Research article

Epidemiological aspects of echinococcosis in Kyrgyzstan

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ABSTRACT

Introduction and Aim: Cystic echinococcosis (CE) is globally distributed throughout the world and is also a significant burden for global health. This study was to evaluate the epidemiological status of CE in Kyrgyzstan.

Materials and Methods: This descriptive and analytical study conducted an epidemiological analysis of the parameters of patients with CE in Kyrgyzstan from 1986–2022. The population morbidity rate was calculated using the following formula: where k is the required indicator, an is the number of cases per year, and b is the average yearly population.

Results: The average intensive indicator increased by 1.8 times compared to the previous indicator and by 3.9 times compared to the initial indicator due to private veterinary service. Most of the recorded morbidity cases (22%) were found in Osh and attributed to the surgical treatment facility for patients residing in the southern regions. Highly intensive morbidity rates of children are observed in Batken, ranging from 4.9% to 3.2% in Osh and Naryn. In the northern region, Talas is in the lead with an average intensive indicator of -1.5%.

Conclusion: The increasing morbidity rate in Kyrgyzstan, which is growing at a rate of 3.5% annually, makes the invasion by CE a serious medical emergency.

Keywords: Cystic echinococcosis; epidemiology; morbidity; Kyrgyzstan; disability-adjusted life years.

INTRODUCTION

Cystic echinococcosis (CE) is caused by larval stage of *Echinococcus (E.) granulosus* in human tissues and organs, characterized by a chronic course, the formation of cysts and destructive damage to the liver, lungs, and other organs (1). CE has been recognized as a public health problem since 1950 (2). CE is distributed throughout the world, and is a significant burden for global health and the economy (3). In Kyrgyzstan, hepatic echinococcosis is hyperendemic (4,5); there has been a two- to three-fold rise in the frequency of CE, especially among teens. The majority of patients with severe CE problems emerge at a hospital at the critical stage (6).

In highly endemic regions, the yearly surgical incidence of CE varies from 18.0 per 1,00,000 individuals to 2.3 per 1,00,000 people. In highly endemic regions with outbreaks, the yearly surgical incidence of CE varies from 2.3 per 1,00,000 individuals to 18.0 per 1,00,000 individuals; in these countries, the incidence can exceed 30.0 per 100,000 people annually. On the other hand, alveolar echinococcosis is confined to the northern hemisphere, mostly in China, Central Asia, Russia, Europe, and North America. It is estimated that there are 18,400 new cases of alveolar echinococcosis each year, which results in 6,87,800 disability-adjusted life years (DALYs) (7).

In Europe, the prevalence of CE varies; it is comparatively less common in the nations of Northern Europe but endemic or even hyperendemic in the southern and southeast regions. Within the framework project, a cross-ultrasound screening investigation of rural populations in Bulgaria, Romania, and Turkey revealed that the prevalence of abdominal CE was 0.59% in Turkey and 0.41% in Bulgaria and Romania (8).

Eastern and Western Siberia, the Far East, the Lower Volga and the Lower Urals, the Stavropol Territory, the North Caucasus, and the regions of Orenburg, Rostov, and Saratov in Russia were found to have a high incidence rate of CE (9). In Georgia, the frequency of CE was 1.4 per 1,00,000 people in 2011, 2.1 in 2012, and 2.7 in 2013 (10). In many areas of Kazakhstan, CE is endemic and very common. In this country, *E. multilocularis* and *E. granulosus* are both prevalent (11). The prevalence of CE has been steadily rising in recent years, with up to 1,000 cases or more reported annually.

Tajikistan has a higher incidence of CE, with an average of 190 cases per year, based on epidemiological statistics (2000–2008 years). Most of the CE cases that have been found affect people living in cities. The administrative hubs of the cities of Dushanbe and Khujand, which have sanitary-epidemiological, medical, and preventive centers that conduct CE diagnostic testing, account for the majority of recorded cases of CE (12). Between 1.5 and 4.5 thousand CE surgeries are carried out annually in Uzbekistan. About 80% of the time, the liver is most affected, followed by the lungs and other organs. In Uzbekistan, there were 7,309 cases of CE reported between 2011 and 2018. In 2011–2018, the average incidence rates were 4.4 and 2.3 per 1,00,000 population, respectively (P = 0.016) (13).

In Kyrgyzstan, the prevalence of CE has significantly increased over the past 30 years and is still a major medical and social issue. The absence of indicators toward patient decrease and the presence of endemic areas, where the incidence rate ranges from 3.6 to 21.2 per 1,000 people, are the main causes of this problem's urgency (14). Since CE is so common, there has been an increase in incidence rates throughout Kyrgyzstan. This study was to evaluate the epidemiological status of CE in Kyrgyzstan.

MATERIALS AND METHODS

This descriptive and analytical study conducted an epidemiological analysis of the parameters of patients with CE in Kyrgyzstan from 1986 to 2022, taking into account state statistics data, annual reporting forms 1 (report on infectious and parasitic diseases), primary materials of epidemiological examination, and form 18 (report on the work of the Center for State Sanitary and Epidemiological Surveillance), which were analyzed and subjected to statistical processing by the department of prevention of diseases and state sanitary and epidemiological surveillance of the Ministry of Health of the Kyrgyz Republic, and medical histories of patients with CE in the regions of Kyrgyzstan.

The sanitary epidemiological services of Kyrgyz Republic examined more than 500 republican and regional reports in total. The Department of Disease Prevention and State Sanitary and Epidemiological Surveillance of the Ministry of Health of Kyrgyz Republic, as well as I.K. Akhunbaev Kyrgyz State Medical Academy in Bishkek, Kyrgyzstan, conducted this study in 2023. The population morbidity rate (per 100,000 people) was calculated using the following formula: where k is the required indicator, an is the number of cases per year, and b is the average yearly population.

The statistical analysis was conducted using Statistica v8.0 (StatSoft Inc., Tulsa, USA). The obtained data are shown as mean ± standard deviation and n (%). To assess differences in parameters, the student's t test was used. Differences were determined to be statistically significant at $p<0.05$. Odds ratios with statistical significance were calculated using MedCalc version 20.106 (MedCalc Software Ltd., Ostend, Belgium). The Ethical Committee of the Research and Production Association "Preventive Medicine" under the Kyrgyz Republic's Ministry of Health granted the study ethical permission (Protocol No. 1, dated February 19, 2010).

RESULTS

In total, according to recent reports, 7 million, or 37.6 thousand people, live in Kyrgyzstan. Of these, 3 million 557.3 thousand people are women (50.5%), and 3 million 480.3 thousand people are men (49.5%). Today, the rural population of Kyrgyzstan is 4 million, or 583.9 thousand people, i.e., 65.1 percent of the total population, employed in the fields of animal husbandry and crop production. 2 million, 453.7 thousand people (34.9%) live in cities. Compared to 2018, the rural population has become 368 thousand more urban by 280.1 thousand people.

During the entire observation period, a total of 19,262 surgically confirmed cases of CE were registered. On average, 520 cases were detected per year. The average intensive index was 9.980/0000, the maximum was 16.9 (2015), and the minimum was 2.9 (1986). Over the entire period of observation, a moderate upward trend with an annual growth rate of 3% has been observed in the long-term dynamics of the incidence of CE in the population. During the time period that was studied, CE went from being a rare helminthiasis to a common parasite. The intensive incidence rate rose 4.5 times from 1986 to 2022, and the republic became an endemic area. In the dynamics of the epidemic process of the incidence of CE, it is possible to determine the frequency at different intervals within 3- 4 years (Fig. 1).

In recent decades, as a result of changes in economic status, the number of farm animals in the private sector has increased, which has led to an increase in the number of slaughters at home when the rules of veterinary supervision are not observed. Dogs are more susceptible to getting affected by echinococcosis larvae when these conditions are present. This pollutes the environment with parasites and infects intermediate hosts of these parasites. The dynamics of the increase in the incidence of CE in the population of Kyrgyzstan are influenced by the forms of management and unsatisfactory veterinary supervision.

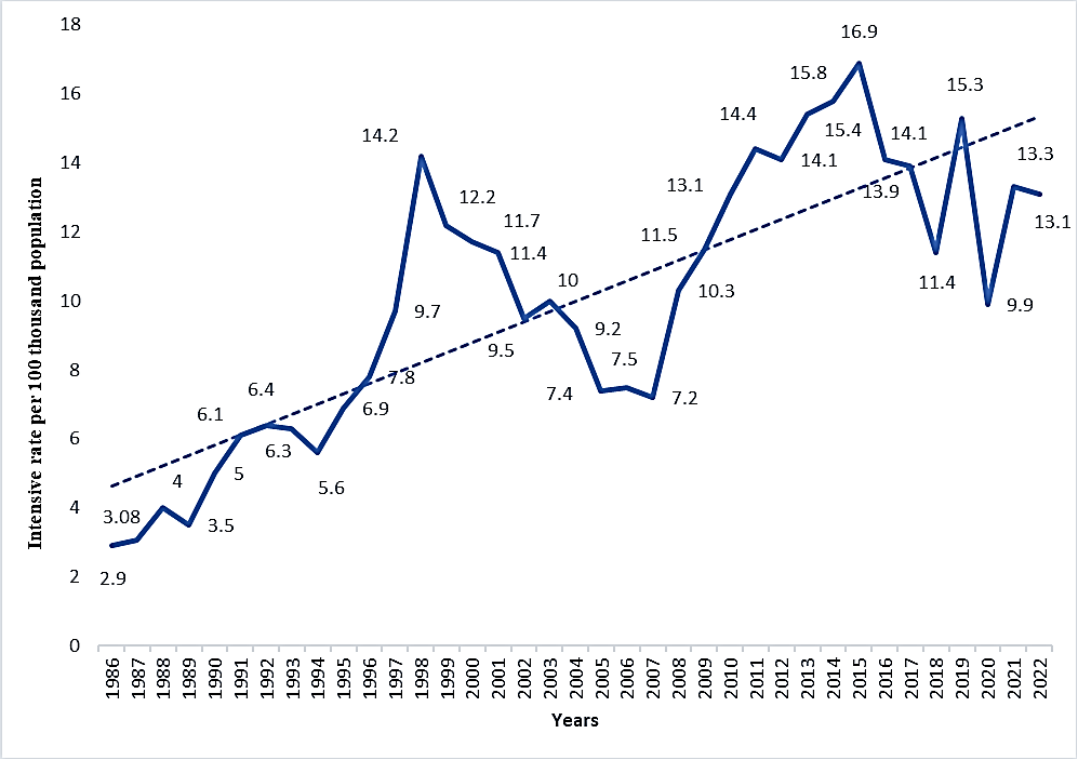

Fig. 1: Long-term dynamics of the incidence of CE in the population of Kyrgyzstan (1986–2022)

The average intensive indicator was low, at 4.5%, during the first 11 years of the analyzed period (1986–1996), due to the formation of a new country and the establishment of animal husbandry priorities. Over the course of the following 13 years (1997–2009), as private veterinary services and livestock farms were established, the average intensive indicator ascended by 2.1 times, or 9.8%. The National Statistical Committee on the Results of Livestock Accounting in Kyrgyzstan reports that as of the end of 2021, there were 34.6 thousand more cattle than there were at 1 million 750.4 thousand, 7.6 thousand more horses than there were at 547.2 thousand, and 632 fewer sheep and goats than there were at 6 million 278.1 thousand.

The average intensive indicator increased by 1.8 times compared to the previous indicator and by 3.9 times compared to the initial indicator due to the paid veterinary service (Fig. 2).

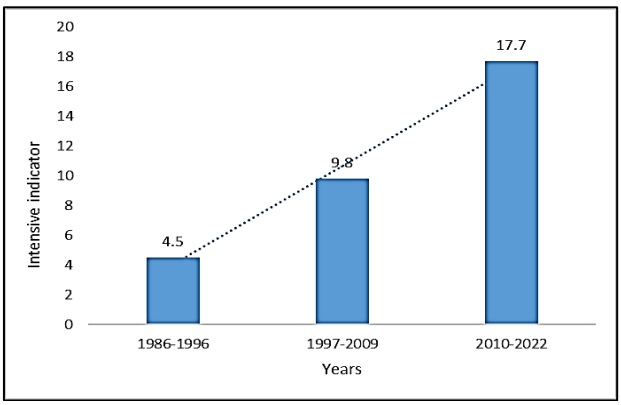

Fig. 2: Dynamics of indicators of the incidence of CE in the population of Kyrgyzstan (1986–2022)

There is a widespread occurrence of CE, with varying regional specific gravities. The southern area accounts for 54% of the recorded incidence of CE. The majority of recorded morbidity cases (22%), which were found in Osh, have been attributed to the surgical treatment facility for patients residing in the southern regions. In Batken, the overall incidence is 13%. Jalal-Abad region is 8% and Osh region is 11% (Fig. 3).

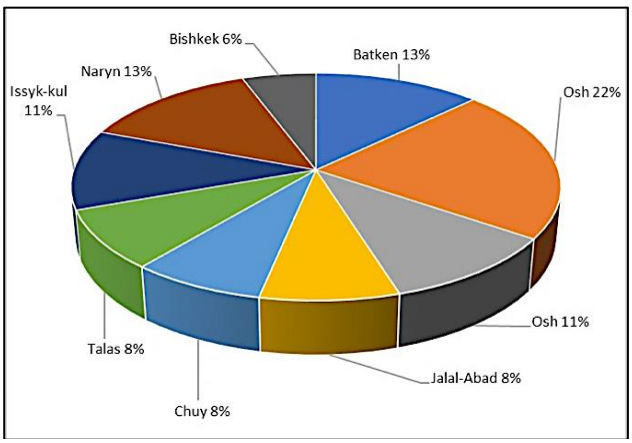

Fig. 3: Distribution of patients with CE by regions of Kyrgyzstan (1986–2022)

The incidence of CE varies by region, and a high intensity indicator is registered in the southern region. In Osh, the intensive indicator was 25.4%, in the Batken, 14.7%, in Osh, 12.2%, and in Jalal-Abad, 9.3%. In the northern region, a high incidence of CE is noted in the Naryn (15.7%), in Issyk-Kul (13.2%), and in the Talas and Chuy (9.8% and 9.0%, respectively) (Fig. 4).

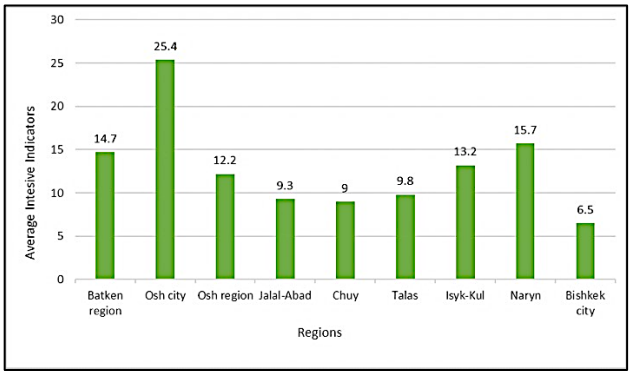

Fig. 4: Average intensive indicator by regions of Kyrgyzstan (1986–2022)

In this study, CE cases were registered in 4304 children under 14 years of age with a specific gravity of 22.3%. In the long-term dynamics, the incidence of CE in children has a different annual increase. Over the period from 1986 to 2004, the growth trend was moderate, with an annual growth rate of 1.1%. Over the period from 2005 to 2022, the trend is estimated to be moderate, but the annual growth rate has increased to 3.2%. During the years of observation, the average intensive morbidity rate of children was 3.9%, the minimum was 1.0% (2006–2007), and the maximum was 10% (2019) (Fig. 5).

Indicators of the incidence of CE in children by region indicate a high incidence of children less than 14 years of age in Jalal-Abad, where the average intensive indicator for the analyzed period is 14.9%. Highly intensive morbidity rates of children are observed in Batken, ranging from 4.9% to 3.2% in the Osh and Naryn. In the northern region, the Talas is in the lead with an average intensive index of -1.5% (Fig. 6).

A study of the specific weight of CE disease in children by region shows that a lot of cases were registered in Osh and Jalal-Abad, with 27.9% and 20.0% of all cases, respectively. The proportion of registered cases of CE in children is relatively high in the Chuy and in Bishkek, at 11.8% and 11.3%, respectively. In other regions, the proportion of registered CE varies from 9.7% in Naryn to 3.4% in Osh (Fig.7). Among 19,262 cases of CE, males are 11,114 (57.7%) and females are 8,148 (42.3%). Among males and females, this indicator is 2.8 and 3.0 per 1,00,000 people, respectively.

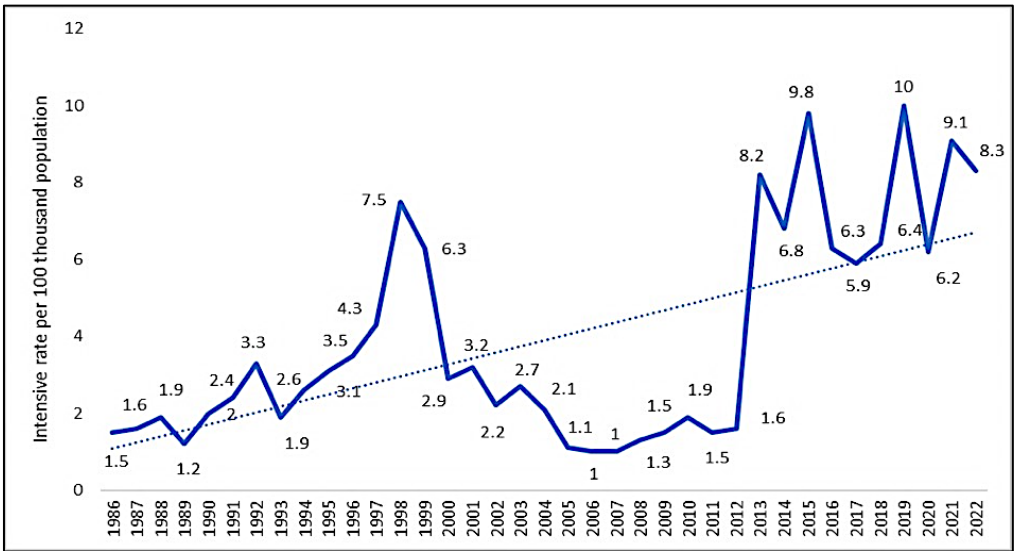

Fig. 5: Long-term dynamics of the incidence of CE in children under 14 years of age (1986–2022).

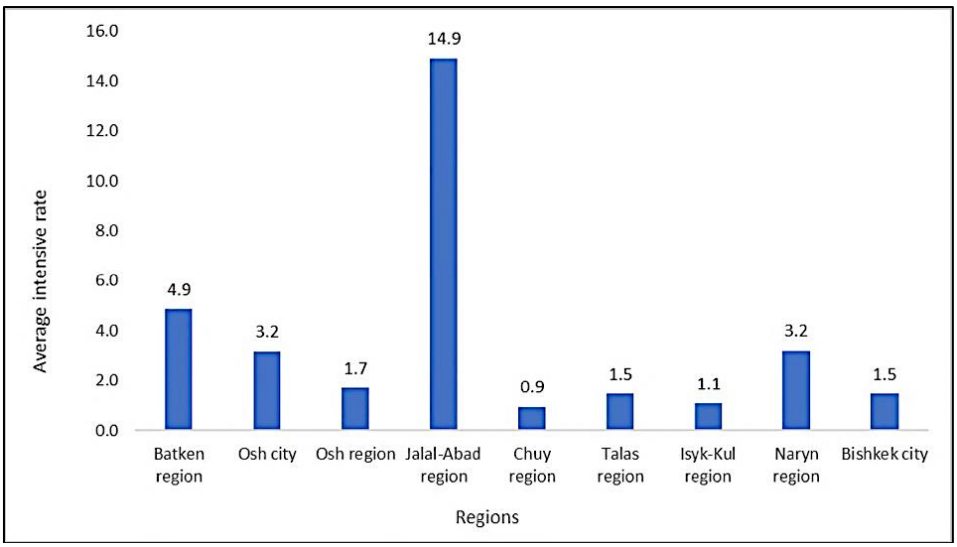

Fig. 6: Distribution of CE in children under 14 years of age by regions of Kyrgyzstan (1986-2022).

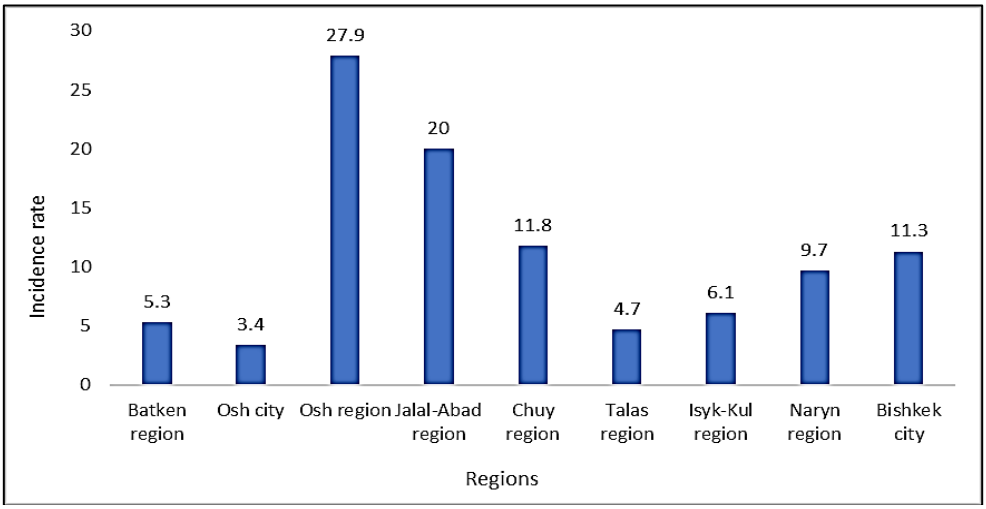

Fig. 7: Percentages of morbidity among children by region

DISCUSSION

The long-term dynamics of CE have identified a rise in the incidence rate. Thus, it increased 4.5 times between 1989 and 2022. CE has been elevated to the common invasions group from the uncommon helminthiasis group. A large number of dogs (280,000 registered) and stray animals assist in the preservation of the Echinococcus development cycle. Southern Kyrgyzstan accounts for 54% of the total incidence of CE reported. With 13% of the total, the Naryn area has the highest share among the northern regions. In Jalal-Abad (14.9), Batken (4.9), Naryn (3.2), and Osh (3.2), there are highly intensive rates of invasion. The overall incidence of children under 14 is 22.3%. There is no statistically significant difference in the gender distribution of CE.

Incidence in humans ranged between 0.10–7.74/1,00,000; prevalence in cattle varied between 0.003 and 64.09%; in sheep, between 0.004 and 68.73%; and in dogs, between 0 and 31.86%, according to a systematic review of 79 publications on the epidemiology of *E. granulosus* in humans and animals between 2000 and 2019. The analysis confirmed the regular underestimation of *E. granulosus* infection data in humans as well as animals (15).

Between 1997 and 2021, 64,745 cases of CE were found in Europe. The yearly incidence rate in EU member states was 0–50/1,00,000, whereas in Europe it was 0-64/1,00,000 on average. This study showed that, whereas usually endemic European Mediterranean nations have seen a decrease in the number of cases of the disease, the epicenter of the disease's current spread throughout Europe is found in these regions (16). CE is often observed in the North Caucasus and Transcaucasia, Moldova, Kazakhstan, Kyrgyzstan, Ukraine, and Central Asia on CIS territory (17). The biggest socioeconomic issue in Central Asia is echinococcosis. The disease is expected to affect 58% of the people living in Central Asian countries (18).

Human incidence rates of CE may exceed 50 per 1,00,000 people annually in endemic locations, and prevalence rates can reach 5–10% in some regions of China, Argentina, Peru, East Africa, and Central Asia (19). Between 1982 and 2000, there were 559 cases of alveococcosis reported in Central Europe.

The WHO has identified many neglected zoonotic illnesses as priorities, including CE and alveolar echinococcosis. There are an estimated 2–3 million cases of human CE globally. One million DALYs and monetary losses occur, resulting in an annual loss of US$3 billion (due to expenses associated with cattle compensation and human health; 7).

CONCLUSION

The increasing morbidity rate in Kyrgyzstan, which is growing at a rate of 3.5% annually, makes the invasion by CE a serious medical emergency. The southern regions, where the incidence rate is 54%, are considered to be in danger. The Naryn area (13%) of Kyrgyzstan has the highest percentage of all the northern regions. 22.3% of cases of CE are in children under the age of 14, with high incidence rates of 14.90/0000, 4.90/0000, and 3.20/0000 in the areas of Jalal-Abad, Batken, and Naryn, respectively.

CONFLICT OF INTEREST

The authors have no conflicts of interest to declare.

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