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ASTHMA IN THE ELDERLY

Asthma characteristics among older adults: using the California health interview survey to examine asthma incidence, morbidity and ethnic differences

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Abstract

Objective: The purpose of this study was to examine the incidence, characteristics of asthma morbidity and care, and ethnic differences that exist in older adults with asthma in California. **Methods:** Data were from the 2009 California Health Interview Survey (CHIS). Characteristics of older adults (≥ 65 years) with and without asthma were compared using population-weighted estimates. Asthma-specific variables were compared among different ethnic groups. Multivariate analyses were performed to determine factors associated with asthma status, asthma episodes/attacks, asthma symptom frequency and emergency department (ED) visits due to asthma. **Results:** Asthma was present in 8.1% of older adults, among which, 67.3% reported taking medication daily for asthma. Asthma symptoms were experienced every day by almost 20%, with over 34% of seniors with asthma having symptoms at least once per week. Despite having a lower frequency of asthma symptoms, Hispanics were 5.31 times more likely to visit the ED due to asthma than were Caucasians. **Conclusions:** The findings from the study showed that older adults with asthma had difficulty with asthma control. We recommend a focus on asthma education so that when symptoms do occur, options are available to avoid costly ED visits. Further research should focus on specific asthma management skills and adherence to asthma treatment regimen among ethnic groups.

Keywords

Asthma, asthma control, asthma symptoms, ethnic differences, healthcare utilization, older adults, self-rated health status

HistoryReceived 29 August 2013
Revised 16 December 2013
Accepted 29 December 2013
Published online 27 January 2014**Introduction**

Asthma is a serious health issue in older adults and mortality from asthma remains high due to underdiagnoses and undertreatment [1]. Older adults with asthma have unique obstacles in managing asthma. They may not be able to comprehend and follow instructions for care and are not always able to make changes in their environment to remove asthma triggers [2]. Older adults also have difficulty with symptom perception until the symptoms become very severe [3]. In addition, they often have multiple co-morbidities, which make symptom perception, health service utilization and medication administration challenging [2].

Older adult patients are often not diagnosed with asthma because of the difficulty in differentiating asthma from other diseases [4]. It is now recognized that many over the age of 65 years are dealing with asthma symptoms, with this age group accounting for the highest asthma mortality among adults [3]. Estimates of the prevalence of asthma in those over 65 years of age have been reported as 7% [5], but that may be an underestimate given that many older adults are undiagnosed, and the confusion in symptoms between asthma and other

diseases. Other groups with high rates of asthma and asthma morbidity include minorities and those with low incomes [6]. Therefore, older adults with asthma, especially those with lower incomes who belong to a minority group, should be a focus for detailed study.

California is home to a very diverse population, with the largest minority group being Hispanics of Mexican descent [7]. Although the incidence of asthma in Hispanics of Mexican descent is lower than other ethnic groups, asthma burden may be higher because of environmental triggers, health literacy issues and lack of insurance [8]. Given that the incidence of asthma and that the numbers of older adults are increasing, it is imperative to examine and address disparities in asthma care within this population. The purpose of this article is to report on the incidence of asthma among older adults in California, examine the characteristics of asthma morbidity and care, and to describe the ethnic differences that exist in older adults with asthma.

Methods**Data source**

Data for this analysis were drawn from the adult portion (aged ≥ 18 years) of the 2009 California Health Interview Survey [9]. The CHIS is the largest state health survey in USA,

which has been conducted every other year since 2001. The survey is collected and managed by the University of California, Los Angeles Center for Health Policy Research in collaboration with the California Department of Public Health and the Department of Health Care Services. The survey provides extensive information on the Californian's health status and health care needs [10]. The CHIS participants are California residents selected by random-digit dial telephone survey. They are asked a variety of questions on health topics including asthma-related questions. The CHIS is conducted in different languages including English, Spanish, Chinese (Mandarin and Cantonese), Korean and Vietnamese. Detailed information about the sampling methods and design is available on the CHIS website [10]. The University Institutional Review Board requirements were waived given that CHIS data are publically available and de-identified.

Sample

Of the 47 614 adult participants in the CHIS data set, the present analyses focused on the 15 565 older adult aged 65 years and older, representing a population of 4 070 453 older adults in California.

Definitions of variables

Demographic variables

Dichotomous variables were created for immigrant status (naturalized citizen or non-citizen, versus US-born citizen), high school education or above versus less than a high school education, and English proficiency (native English speaker or speak English well or very well, versus speaking English not well or not at all). Smoking categories were created by combining data from variables assessing "current smoker" and "ever smoked 100 cigarettes or more in lifetime". Those who had smoked >100 cigarettes in their lifetime but were not a current smoker were classified as previous smokers. Those who were not current smokers or previous smokers were classified as "never a smoker". When presenting income levels among demographic variables, four categories of income are presented based on % of the Federal Poverty Level (FPL). To increase parsimony among regression analyses, an income of 200% of the Federal Poverty Level (FPL) was chosen as a dichotomous cut-point for poverty (0–199% of FPL versus 200% + FPL) due to previous literature suggesting that this cut-point was a more appropriate indicator of poverty among those living in California [11]. Due to the small number of Pacific Islander and American Indian/Alaskan Native participants, ethnicity was collapsed into five groups: "Hispanic" (80% Mexican, 6% Salvadoran, 14% other Hispanic), "Asian", "African-American", "Caucasian" or "Other/multiple ethnicities". Self-reported health was measured by a single item question with lower scores indicating better health (1 = Excellent to 5 = poor). Living alone was determined by examining reported household size, with households of size 1 considered as living alone.

Asthma-specific variables

Current asthma status was determined by the 2009 CHIS data, taking into account previous diagnoses, the respondent's

belief that he or she still had asthma, and recent asthma symptoms or episodes. Among those with asthma, respondents were asked if they experienced an asthma episode or attack in the previous year, took daily medication for asthma, or visited the emergency department (ED) due to asthma in the past year. Additionally, respondents were asked about the frequency of asthma symptoms. Asthma symptom frequency ranged from 1 ("Not at all") to 5 ("Every day").

Statistical analyses

All analyses were conducted using Stata 11.2 (Stata Corporation, College Station, TX) and utilized sample weighting to account for the complex sample design present in the CHIS data. The sample weights used for statistical analyses in this study were provided with the data by CHIS. To compare characteristics of older adults with or without asthma, means and proportions were calculated with group differences tested using Wald adjusted or Pearson design-based tests of association where appropriate. Similar analytic techniques were used to describe asthma-specific treatment, symptoms and resource utilization among older adults by ethnicity. To assess the association between key variables and asthma-specific variables (asthma status, asthma symptom frequency and resource utilization) adjusted for the effects of other key variables, linear or logistic multivariate regressions were used where appropriate. Independent variables were selected based on previous literature and theoretical importance. Categorical variables were dummy-coded for use in multivariate regressions. Significance tests were two-tailed, with $\alpha = 0.05$.

Results

Older adults with versus without asthma: sample description

The descriptive statistics of older adults with and without asthma are presented in Table 1. Asthma was present among 1323 participants, representing 8.1% of older adults in California, or, over 328 000 Californians. To avoid identification, CHIS data censor ages 85 years [9], therefore, whereas the age of participants used in analyses could be 65 years or older, observations of age in the data set ranged from 65 to 85 years old. For example, if a participant was 91 years old, he or she would appear in the data set as 85 years old. Almost all older adults had insurance (98.9%), with 94% being insured by Medicare (with asthma: 96.8%, without asthma: 94.0%, $p = 0.003$). Relative to older adults without asthma, older adults with asthma were more likely to be female, poor, insured with Medicaid, have previously been a smoker, had lower levels of self-reported health, and were less likely to be an immigrant to the US older adults with asthma, compared with other older adults, were also more likely to have been diagnosed with heart disease (26.9% versus 18.9%, respectively, $p < 0.001$) and high blood pressure (65.4% versus 59.1%, respectively, $p = 0.010$), and less likely to be married (54.4% versus 60.1%, respectively, $p = 0.015$). Groups did not differ with regard to rates of diabetes (21.9% versus 19.4%, respectively, $p = 0.223$) or living alone (27.3% versus 24.5%, respectively, $p = 0.112$).

Table 1. 2009 CHIS demographic characteristics among seniors (aged ≥ 65 years).

Demographics	All seniors	With asthma (8.1%)	Without asthma (91.9%)
Age in years, mean (SE)	74.38 (0.06)	74.44 (0.26)	74.38 (0.06)
Female, %	56.0	67.2	55.0***
Ethnicity, %			
African-American	6.3	8.4	6.2
Asian	11.8	8.2	12.2
Caucasian	63.1	65.6	62.8
Hispanic	11.7	10.9	11.8
Other/multiple ethnicity	7.1	6.9	7.1
High school education or above, %	81.8	79.1	82.0
Family income, as % of FPL, %			
<100% FPL	11.4	15.4	11.1*
100–199% FPL	21.9	22.7	21.9
200–299% FPL	15.2	16.6	15.0
$\geq 300\%$ FPL	51.5	45.4	52.1
Immigrant to USA ^a , %	25.0	16.1	25.7***
Married, %	59.6	54.4	60.1*
Living alone, %	24.7	27.3	24.5
English proficient ^b , %	87.5	91.0	87.2
Insured by Medicaid	19.9	24.0	19.5*
Self-reported health, %			
Excellent	14.0	0.8	14.5***
Very good	28.5	20.0	29.2
Good	30.0	30.6	29.9
Fair	19.5	24.8	19.0
Poor	8.1	16.5	7.4
Smoking status, %			
Never a smoker	49.5	41.4	50.3**
Current smoker	7.5	7.2	7.5
Past smoker	43.0	51.4	42.2
Comorbidities, %			
Heart disease	19.5	26.9	18.9***
High blood pressure	59.6	65.4	59.1**
Diabetes	19.6	21.9	19.4

CHIS, California Health Interview Survey; FPL, Federal Poverty Level. Values and SEs adjusted by population weights. *p* Values represent Wald adjusted or Pearson design-based tests of association between asthma status and key variables.

^aImmigrants comprised of naturalized citizens and non-citizens.

^bEnglish proficiency is comprised of English-only speakers and those who speak English very well or well versus those who speak English not well or not at all.

**p* < 0.05.

***p* < 0.01.

****p* < 0.001.

California older adults with asthma: ethnicity, demographics and asthma-specific variables

Proportions of variables of interest by ethnic group among older adults with asthma are presented in Table 2. The majority of Asian and Hispanic older adults with asthma never smoked, whereas the majority of African-American and Caucasian older adults were previous smokers. More than half of Hispanic, Asian and other/mixed ethnicity, and 48.8% of African-American older adults had incomes <200% of the FPL. The relationship between ethnicity and being insured by Medicaid fluctuated in line with income levels, with the highest rates of Medicaid insurance among Hispanic, Asian and African-American ethnicities. Relative to other ethnicities, Hispanic and Asian older adults were more likely to be immigrants to USA and less likely to be proficient in English. Self-reported health varied by ethnicity, with multivariate

regression using dummy-coded ethnicity groups to predict self-reported general health indicating that Caucasians had higher self-reported health than African-Americans ($b = -0.60$, $p < 0.001$), Hispanics ($b = -0.74$, $p = 0.001$) and other/mixed ethnicity ($b = -0.60$, $p = 0.010$). More than two-thirds of all older adults with asthma took daily medication for their asthma, with >40% of older adults having an asthma attack or episode in the past year. Asthma symptoms were experienced *every day* by almost 20%, with over 34% of older adults with asthma having symptoms *at least once per week*. Past-year ED visits due to asthma differed by ethnicity. More than 30% of Hispanic older adults with asthma visited the ED due to asthma, compared to only 7.1% of Caucasians. Among older adults within California, this represented $\sim 11\,000$ Hispanics and 15 000 Caucasians visiting an ED due to asthma over a 1-year period.

Multiple regression models estimating asthma-specific variables

Results of linear and logistic regressions estimating asthma status, past-year asthma attack/episode, asthma symptom frequency and past-year ED visit due to asthma, are presented in Table 3. The first column of coefficients reports output from a multivariate logistic regression examining current asthma status as the outcome. Holding other variables constant, the odds of currently having asthma were 44% lower for men relative to women, and 48% lower for immigrants compared to those born in USA. Additionally, the odds of having asthma decreased with higher levels of self-reported health. Whereas there was no difference in asthma among current smokers and those who were never smokers, previous smokers were 49% more likely to have asthma than those who were never smokers. The second column of coefficients reports output from a multivariate logistic regression examining the occurrence of an asthma episode or attack within the past year among those with asthma. Adjusted for other variables, an asthma episode or attack within the past year was less likely with higher levels of self-reported health and those insured with Medicaid relative to others. The third column of coefficients reports output from a multivariate linear regression examining the frequency of asthma symptoms. Holding other variables constant, asthma symptoms were more frequent among men than women, Caucasians than Hispanics or African-Americans, those insured by Medicaid than others, current smokers than those who were never smokers, and those who take daily medication for asthma than others. Asthma symptom frequency decreased with higher levels of self-reported health. There was no difference in asthma symptom frequency between those who were never smokers and previous smokers. The fourth column of coefficients reports output from a multivariate logistic regression examining past-year ED visits due to asthma. Adjusted for other variables, past-year ED visits were more likely among Hispanics than Caucasians, those taking daily medication for asthma than those who did not, and those who experienced an asthma attack or episode within the past year. The odds of visiting an ED due to asthma decreased with higher levels of self-reported health. Relative to those who were never smokers, current smokers were 70%

Table 2. 2009 CHIS key variables by ethnicity among seniors with asthma (aged ≥65 years), %.

	Overall	African-American	Asian	Caucasian	Hispanic	Other/Mix
Taking daily medication for asthma	67.3	64.4	62.9	66.6	71.2	76.0
Asthma episode/attack (past year)	43.8	42.8	42.6	41.3	47.5	63.8
Frequency of asthma symptoms						
Not at all	13.0	9.6	9.9	12.4	18.1	18.1
Less than every month	34.5	47.1	38.0	33.2	36.8	24.1
Every month	18.4	21.7	18.1	16.7	19.7	28.8
Every week	14.4	10.0	6.5	16.1	14.0	13.7
Every day	19.8	11.7	27.6	21.7	11.3	15.3
ED visit due to asthma (past year)	11.6	15.9	10.1	7.1	31.3	19.9***
Smoking status						
Never a smoker	41.4	35.7	58.9	36.5	65.8	34.9*
Current smoker	7.2	8.8	1.4	8.1	5.7	6.6
Past smoker	51.4	55.5	39.7	55.4	28.5	58.5
Family income, as % FPL						
<100% FPL	15.4	9.6	32.6	7.9	40.4	33.2***
100–199% FPL	22.7	39.2	18.3	17.1	36.0	40.0
200–299% FPL	16.6	14.0	10.8	20.6	8.9	0.3
≥300% FPL	45.4	37.2	38.2	54.4	14.7	16.5
Immigrant to USA ^a	16.1	1.4	87.7	4.1	47.0	15.0***
Comorbidities						
Heart disease	26.9	46.2	13.4	26.0	20.4	37.6*
High blood pressure	65.4	76.9	73.5	61.8	63.2	80.0
Diabetes	21.9	36.6	11.1	19.8	29.3	25.5
Married, %	54.4	37.3	55.5	57.4	50.1	51.8
Living alone, %	35.5	24.4	20.0	27.5	28.7	35.5
English proficiency ^b	91.0	100.0	60.3	100.0	52.1	91.7***
Insured by Medicaid	24.0	41.5	48.7	9.5	57.0	58.2***
Self-reported health ^c						
Excellent	8.1	3.8	6.6	10.0	2.2	6.8*
Very good	20.0	5.2	20.9	23.8	13.5	11.0
Good	30.6	35.5	23.8	33.2	23.5	18.8
Fair	24.8	35.7	30.8	20.6	27.9	40.0
Poor	16.5	19.8	17.8	12.5	33.0	23.3

CHIS, California Health Interview Survey; FPL, Federal Poverty Level. Percentages adjusted by population weights. *p* Values represent Pearson design-based tests of association between ethnicity and key variables. ED, Emergency Department.

^aImmigrants comprised of naturalized citizens and non-citizens.

^bEnglish proficiency is comprised of English-only speakers and those who speak English very well or well versus those who speak English not well or not at all.

^cResults from a multivariate regression using dummy-coded ethnicity groups indicated that Caucasians had higher self-reported health than African-Americans, Hispanics, and those with other/mixed ethnicity.

**p* < 0.05.

****p* < 0.001.

less likely to have visited the ED within the past year due to asthma.

Discussion

Our analysis estimate that 8.1% of older adults in California reported being told that they had asthma. Compared with other older adults, those with asthma were more likely to be female, poor, US citizens, insured by Medicaid and/or Medicare, have a history of smoking, and rate their health as fair or poor. These findings are similar to those characteristics cited elsewhere [12–14]. An interesting but not unexpected finding among older adults with asthma was the number of patients with comorbid heart disease and high blood pressure. The combination of asthma with other diseases such as cardiac disease may impact the patient's ability to distinguish symptoms and affects asthma management [2]. In fact, when interviewed in a qualitative study, older adults acknowledged that they sometimes take both cardiac medications and asthma medications when they experience symptoms of chest tightness, and shortness of

breath [2]. In our study, we found that almost half of the older adults sampled had an asthma attack at least within the past year with 20% reporting daily asthma symptoms. The frequency of symptoms is an indication of uncontrolled asthma, which may lead to ED visits, hospitalizations and in extreme cases, death [13]. Older adults have one of the highest mortality rate from asthma, accounting for approximately half the deaths from asthma each year [13,15]. According to the National Asthma Guidelines, uncontrolled asthma is defined as symptoms greater than twice weekly, limitations in daily activities and use of the ED for asthma attacks or exacerbations [14]. One of the guideline recommendations is for health providers to monitor asthma control at every visit and adjust medication to provide control of symptoms [16]. A quick response (or "rescue") medication has no influence on the underlying inflammation that is the hallmark of asthma. Asthma control medications are required in order to reduce the inflammatory response and if the attack symptoms are not eradicated with the use of bronchodilators, then the next step is an urgent care visit to provider or ED depending on the severity of symptoms. Given that older

Table 3. Multiple regressions estimating asthma-specific variables among California seniors (aged ≥ 65 years).

	Asthma status		Asthma episode/attack (past year) ^a		Frequency of asthma symptoms ^{a,b}		ED visit due to asthma (past year) ^a	
	OR	CI	OR	CI	<i>b</i>	CI	OR	CI
Male ^c	0.56	(0.43, 0.72)***	0.95	(0.68, 1.34)	0.28	(0.06, 0.51)*	1.34	(0.66, 2.71)
Ethnicity ^d								
African-American	0.89	(0.57, 1.37)	0.71	(0.36, 1.43)	-0.54	(-0.90, -0.19)**	1.99	(0.63, 6.26)
Asian	0.87	(0.52, 1.45)	0.49	(0.20, 1.22)	-0.11	(-0.68, 0.46)	1.18	(0.20, 6.97)
Hispanic	0.87	(0.64, 1.19)	0.56	(0.26, 1.21)	-0.63	(-1.02, -0.25)**	5.31	(1.60, 17.55)**
Other/Mixed	0.84	(0.55, 1.28)	1.47	(0.66, 3.26)	-0.49	(-1.07, 0.10)	1.80	(0.44, 7.30)
Immigrant to USA	0.52	(0.36, 0.73)***	1.38	(0.72, 2.64)	0.01	(-0.40, 0.43)	0.69	(0.20, 2.32)
Insured by Medicaid	1.32	(0.99, 1.76)	2.37	(1.38, 4.08)**	0.29	(0.02, 0.55)*	1.18	(0.52, 2.68)
Self-reported health ^e	0.68	(0.62, 0.75)***	0.80	(0.69, 0.94)**	-0.17	(-0.28, -0.06)**	0.64	(0.48, 0.86)**
Smoking status ^f								
Current smoker	1.09	(0.63, 1.87)	0.64	(0.30, 1.38)	0.82	(0.19, 1.44)*	0.30	(0.10, 0.85)*
Past smoker	1.49	(1.22, 1.84)***	0.73	(0.52, 1.03)	-0.07	(-0.26, 0.13)	0.85	(0.45, 1.59)
Taking daily asthma medication			1.10	(0.75, 1.64)	0.63	(0.42, 0.84)***	4.64	(1.87, 11.51)**
Asthma episode/attack (past year)					0.18	(-0.02, 0.39)	4.33	(2.29, 8.18)***
Frequency of asthma symptoms							1.00	(0.79, 1.27)

Values and SEs adjusted by population weights. ED, Emergency Department; OR, odds ratio; CI, 95% confidence interval of the estimate (lower limit, upper limit).

^aAmong seniors with asthma.

^bA linear multivariate regression was used due to the continuous nature of asthma symptom frequency.

^cRelative to females (male = 1).

^dCaucasian is the reference group.

^eHealth status ranged from 1 = poor to 5 = excellent.

^fRelative to those who were never a smoker.

* $p < 0.05$.

** $p < 0.01$.

*** $p < 0.001$.

adults report having difficulty perceiving symptoms [2], arrival in the ED may lead to hospitalization. Unfortunately in this study, we have no knowledge of the specific medications utilized to treat asthma (i.e. a daily anti-inflammatory and/or a rescue inhaler), but the majority of respondents indicated daily medication usage. Control medications to reduce underlying inflammation require daily use without regard to symptoms. Other studies have reported that for some, medication adherence is contingent on symptoms to prompt medication usage. Halm et al. [17] found that older adults were more likely to view asthma as an illness that is only present when symptoms were experienced. Sofianou et al. [18] confirmed that beliefs about asthma were a hindrance to consistent use of anti-inflammatory medications and thus asthma control. Hartert et al. [19] studied adults 65 years and older in Tennessee and reported that even among older adults with severe asthma, only 25% filled their prescriptions for maintenance medications. It is therefore not surprising that the asthma mortality rate is so high in the older adult. Tailored interventions aimed at this population are needed to increase medication compliance.

Similar to other studies, we also found that asthma-specific variables differed by ethnicity [20,21]. Asthma symptoms were more frequent in Caucasians than African-Americans or Hispanics, despite Caucasians having the highest self-rated health. It was also interesting that Hispanics were 5 times more likely to use the ED for asthma compared with Caucasians, but did not have more symptoms, use more medication or have more asthma attacks than Caucasians. Similarly, Boudreaux et al. [22] found that African-American and Hispanic adults with asthma were hospitalized more often and had a greater number of ED visits than Caucasians.

While others have commented on the more frequent use of the ED by minority groups [6,21], few have found that the use of the ED was accompanied by a report of fewer symptoms in general. Self-report of the low frequency of asthma symptoms is counterintuitive [23,24], but may be explained in part by the previously mentioned belief that asthma is only present when there is an exacerbation [17]. Hispanic older adults with asthma may not seek any care until they are struggling to breathe when symptoms become so severe that the ED is the primary option. Further study may elucidate these findings.

The study has several limitations related to the use of a pre-existing data set. First, because the CHIS sampling strategy did not include institutionalized populations, the results from this study cannot be generalized to older adults with asthma in long-term care facilities such as nursing homes, assisted living facilities and rehabilitation settings. Second, the sample is drawn from older adults from California, therefore further research is needed to compare current findings with those from nationwide data. According to the 2012 US Census data, the ethnic composition of our sample may differ from other states given that the Hispanic community is larger in California compared to the rest of the US and the African-American community is smaller [25]. Further, Hispanics and some Asian sub-groups are over-sampled (i.e. Vietnamese, Chinese and Koreans) in CHIS [26]. We were not able to analyze more subcategories of Hispanics, such as Mexicans, Puerto Ricans, Cubans, Salvadorian, other central and South American Hispanics due to the small numbers of older adult with asthma within the Hispanic subcategories. Third, we were unable to independently validate asthma diagnoses due to the self-reported nature of CHIS. This limited access to the original

participants coupled with the fact that in older adults there is an overlap of symptoms for asthma and other types of diseases [27] the health issues reported may not be specific to asthma alone.

Conclusion

The recognition that respiratory disease in the older adult is frequently misdiagnosed, or is undiagnosed and undertreated, has been a topic of much attention within recent years [4,13]. With the prediction that the population of older adults with asthma may double by 2030 [28], it is imperative that we address some of the issues for the older adult with asthma, and reduce morbidity and mortality in this population. Findings from this study show that older adults with asthma had difficulty with asthma control. We recommend a focus on asthma education so that when symptoms do occur, older adults are aware of available options in order to avoid costly ED visits. Further research should focus on specific asthma management skills and adherence to asthma treatment regimen among ethnic groups.

Declaration of interest

All the authors do not have any interest to declare.

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