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ABSTRACT

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POTENTIAL RISKS OF SLEEP DISORDERS IN CHILDREN OF THE KHARKIV OBLAST DURING THE MILITARY CONFLICT: SURVEY RESULTS

Introduction. Problems of sleep disorders in children are not given much attention. Since the beginning of military activities on the territory of Ukraine, sleep quality has been affected by different factors.

Materials and Methods. We surveyed 232 healthy children aged 11–18 years who were residents of the Kharkiv Oblast and determined potential factors of sleep disorders depending on age, gender, and environmental factors using an original 20-question questionnaire in April 2023. Descriptive and logistic regression analyses were used.

Results. We registered age-dependent sleep behaviour disorders, which increased with age. 99 (42.7 %) children were found to go to bed after 24:00, while 122 (52.6 %) children slept less than 7–8 hours a day. The use of gadgets before going to bed for more than 2 hours was characteristic of children older than 13 years, and 66 (28.4 %) children used them for more than 3 hours. 32 (13.7 %) children associated the use of gadgets with poor sleep, 50 (21.5 %) children – with headaches, 93 (40.0 %) children – with morning weakness, and 148 (63.7 %) children – with doing homework. Forcibly relocated children did not go to bed when they felt they wanted to sleep 1.6 times more often; they had a sleep duration of less than 7 hours 5 times more often and noted daytime fatigue 1.4 times more often. Staying in Kharkiv and the region during the hostilities led to sleep behaviour disorders, namely, the inability to fall asleep and wake up at the same time, 1.2 times more frequently.

Conclusions. A significant contribution to sleep behaviour disorder in children is made by the use of gadgets before going to bed and doing school homework, forced relocation and living in the Kharkiv Oblast during the military conflict.

Keywords: pediatric, war, sleep disorder, questionnaire.

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ПОТЕНЦІЙНІ РИЗИКИ ПОРУШЕННЯ СНУ У ДІТЕЙ, МЕШКАНЦІВ ХАРКІВСЬКОЇ ОБЛАСТІ, ПІД ЧАС ВОЄННОГО КОНФЛІКТУ: РЕЗУЛЬТАТИ АНКЕТУВАННЯ

Вступ. Проблема порушення сну у дітей не приділяється багато уваги. З початку воєнних дій на території України з'являються інші за якістю чинники можливого порушення сну.

Матеріали та методи. Проводили анкетування 232 здорових дітей віком 11–18 років, мешканців Харківської області та визначали потенційні фактори порушень сну залежно від віку, статі та середовищних чинників за допомогою оригінального опитувальника з 20 питань упродовж квітня 2023 р. Використовували описовий та логіт-регресійний аналіз.

Результати. Визначено порушення сну та його гігієни, частка яких зростає з віком дитини. Зареєстровано, що після 24-ої години лягають спати 99 (42,7 %) дітей, 122 (52,6 %) дітей мають тривалість сну менше 7–8 годин на добу. Використання гаджетів перед сном понад 2 годин притаманно дітям старше 13 років, а понад 3 години їх використовує 66 (28,4 %) дітей. 32 (13,7 %) дітей пов'язують використання гаджетів з поганим засинанням, 50 (21,5 %) дітей з головним болем та 93 (40,0 %) дітей з ранковою слабкістю, 148 (63,7 %) дітей з виконанням домашнього завдання. Діти, які стали вимушеними переселенцями, у 1,6 разів відчували потребу спати, але не лягали; у 5 разів частіше мали тривалість сну менше 7 годин; у 1,4 рази частіше денну втомлюваність. Перебування в Харківській області під час воєнних дій у дітей в 1,2 рази частіше призводить до неможливості засинання та прокидання в один й той самий час.

Висновки. Значний вклад в порушення сну у дітей вносять використання гаджетів перед сном та виконання шкільного домашнього завдання, вимушене переселення та перебування в Харківській області під час мілітаристського конфлікту

Ключові слова: діти; мілітаристський конфлікт, порушення сну, анкетування.

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ABBREVIATIONS

Abs. – absolute value

URTI – upper respiratory tract infections

OR – odds ratio

CI – confidence interval

INTRODUCTION / ВСТУП

Sufficient duration of sleep is known to be necessary for optimal physical and mental health, immune function, and development of children [1]. In developed countries, sleep of insufficient quantity and quality is a significant problem. Short sleep duration is associated with a variety of adverse health outcomes, including cardiovascular diseases, obesity, and all-cause mortality [2]. Sleep disorders in children have been studied from the perspective of health status. Thus, children with hypertrophy of the tonsils, negative socio-demographic factors, neurological deficit, pain, and spasticity are at risk of sleep disorders [3, 4]. Among healthy children, according to the latest research, the risk of sleep disturbances is imposed by the use of gadgets before going to bed, bad habits in teenagers, and the related staying up till late [5].

Since the beginning of military activities on the territory of Ukraine, military occupation, massive shelling, children's relocation or separation from one or both parents, stay in shelters, sleep quality has been affected by other different factors. Residents of the Kharkiv Oblast and the city of Kharkiv, including children, constantly suffer from shelling due to their proximity to the Russian border. Until now, children continue to study remotely or in shelters. That is the long-term risk of a threat to life, poor socialization, fears, and anxiety can not only potentially affect sleep quality but also lead to depressive states in children [6].

Objective: to conduct a survey of healthy children who were residents of Kharkiv City and the Kharkiv Oblast and identify potential factors of sleep disorders depending on age, gender, and environmental parameters.

Materials and Methods. The questionnaire included data of the children studying at an educational institution which comprised 350 children aged 11–18 living in the city of Kharkiv and the Kharkiv Oblast. 232 children and their parents consented to participate in the study via filling out an online Informed Consent Form. Among the children, there were 97 boys and 135 girls. Inclusion criteria: children aged 11–18 who are residents of Kharkiv and the Kharkiv Oblast. Exclusion criteria: any chronic diseases, acute diseases during the survey. The survey was conducted in April 2023.

The questionnaire contained 20 questions with different distractors:

1. Your age?

2. Your gender?

3. Have you lived in the occupied territories during the war?

4. Did you have to change your place of residence because of the war?

5. If you changed your place of residence, where did you move?

6. Does it happen that you want to sleep, but you do not go to bed?

7. Do you think that you procrastinate (put off falling asleep) before going to bed or when you're already in bed?

8. What time do you go to bed?

9. How many hours do you sleep on average?

10. Do you go to bed and wake up at the same time every day?

11. How much time do you use gadgets (smartphone/tablet/computer) before going to bed?

12. Do you happen to wake up in the middle of the night and start surfing the phone?

13. Do you use your gadgets more in the evening/night on weekends?

14. How many episodes of URTI (cold, runny nose, cough, fever) have you had in the last year?

15. Do you find it difficult to fall asleep after using a gadget before going to bed?

16. How many days a week do you feel tired during the day?

17. Have you noticed that after a bad night's sleep, it's hard to concentrate at school or do your homework?

18. Do you have a headache in the morning due to the lack of sleep?

19. Do you feel weakness in the morning?

20. Why do you think you fall asleep later than you planned?

The survey was conducted using an online form. This study was approved by the Ethics Committee (Minutes No. 2 dated October 12, 2022), was conducted with the involvement of minor children, and did not include measures that could harm their health. The children and their parents gave consent to participate in the study. Statistical analysis was performed using MedCalc Statistical Software version 18.2.1 (MedCalc Software bvba, Ostend, Belgium, 2018). We used descriptive analysis with proportion calculation, logit-regression analysis with odds ratio (OR), and 95% confidence interval (CI) determination. The difference in parameters was considered statistically significant at $p < 0.05$.

Results. The demographic data of the children who participated in the survey are shown in Table 1.

Table 1 – Demographic characteristics of the children who participated in the survey

Parameter	Abs. (%)	95% CI	p
Age, years			
11–12	5 (2.2)	0.02; 0.04	0.0215
13–14	78 (33.6)	0.27; 0.39	0.3362
15–16	124 (53.4)	0.47; 0.59	0.5344
17–18	25 (10.7)	0.06; 0.14	0.1077
Boys	97 (41.8)	0.35; 0.48	0.4181
Girls	135 (58.1)	0.51; 0.64	0.5818
Children who had lived under occupation	35 (15.0)	0.10; 0.19	0.1508
Children who became forced migrants	151 (65.1)	0.58; 0.71	0.6508

Among the children who became forced migrants, 80 (52.9 %) children moved to other countries, and 71 (47.1 %) children – to other regions of Ukraine.

We did not get a gender-related difference in the proportion of responses by children aged 11–18, so we do not present these results in this paper.

98 (42.2 %) children answered "often," "very often," and "always" to the question "Does it happen that you want to sleep, but you do not go to bed?" Of them, 16 (16.3 %) children had lived in the occupied territories, and 82 (83.6 %) children had not (OR = 1.1; 95% CI = 0.7–1.6; p = 0.6436); 70 (71.4 %) children had changed their place of residence and 28 (28.5 %) children had not (OR = 1.6; 95% CI = 0.9–1.8; p = 0.0097). That is, the change in normal life did not affect children's desire to sleep as needed.

The question "Do you think that you procrastinate (put off falling asleep) before going to bed or when you're already in bed?" did not reveal a statistically significant difference in responses between age groups whether the child had lived in the occupied territories or had become a forced migrant.

We analyzed the time when children went to bed. Of the total cohort comprising 252 children, 99 (42.7 %) children went to bed after 24:00, and most of them were 17–18 years old. Such possible risk factors as living in the occupied territories and forced relocation did not affect the time of going to bed after 24:00 (OR = 1.0; 95% CI = 0.8–1.7; p = 0.2267 and OR = 0.9; 95% CI = 0.7–1.3; p = 0.9033, respectively).

The results of the analysis of sleep duration during the day turned out to be very interesting. It was found that 122 (52.6 %) of the interviewed children slept less than 7 to 8 hours a day, whereas 47 (20.2 %) children slept 5 to 6 hours a day, and 75 (32.3 %) children slept 6 to 7 hours a day. The

analysis of the age distribution showed that the largest share of such children were 17–18 (68.0 %) years old. We noted that only 5 (2.1 %) children had a sleep duration of ≥ 9 hours. However, children who had lived under occupation did not have a risk of reduced sleep duration of < 7 hours per day (OR=0.9; 95% CI = 0.6–1.3; p = 0.6180). But those children who had changed their place of residence were 5 times more likely to have a sleep duration of < 7 hours (OR = 5.0; 95% CI = 1.6–2.9; p = 0.0001).

We also questioned the children about sleep hygiene, i.e., whether they went to bed and woke up at the same time every day. In the total cohort of subjects, 169 (72.8 %) children answered "always" and "almost always." However, 63 (22.1%) children had sleep disorders. There was an age-dependant tendency to a decrease in the proportion of children who could maintain the regime of falling asleep and waking up at the same time: 11–12 years – 100 %, 13–14 years – 57 (73.0 %), 15–16 years – 90 (72.5 %), 17–18 years – 17 (68.0 %). Children who had lived under occupation did not have a higher risk of changing sleep/wake behavior (OR = 0.8; 95% CI = 0.6–1.1; p = 0.3518). On the other hand, the children who stayed in Kharkiv and the region during the hostilities had disorders of sleep hygiene, namely, the inability to fall asleep and wake up at the same time, 1.2 times more frequently (OR = 1.2; 95% CI = 1.1–1.9; p = 0.0104).

We did not observe a higher frequency (i.e., more than 3 times a year) of URTI episodes in the children interviewed – only in 28 (12.0 %) subjects; therefore, the connection between sleep peculiarities and a possible decrease in immunity was not studied further.

The next analysis concerned the impact of gadget use (smartphone/tablet/computer) on sleep-related processes. The time of gadget use before bedtime was up to 1 hour in 85 (36.6 %) children, 2–3 hours

in 81 (34.9 %) children, and more than 3 hours in 66 (28.4 %) children. It was found that all children aged 11–12 years used gadgets for less than 1 hour; however, we did not observe a statistical difference among other age groups. We studied the impact of factors such as "occupation" and "relocation" on using gadgets for more than 2 hours before bedtime, but no association was found (OR = 1.1; 95% CI = 0.9–1.4; p = 0.2368 and OR = 0.9; 95% CI = 0.7–1.2; p = 0.4351, respectively).

Waking up at night and using gadgets at night was registered in 18 (7.7 %) children and increased use of gadgets in the evening or at night on weekends was registered in 71 (30.6 %) children. However, we did not observe the influence of living under occupation and forced relocation on these phenomena (OR = 0.6; 95% CI = 0.3–1.3; p = 0.2996, OR = 2.6; 95% CI = 0.8–0.9; p = 0.1100 and OR = 1.3; 95% CI = 0.8–2.1; p = 0.1685, OR = 0.9, 95% CI = 0.6–1.4; p = 0.9496, respectively). On the other hand, 32 (13.7 %) children noted that it was difficult for them to fall asleep after using gadgets before going to bed, and these were exclusively children aged 15–18 years, with no significant association with living under occupation and forced relocation (OR = 1.5; 95% CI = 0.7–3.3; p = 0.2389 and OR = 1.1; 95% CI = 0.5–2.3; p = 0.6441).

A few more questions were devoted to the general well-being of children during the day and the possible connection with sleep. To the question "How many days a week do you feel tired during the day?", 74 (31.8 %) children answered "3 to 6 days",

and 68 (29.3 %) children answered "always," with no statistically significant difference among different age groups. The presence of children under occupation did not affect the presence of daytime fatigue (HR 0.8 95% CI 0.6 -1.2; p=0.3959). However, a forced relocation was associated with fatigue (OR = 1.4; 95% CI = 1.1–1.6; p = 0.0001).

95 (40.9 %) children noticed that they "often," "very often," or "always" had difficulties concentrating at school or doing their homework after a bad night's sleep. An age-dependent increase in the frequency of this observation was found. 11–12 years old – 1 (20 %) subject, 13–14 years old – 26 (33.8 %) subjects, 15–16 years old – 53 (42.7 %) subjects, and 17–18 years old – 15 (60.0 %) subjects. But such factors as living under occupation and forced relocation did not significantly affect this symptom (OR = 0.7; 95% CI = 0.4–1.2; p = 0.2461 and OR = 0.9; 95% CI = 0.6–1.3; p = 0.8037).

Headaches in the morning due to lack of sleep were noted by 50 (21.5 %) children, and 93 (40.0 %) children noted weakness in the morning. Living under occupation and forced relocation of children had no association with these symptoms (OR = 0.8; 95% CI = 0.4–1.6; p = 0.6651, OR = 1.2; 95% CI = 0.7–2.1; p = 0.4421 and OR = 1.0; 95% CI = 0.7–1.6; p = 0.7115, OR = 0.9; 95% CI = 0.7–1.3; p = 0.8813, respectively).

The opinion of each child regarding their own reasons for falling asleep late was also taken into account (Table 2).

Table 2 – Subjective factors of children's staying late at night

Factor	Abs. (%)	95% CI	p
I can't sleep for no reason	131 (48.7)	0.50; 0.62	0.5646
I chat with my friends	99 (42.6)	0.36; 0.49	0.4267
Listening to music	78 (33.6)	0.27; 0.39	0.3362
Doing my homework	148 (63.7)	0.57; 0.69	0.6379
Browsing social networks	109 (46.9)	0.40; 0.53	0.4698
Reading the news	40 (17.2)	0.12; 0.22	0.1724

Those children who had lived under occupation couldn't fall asleep "for no reason" 1.6 times more often (OR = 1.6; 95% CI = 1.3–2.0; p = 0.0001). All 40 children who read the news were aged 15–18.

Discussion. The study itself is represented more as a screening than an in-depth clinical study. We aimed to pay attention of professionals and parents to sleep problems in school-aged children. A simple questionnaire made it possible to identify possible

risk factors for sleep behavior disorders in children and to suspect insomnia. We suppose that the originality of our research lies in the study of potential factors of sleep behaviour disorders in children during the military conflict, i.e., in the conditions of living under occupation and forced relocation. The survey involved 232 school-age children with no acute or chronic diseases who were residents of Kharkiv and Kharkiv Oblast. The

proximity of the Kharkiv Oblast to the borders of the aggressor country led to the death of hundreds of civilians, large-scale destruction of infrastructure, as well as to a humanitarian crisis that has continued for more than 650 days. Many residents had to be evacuated to the western regions of Ukraine and neighboring countries. However, those who could not leave the city were forced to hide from shelling and airstrikes in the subway and basements. That is, war has serious consequences for mental health, especially for children. Children become especially vulnerable after losing their parents, friends, home, and familiar things. Chronic stress and psychological trauma can have profound and often irreversible consequences, affecting children's health and well-being long after the adverse events of war. Schooling and education have also changed significantly since the COVID-19 pandemic [7].

The cluster of questions related to sleep hygiene allowed to determine that out of 252 subjects, 99 (42.7 %) children went to bed after 24:00, while 122 (52.6 %) of the interviewed children slept less than 7 to 8 hours a day, 47 (20.2 %) children slept 5 to 6 hours a day, and 75 (32.3 %) children slept 6 to 7 hours a day. The consensus statement of the American Academy of Sleep Medicine recommends that children aged 13–18 sleep 8 to 10 hours a day on a regular basis in order to maintain optimal health status, as this sleep duration has been proven to improve attention, behavior patterns, school performance, memory, emotional regulation, quality of life, as well as mental and physical health [1]. However, we identified an age-dependent tendency to a decrease in the proportion of children who could maintain the regime of falling asleep and waking up at the same time: 11–12 years – 100 %, 13–14 years – 57 (73.0 %), 15–16 years – 90 (72.5 %), 17–18 years – 17 (68.0 %). As the child grows and becomes autonomous, parents and medical personnel should pay attention to sleep hygiene.

Taking into account that, on the one hand, chronic disruption of the circadian rhythm in children lowers immunity and increases the incidence of URTI, and on the other hand, SARS-CoV2 infection is associated with sleep disturbances, we included this question in the questionnaire, but did not observe a high frequency of URTI episodes among children [1, 7, 8].

The next cluster of questions concerned the use of various gadgets before going to bed and determining the proportion of children with insomnia risk. In a study involving 183 children who agreed to be deprived of screen time after 21:00,

sleep duration increased by 17 minutes, and daytime alertness significantly improved [9]. Another study involving 300 Swiss teenagers demonstrated that screen time in the evening negatively correlated with sleep duration [10]. Similar to our study, a survey of 864 Argentinian children aged 12 to 18 years showed that time spent playing video games was negatively associated with sleep duration and positively associated with daytime sleepiness, while smartphone use was associated with lower academic performance, and sleep duration was inversely proportional to daytime sleepiness. We did not study the students' performance, but 95 (40.9 %) children noticed difficulties concentrating at school or doing their homework after a bad night's sleep.

We found that 85 (36.6 %) children aged 13–18 used gadgets before bedtime for up to 1 hour, 81 (34.9 %) children – for 2–3 hours, and 66 (28.4 %) children – for more than 3 hours. Moreover, 32 (13.7 %) children noted that they had difficulties falling asleep after using gadgets before going to bed, and these were exclusively children aged 15–18 years.

An Argentinian study identified daytime sleepiness in 614 (71 %) children. We registered some symptoms of insomnia: headache in 50 (21.5%) children and weakness in the morning in 93 (40.0 %) children.

It is important to consider children's opinion and pay attention to their well-being. According to 148 (63.7 %) children, the most important reason that could affect falling asleep and sleep duration was doing homework.

Two other factors that could have an impact on children's sleep, and which were the focus of our analysis, were occupation and forced relocation of children.

We did not observe the influence of the "being under occupation" factor on the characteristics of sleep hygiene in children, except only one parameter: the children who had lived under occupation could not name the reasons for having difficulty falling asleep 1.6 times more often than children who had never been under occupation. The authors assumed that living under occupation might not last long, and the sample of such children was small. The insufficient study of this factor represents a limitation of our study and a promising direction for further study.

At the same time, we observed the impact of forced relocation on sleep behaviour in school-aged children. Forcibly relocated children did not go to bed when they felt they wanted to sleep 1.6 times

more often; they had a sleep duration of less than 7 hours 5 times more often and noted daytime fatigue 1.4 times more often. That is, forced relocation of children can lead to the transition from transient to chronic insomnia.

We cannot fail to mention that living in a city and region exposed to enemy attacks and shelling of the civilian population, frequent alert signals, the need to run to shelters, distance learning or learning in shelters also affect children's sleep. The children who stayed in Kharkiv and the region during the hostilities had sleep behaviour disorders, namely, the inability to fall asleep and wake up at the same time, 1.2 times more often.

Insufficient sleep may go unrecognized by clinicians if children and their parents are not asked about it as part of a routine medical history collection. Although sleep hygiene approaches in children are easy to implement and follow, very few studies have been conducted evaluating the effectiveness of available methods [10]. There was no difference between boys and girls in the frequency of different responses to the questionnaire, although data on the gender-specific characteristics of sleep disorders in children of different ages are quite contradictory.

Currently, diaries and special questionnaires are used to prevent sleep disorders in children. Sleep diaries provide valuable information about sleep behaviour. They are easy to use to assess the duration and quality of sleep in children. Both paper and electronic diaries can be the basis for providing recommendations on preventing insomnia and its treatment [11]. Diaries can be created with one's own hand, but they should contain the following elements: the time when the child goes to bed, when the child falls asleep, when the child wakes up, and the frequency and duration of daytime sleep.

CONCLUSIONS / ВИСНОВКИ

A survey of children aged 11–18 who lived in the city of Kharkiv and the Kharkiv Oblast during the war in Ukraine made it possible to determine sleep behaviour disorder, which depended on age, use of gadgets, homework, and forced relocation. However, the stay of children in the city of Kharkiv and the Kharkiv Oblast, which is constantly subject to enemy shelling and related actions, also affected the sleep behaviour of school-aged children. We noted that sleep behaviour was increasingly affected as the child grew. It is essential to change lifestyle in

Another reliable tool for diagnosing insomnia is specific questionnaires. They are published in English-language literature, but are not routinely used in Ukraine. One of the popular questionnaires is a fairly valid tool with a sensitivity of 85% and a specificity of 87% – the PSQ-SRBD questionnaire (Pediatric Sleep Questionnaire - Sleep related breathing disorders), which is used in children aged 2–18 years. The questionnaire makes it possible to detect symptom complexes and behavioral disorders that lead to insomnia without the use of polysomnography, which reduces costs and facilitates clinical approaches to the diagnosis of sleep disorders in children. The questionnaire helps to diagnose snoring, sleepiness, and behavioral disorders in children of both sexes and has demonstrated good stability during repeated testing [12].

To study the relationship between sleepiness and the mental and physical health of adolescents aged 12–18, the ESS-CHAD questionnaire (Epworth Sleepiness Scale for Children and Adolescents) was developed [13].

We also suggest using the questionnaire we used in this study for parents or clinicians. Even though our study had several limitations (limited survey of one educational institution, different number of children when comparing those who were under occupation and those who were forced to relocate), the strength of our study is represented by a large sample of children included in the survey; short-term study duration (April 2023); the cohort being from one region of Ukraine; determination of possible factors related to the militaristic conflict that affect sleep in children. Most importantly, we tried to draw parents' and specialists' attention to the problems of sleep behaviour in childhood.

order to get more sleep and to provide counseling or psychological support, especially when children and their parents understand the problems and are motivated to make efforts in the context of a militarized conflict.

Chronic stress and sleep disorders in school-age children during military actions can have certain adverse consequences for both academic performance and mental and physical health. Therefore, parents should pay attention to sleep hygiene and consult a psychologist in a timely manner. Children can also receive information about sleep hygiene during the war at school.

PROSPECTS FOR FUTURE RESEARCH / ПЕРСПЕКТИВИ ПОДАЛЬШИХ ДОСЛІДЖЕНЬ

The authors consider that the prospects for further research are to expand the survey of children regarding sleep characteristics in different regions of Ukraine, develop a tool for diagnosing transient and chronic insomnia, and conduct a monitoring study after providing recommendations to children and parents regarding sleep hygiene. It would be appropriate to conduct a study of polysomnography use in children with chronic sleep disorders before and after behavioral disorder correction.

CONFLICT OF INTEREST / КОНФЛІКТ ІНТЕРЕСІВ

The authors declare no conflict of interest.

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Riga O. O. – design development, data analysis and interpretation, final editing of the manuscript for publication.

Onikiyenko O. L. – the idea and concept of the paper, final editing of the manuscript for publication.

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