to 3.2) and IADL score of 0.9 (CI -0.5 to 2.2). For dentate subjects, mean ADL score was 2.3 (CI 1.4 to 3.2), and non-dentate, 2.6 (CI 0.9 to 4.3). Mean IADL score for dentate subjects was 1.3 (CI -0.08 to 3.5 and non-dentate 0.1 (CI 0.00 to 0.1).

The questionnaire results for both utilization and oral self-care behaviors are presented in Table 2. The utilization behaviors of dentate to non-dentate individuals differed greatly only in their visits to the dentist as a child at least every 3 years, dentate more than non-dentate. However, dentate subjects were more likely to have received professional instructions in flossing, tooth brushing, use of fluoride and oral rinses. Most non-dentate subjects never received these services. Most subjects either tooth brushed or denture brushed on a daily basis.

Characteristics	All subjects	Dentate subjects	Non-dentate subjects
Age	Mean 76.3 years	Mean 76.1 years	Mean 73.4
Gender	Male (93%)	Male (91%)	Male (96%)
Marital status	Single (25%)		
	Married (23%)		
	Divorced (30%)		
	Widowed (33%)		
Race	Caucasian (66%)		
	African American (27%)		
	Hispanic American (4%)		
	Asian/Pacific Islander (3%)		
Education attained	High school or more education (67%)	High school or more education (72%)	High school or more education (57%)
Income level	Greater than \$35,000 (55%)	Greater than \$35,000 (52%)	Greater than \$35,000 (60%)
Present dental insurance coverage	6%	9%	None
Past dental insurance coverage	62%	37%	40%

**Table 1:** Demographics.

Behavior	Utilization (%)	Oral Self-Care (%)
As child, visited DDS at least once a year	30	27
As child, visited DDS at least every 3 years	30	14
As adult, visited DDS at least once a year	45	45
As adult, visited DDS greater than one year	33	31
Visits for emergency only	21	18
Visits for routine or scheduled care	82	88
Provided professional instructions in flossing	48	76 (never)
Provided professional instructions in tooth brushing	37	62 (never)
Provided professional instructions in use of fluoride	89	100 (never)
Provided professional instructions in oral rinses	59	86 (never)
Dentate daily oral regimen included flossing	30 (daily)	
	22 (sometimes)	
	44 (never)	
Dentate daily oral regimen included tooth brushing	8100%	

Dentate daily oral regimen included oral rinses	33 (daily)	
	33 (sometimes)	
Dentate daily oral regimen included use of fluoride	81 (never)	
Non-dentate daily oral regimen included denture brushing		77 (daily)
Non-dentate daily oral regimen included soaking prosthesis		68 (daily)

**Table 2:** Questionnaire results.

**Dentate subset**

On average, dentate subject ADOH total scores were 2.2 (n=42; CI 1.0 to 3.5), a cumulative score implying independence in some tasks but needing assistive devices in other tasks. Significant moderate, inverse correlations between ADOH total score and dependent variable included FIM measures of function, receiving oral hygiene instructions, and daily oral hygiene regimens were found. Trends were also found with other measures of function and mental status (Table 3). ADOH dependency showed a significant moderate, inverse correlation with FIM functional measures: Feeding, grooming, dressing that required upper body movements, and transfer ability from bed to chair and to toilet and tub. The findings also demonstrated a significant moderate, inverse correlation for never having received oral rinsing instructions or including flossing or fluoride in oral hygiene regimens. However, a strong, positive correlation was found with subjects never including fluoride applications in their oral self-

care regimens. Trends in the data implied a positive correlation between ADOH dependency and dependency in function required for bathing and for dressing that required lower body movements. Findings also showed a trend correlating ADOH dependency and deficits in mental capacity.

**Non-dentate subset**

On average, non-dentate subject ADOH total scores (tasks including only denture brushing and use of oral rinses) were 0.9 (n=21; CI 0.1 to 1.7), a cumulative score indicating independence but with few subjects needing assistive devices. Significant strong, inverse correlations between ADOH total score and dependent variables included measures of neurological deficits, function, and daily oral hygiene regimens. Trends were also found in other measures of

function and aids to improve sight (Table 4). ADOH dependency showed a significant strong, inverse correlation with ADL functional dependency in eating, dressing toileting, and transferring from bed to chair. The findings also showed a strong, inverse correlation with FIM/ADL continence measure. To support these findings, the FIM/ADL total score demonstrated independence in function as ADOH total score demonstrated dependence. The findings also demonstrated a significant, moderate inverse correlation with ADOH dependency and never including soaking of the prosthesis as part of an oral hygiene routine. Trends in the data implied a possible correlation between ADOH dependency and sight. The findings implied ADOH dependency was related to subjects wearing glasses to improve their sight. Again, ADOH dependency had a strong inverse relationship with FIM/ADL measure of bathing.

Pearson Correlation between ADOH and FIM					
Measure	n	r statistic	Confidence interval	p-value	Interpretation
FIM/Feeding	31	-0.35	-0.63 to 0.00	0.05	Inverse medium (moderate) correlation
FIM/Grooming	29	-0.44	-0.07 to -0.00	0.02	Inverse medium (moderate) correlation
FIM/Dressing-Upper body	29	-0.43	-0.69 to -0.07	0.02	Inverse medium (moderate) correlation
FIM/Transfer bed/chair	27	-0.49	-0.73 to -0.13	0.01	Inverse medium (moderate) correlation
FIM/Transfer toilet	25	-0.44	-0.71 to -0.05	0.03	Inverse medium (moderate) correlation
FIM/Transfer tub	20	-0.49	-0.77 to -0.06	0.03	Inverse medium (moderate) correlation
OHI Rinse Never	26	-0.39	-0.68 to -0.00	0.05	Inverse medium (moderate) correlation
OH Floss Never	25	-0.45	-0.72 to -0.07	0.02	Inverse medium (moderate) correlation
OH Fluoride Daily	25	-0.46	-0.72 to -0.08	0.02	Inverse medium (moderate) correlation
OH Fluoride Never	24	0.46	0.07 to 0.73	0.02	Positive medium (moderate) correlation
Trends					
FIM/Bathing	2900 %	-33%	-0.62 to 0.04	.08	Near inverse medium (moderate) correlation
FIM/Dressing –Lower body	2900 %	-34%	-0.63 to 0.03	0.07	Near inverse medium (moderate) correlation
Folstein MM test	9	-0.63	-0.91 to 0.05	0.06	Near inverse large (strong) correlation

**Table 3:** Dentate Correlations.

Spearman Correlation between ADOH and FIM					
Measure	n	r statistic	Confidence interval	p-value	Interpretation
FIM/ADL / Eating	11	-0.79	-0.94 to 0.36	0.004	Inverse large (strong) correlation
FIM/ADL / Toileting	10	-0.93	-0.98 to -0.73	0.0001	Inverse large (strong) correlation
FIM/ADL / Dressing	10	-0.93	-0.98 to -0.73	0.0001	Inverse large (strong) correlation
FIM/ADL / Transferring	11	-0.75	-0.93 to -0.28	0.008	Inverse large (strong) correlation

<b>FIM/ADL / Continen</b>	10	-0.93	-0.98 to -0.73	0.0001	Inverse large (strong) correlation
<b>Total FIM/ADL Score</b>	10	-0.85	-0.96 to -0.48	0.002	Inverse large (strong) correlation
<b>OH Pros Soak Never</b>	22	-0.46	-0.74 to -0.05	0.03	Inverse medium (moderate) correlation
<b>Trends</b>					
<b>Eye / Glasses</b>	17	0.42	-0.07 to 0.75	0.09	Near positive medium (moderate) correlation
<b>Eye / No Glasses</b>	17	-0.42	-0.75 to 0.07	0.09	Near inverse medium (moderate) correlation
<b>FIM/ ADL / Bathing</b>	10	-0.61	-0.90 to 0.03	0.06	Near inverse large (strong) correlation

**Table 4:** Non-Dentate Correlations

### Post-hoc power calculations

The post-hoc power analysis for increments of scoring in both dentate and non-dentate assessments had a clinically relevant difference of 1 inferring that a major change in function was being demonstrated at every increment of rating scale ( $p=.05$ ): Dentate,  $H_o=2.2 \pm 3.9$  standard deviations; and non-dentate,  $H_o=0.9 \pm 1.7$  standard deviations. However, post-hoc power calculations for sample size for dentate (238 subjects) and non-dentate (45 subjects), demonstrated inadequate sample size for both subsets.

### Discussion

Significant correlations for dentate subjects demonstrated ADOH dependency was associated with FIM when decrements or dependencies were found in upper body functions. These included feeding, grooming, dressing, and transferring to bed, chair, toilet, or tub. These findings have meaning for occupational and physical rehabilitation and portends a relationship between dentist and therapist in improving function and quality of life, a major component of quality of life issues [18]. Trends in the data also lent support to these findings.

For non-dentate subjects, correlation results implied that ADOH independence was not associated with FIM/ADL dependency, a finding that was also repeated in trend results. Unlike FIM for dentate subjects, FIM/ADL for non-dentate subjects was not useful in associating upper body strength and tasks involved in oral self-care behaviors for denture maintenance. In other words, non-dentate individuals may be dependent in performing FIM/ADLs but maintain independence in oral self-care behaviors.

Subjects were characterized by higher levels of income and education. While not currently covered by dental insurance, 37% of dentate and 40% of non-dentate subjects had been covered, possibly as a benefit of employment. The majority (82% dentate, 88% non-dentate) reported accessing a dentist for routine and scheduled dental care, although child and adult histories indicated lower rates. This may also be explained by current residential status, residents of a nursing home with access to excellent dental services and access to an on-site regular source of dental care. Most reported high rates of not having been

instructed in oral health daily regimens, non-dentate more than dentate subjects.

Interestingly, a significant correlation, albeit moderate, between ADOH dependency and receiving oral rinse instructions was found among dentate subjects. This finding may be explained by oral rinsing, while being the least demanding ability in ADOH, was limited due to tasks involving opening containers and pouring liquid into a cup. Oral hygiene regimens mainly consisted of tooth (81% dentate) or denture (77%) brushing supporting previous findings [19]. About half of dentate subjects also included flossing (50%) and use of oral rinses (66%) into their oral self-care regimens. About a third included these behaviors in daily regimens. Even when ADOH dependency was demonstrated, significant correlations implied that OH regimens included optimum tasks, flossing and fluoride use, albeit not on a daily basis. Non-dentate subjects also reported high rates (68%) of soaking their prosthesis overnight, an optimum behavior. This behavior continued even when ADOH dependency was assessed as a significant correlation, albeit moderate, between ADOH dependency and prosthesis soaking overnight.

All subjects demonstrated independence in ADOH, non-dentate more so than dentate. This may be explained by the difference in tasks for each subject category. Dentate subjects were asked to perform flossing, the highest hierarchical task on the ADOH scale. In both subject categories, any decrement in independence was due to the need for assistive devices, the lowest dependency score on the ADOH scale.

Subjects were also characterized by being part of a younger cohort of older adults and exhibited independence in medical functional indices as well as the Index of ADOH. Yet, examination of the data indicated independence in young older cohorts translated to old older cohort older adults, with only two individuals (dentate) demonstrating complete dependence.

While the discrimination between scores in the ranking scale were proven to be different from one another, the limitation of this study was sample size. A previous study [10] of Spanish nursing home residents had a sample size of 390 subjects, an amount exceeding the calculated, needed sample size from the power analysis. In their study, the Index of ADOH was significantly related to the Barthel Index, measuring performance in variables describing FIM/ADLs and mobility.



While ADOH dependency was significantly correlated with many functional variables, increasing the sample size may demonstrate more significant correlations and lend to validating the Index as an accurate assessment tool in comparison to traditional measures. Trends in the data suggest near correlations. For example, dementia or loss of mental capacity in dentate subjects (Folstein MME) demonstrated near, strong correlation ( $p=0.06$ ) with ADOH dependency. This was followed by ADOH dependency having a moderate relationship ( $p=0.09$ ) with the need for glasses to increase vision function.

## Conclusions

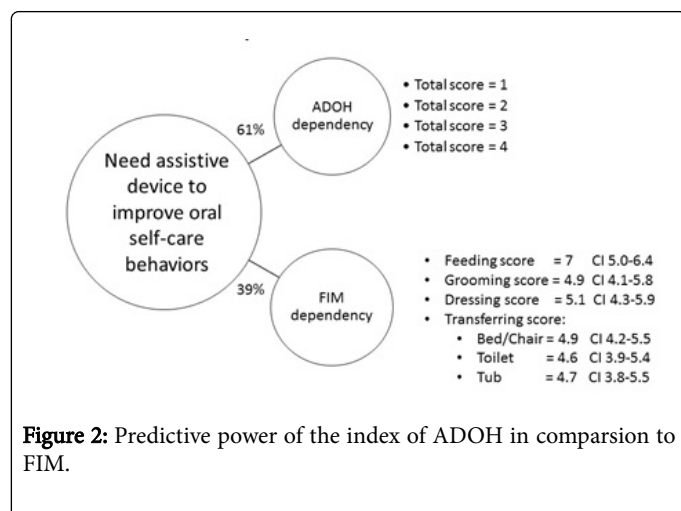
### Researcher's summary

In dentate individuals, ADOH dependency is associated with functional decrements and significantly correlated with FIM dependency, much of which related to upper body movements. FIM dependency tasks included feeding, grooming, dressing (upper body), and transferring to bed, chair, toilet, and tub. Logically, these types of neurological and muscular movements are required to increase the ability for older adults to manipulate the aids used in daily oral self-care.

In non-dentate individuals, ADOH dependency was not associated with FIM/ADL dependency. Thus, denture wearers can be dependent in FIM/ADL upper body function yet independent in maintaining denture, oral self-care behaviors (Figure 2).

### Clinician's summary – Clinical practice guideline

**Clinical question:** In older adults, what is the probability that Index of ADOH in comparison to FIM will predict dependency in the need for an assistive device to improve oral self-care behaviors? Also, what Index of ADOH Total Score and FIM individual categorical score will trigger a need for an assistive device given what the comparison of probability of effectiveness of these two assessment instrument's?



**Figure 2:** Predictive power of the index of ADOH in comparison to FIM.

**Pipo format:** P (Population) = Older adults 65 years of age and older

I (Intervention; condition studied) = Index of ADOH

C (Comparison) = FIM

O (Outcome) = Total dependency score (Index of ADOH); Individual categorical score (FIM)

**Date of CPG:** January, 2016

**Function category:** Institutionalized older adults; Function level near independence

**Significance:**

**Statistical:** Established

**Clinical:** Limited – Sample size; Local population (One nursing home)

**Meaning in practice:** Limited to institutionalized older adults

**Utility:** Decision data only

**Cost:** For local application

**Patient risk level:** Application – High, Equipoise, Low

**Clinical practice guideline – Decision data only**

**Decision analysis:** When assessing for functional dependency in either the dental office or nursing home facility dentate patients, the average probability that the Index of ADOH, given patient total scores ranging from 1 to 4, will predict dependency in the need for an assistive device to improve oral self-care behaviors is, on average, 61%; for FIM dependency, the probability is, on average, 39%, given the total score of in each shown in the FIM node. In other words, when using ADOH total score, a score ranging from 1 to 4 will trigger the need for an assistive oral device 61% of the time on average. When using FIM scores, scores that trigger a need for assistive oral devices 39% of the time on average are:

Feeding=5

Grooming=4.5

Dressing (Upper body) =4.6

Transferring:

Bed/chair = 4.2

Toilet = 3.8

Tub = 3.4

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