The influence of individuals, workload, and physical work environment on work stress of nurses at Mamuju Regional General Hospital

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Abstract: Occupational stress in nurses is an important problem because it can impact the health of the workforce, patient safety, and the quality of hospital services, especially in working conditions with high physical and mental demands. This study determines the influence of individual factors, workload, and physical work environment on work stress in nurses at Mamuju Regional General Hospital. This study used a quantitative cross-sectional design with a total sample of 121 nurses, measuring work stress using a cocorometer, mental workload using NASA-TLX, and lighting and temperature as the physical work environment, and analyzed using the chi-square test and ordinal logistic regression. Bivariate analysis showed a significant influence between mental workload on job stress (p=0.003<0.005), and work environment temperature on job stress (p=0.002<0.005). Mental workload and workplace temperature significantly affect nurses' work stress, with high mental workload and non-standard temperatures increasing the risk of stress, while individual factors and lighting have no significant effect. Mental workload and work environment temperature conditions are dominant factors that influence nurses' work stress, so that proportional workload management and control of physical work environment conditions are important strategies in preventing work stress and improving the quality of nursing services.

Keywords: Individual factors, Job stress, Workload, physical work environment.

1. Introduction

Hospitals are healthcare institutions that play a central role in treating and maintaining public health. As healthcare centers, hospitals provide comprehensive and integrated services, ranging from promotion and prevention efforts, diagnostics, medical therapy, and rehabilitation. These services are carried out by various professional health workers who work in an organized manner, supported by increasingly sophisticated medical facilities and technology, thereby improving the overall quality of health services [1]. The existence of hospitals is very strategic in improving public health and meeting the needs and expectations of the community for effective and high-quality health services [2, 3]. The success of hospitals in carrying out their functions is greatly influenced by the quality of the services they provide. One of the main factors that determines this quality is human resources, especially health workers who are directly involved in patient care. Hospitals not only function as providers of basic health services, but also as referral centers and providers of medical support services. Therefore, the quality of human resources is a key element in ensuring the effectiveness and efficiency of health services [4]. Among health workers, nurses play a crucial role in the hospital care system. Their role continues to evolve, going beyond providing nursing care to educating patients and families, advocating

for patients, counseling, leading, acting as agents of change, and contributing to the development of evidence-based nursing practice [5]. Nurses are also the dominant healthcare personnel in hospitals, representing about 60% of the total workforce, and acting as 24-hour care providers on the front lines [6, 7].

In practice, hospitals face various potential occupational hazards that can affect healthcare personnel, patients, and the surrounding environment. Therefore, the implementation of Hospital Occupational Safety and Health (K3RS) is mandatory to prevent Occupational Diseases (PAK) and Work Accidents (KAK). These hazards include biological, chemical, ergonomic, physical, and psychological factors that can trigger work stress, especially in nurses with high workloads and intensive interactions with patients [8]. Work-related stress is a global problem that has a significant impact on various sectors, including the health sector. The 2024 Health and Safety Executive report shows that most work-related illnesses are caused by stress, depression, and anxiety. Gallup Consulting data from 2024, as reported by Moningka et al. [9], also shows that work stress is still widely experienced by workers in Southeast Asia, including Indonesia. In the health sector, nurses are a group with a high prevalence of work stress due to heavy and complex job demands [10].

In Indonesia, the results of the Basic Health Research show that work stress is a serious problem among health workers, including nurses. Work stress can cause decreased concentration, poor decision-making, mental health problems, and even decreased performance and service quality [11-13]. International studies also show that work stress in nurses results in decreased service quality, increased absenteeism, burnout, and nurse turnover [14, 15]. The factors that cause work stress in nurses are very diverse. Research by Jachmann et al. [16] and Kusumawati et al. [17] shows that a stressful work environment, high patient volume, staff shortages, and rapidly changing patient conditions are the main factors that trigger stress, especially in the Emergency Unit. In addition, individual characteristics, emotional demands, and the physical work environment also contribute to increased work stress [18]. This situation was also found at the Mamuju Regional General Hospital (RSUD), which was established in 1982 and continues to experience a shortage of nursing staff. Based on an analysis of human resource needs, there is a shortage of 38 nurses. A preliminary survey using the Perceived Stress Scale (PSS-10) showed that most nurses experience moderate to severe levels of work stress.

In addition, the 2024 patient safety incident report shows that there were near misses and incidents caused by staff, which were related to workload and job stress. Interviews with nurses and ward managers revealed that high workload, individual factors, and suboptimal work environments contribute to work stress and potential service errors [19]. Based on these findings, it can be concluded that work stress in nurses is influenced by interrelated individual factors, workload, and the physical work environment. These three factors have been proven to significantly contribute to the level of work stress among nurses and have an impact on the quality of nursing services and patient safety. Therefore, research on the influence of individual factors, workload, and physical work environment on work stress among nurses at the Mamuju Regional General Hospital is highly relevant to comprehensively understanding the problem and providing a basis for efforts to improve the quality of nursing services.

2. Materials and Methods

This study is a quantitative cross-sectional study to examine the relationship between independent and dependent variables, conducted at Mamuju Regional General Hospital in October–November 2025, with a population and sample of 121 nurses using total sampling. Work stress was measured objectively through increased saliva enzyme secretion using a cocorometer, with criteria of no stress (<30), mild stress (31–45), moderate stress (46–60), and severe stress (>61). Individual factors included age (<40 years and >40 years), gender (male/female), marital status (married, single, divorced/widowed/widower), and length of service (<5 years and >5 years). The workload studied was mental workload, measured using NASA-TLX with categories of low (<50), moderate (50–80), and heavy (>80), while the physical work environment included lighting and room temperature measured using a lux meter and thermometer, which were then compared with the Threshold Limit Value (TLV)

in accordance with Minister of Manpower Regulation No. 5 of 2018. The study population consisted of all 121 nurses at the Mamuju Regional General Hospital, with a total sampling technique, so that the entire population became the sample. The NASA-TLX measurement tool has been proven to be valid (calculated r 0.534–0.770 > table r 0.361) and reliable (Cronbach Alpha 0.748) based on previous tests. Data analysis was performed univariately, bivariately using the chi-square test, and multivariately using ordinal logistic regression to assess the simultaneous influence of independent variables on nurses' work stress levels. This study has obtained ethical approval from the Faculty of Public Health, Hasanuddin University, as stated in the Ethical Approval Recommendation Number: 1984/UN4.14.1/TP.01.02/2025 and was conducted in accordance with the principles and provisions of the research code of ethics.

3. Result and Discussion

Mamuju Regional General Hospital was established in 1982 and began operating in 1984. It has undergone various institutional developments until it attained BLUD status in 2019. It was designated as a type C hospital, fully accredited in 2022, and currently manages inpatient, outpatient, intensive care, and support services with 144 beds and a BOR of 52%. This hospital has a vision of creative, educational, friendly, and comfortable services, carrying out comprehensive health services, education, research, and development functions with a complete organizational structure and is based on the philosophy of humane service, professionalism, and a commitment to continuous quality improvement.

3.1. Respondent Characteristics

Table 1.
Frequency Distribution of Respondent Characteristics, Workload, Physical Work Environment, and Job Stress at Mamuju Regional General Hospital in 2025.

Variables	Category	Frequency (n)	Percentage (%)
Age	< 40 years	82	67.8
	≥ 40 years	39	32.2
Gender	Man	22	18.2
	Woman	99	81.8
Marital status	Not married yet	18	14.9
	Marry	97	80.1
	Divorced/Widowed/Widower	6	5.0
Years of service	< 5 years	21	17.4
	≥ 5 years	100	82.6
Education	D.III	46	38.0
	S1	23	19.0
	Professional Bachelor's Degree	52	43.0
Mental Workload	Low	14	11.6
	Currently	102	84.3
	Heavy	5	4.1
Lighting	It is not in accordance with	87	71.9
	In accordance	34	28.1
Work Room Temperature	It is not in accordance with	60	49.6
	In accordance	61	50.4
Work Stress	No stress	51	42.1
	Mild stress	55	45.5
	Moderate stress	15	12.4
	Severe stress	0	0

The results of the univariate analysis showed that most respondents were aged <40 years, female, married, had a work period of ≥5 years, and had a Bachelor's degree in Professional Studies, which reflects the dominance of experienced nurses and those with higher education backgrounds at Mamuju Regional General Hospital. The majority of respondents experienced a moderate mental workload,

while the physical work environment still showed problems, especially in the lighting aspect, which was mostly not up to standard and the workroom temperature, which was almost balanced between appropriate and inappropriate. The distribution of work stress levels showed that most nurses were in the no stress and mild stress categories, with no severe stress being found, which indicates that although work demands and environmental conditions were not yet fully optimal, most nurses were still at a relatively controlled stress level.

3.2. Bivariate Analysis

Table 2.
Relationship between Age and Work Stress

Age	Work Stress								Total	Asymp. Sig
	No Stress		Mild Stress		Moderate Stress		Severe Stress			
	n	%	n	%	n	%	n	%		
<40 Years	32	26.4	40	33.1	10	8.3	0	0	82	
≥ 40 Years	19	15.7	15	12.4	5	4.1	0	0	39	0.544
Total	51	42.1	55	45.5	15	12.4	0	0	121	

The analysis results show that in both the <40 and ≥40 age groups, most respondents were in the no to mild stress category, and no severe stress was found in either group. The chi-square test yielded a p-value of 0.544 (p>0.05), thus concluding that there was no significant relationship between the respondents' age and their level of work stress.

Table 3.
Relationship between Gender and Work Stress.

Gender	Work Stress								Total	Asymp. Sig
	No Stress		Mild Stress		Moderate Stress		Severe Stress			
	n	%	n	%	n	%	n	%		
Man	13	10.7	8	6.6	1	0.8	0	0	22	
Woman	38	31.4	47	38.8	14	11.6	0	0	99	0.161
Total	51	42.1	55	45.5	15	12.4	0	0	121	

The analysis results show that most male respondents were in the no-stress category, while most female respondents were in the mild stress category, and no severe stress was found in either group. The chi-square test yielded a p-value of 0.161 (p > 0.05), thus concluding that there is no significant relationship between gender and work stress levels.

Table 4.
Relationship between Marital Status and Work Stress.

Marital status	Work Stress								Total	Asymp. Sig
	No Stress		Mild Stress		Moderate Stress		Severe Stress			
	n	%	n	%	n	%	n	%		
Not married yet	4	3.3	10	8.3	4	3.3	0	0	18	
Marry	44	36.3	42	34.7	11	9.1	0	0	97	0.310
Divorced/Widowed/Widower	3	2.5	3	2.5	0	0	0	0	6	
Total	51	42.1	55	45.5	15	12.4	0	0	121	

The analysis results showed that across all marital status groups, most respondents were in the no-stress to mild-stress category, with no severe stress levels. The chi-square test yielded a p-value of 0.310 (p > 0.05), thus concluding that there is no significant relationship between marital status and work stress levels.

Table 5.
Relationship between Length of Service and Job Stress

Years of service	Work Stress								Total	Asymp. Sig
	No Stress		Mild Stress		Moderate Stress		Severe Stress			
	n	%	n	%	n	%	n	%		
< 5 Years	7	5.8	10	8.3	4	3.3	0	0	21	
> 5 Years	44	36.3	45	37.2	11	9.1	0	0	100	0.496
Total	51	42.1	55	45.5	15	12.4	0	0	121	

The analysis results showed that both nurses with a work period of <5 years and ≥5 years were mostly in the mild to no stress category, and no severe stress was found in either group. The chi-square test yielded a p-value of 0.496 (p > 0.05), thus it can be concluded that there is no significant relationship between work period and work stress levels.

Table 6.
Relationship between Education and Work Stress.

Education	Work Stress								Total	Asymp. Sig
	No Stress		Mild Stress		Moderate Stress		Severe Stress			
	n	%	n	%	n	%	n	%		
D.III	17	14	24	19.8	5	4.1	0	0	46	
S1	10	8.3	8	6.6	5	4.1	0	0	23	
Bachelor's Degree Professional Degree	24	19.8	23	19	5	4.1	0	0	52	0.465
Total	51	42.1	55	45.5	15	12.4	0	0	121	

The analysis results show that at all levels of education (D.III, S1, and S1 Profession), most respondents were in the no stress to mild stress category, and no severe stress was found. The chi-square test yielded a p-value = 0.465 (p > 0.05), so it can be concluded that there is no significant relationship between education level and work stress levels.

Table 7.
Relationship between Mental Workload and Job Stress.

Mental Workload	Work Stress								Total	Asymp. Sig
	No Stress		Mild Stress		Moderate Stress		Severe Stress			
	n	%	n	%	n	%	n	%		
Low Workload	12	9.9	2	1.7	0	0	0	0	14	
Medium Workload	38	31.4	51	42.1	13	10.7	0	0	102	0.003
Heavy Workload	1	0.8	2	1.7	2	1.7	0	0	5	
Total	51	42.1	55	45.5	15	12.4	0	0	121	

The analysis results show that an increase in the mental workload category is followed by an increase in the proportion of respondents experiencing mild to moderate stress, while at low mental workloads, most respondents do not experience stress. The chi-square test produces a p-value = 0.003 (p < 0.05), so it can be concluded that there is a significant relationship between mental workload and job stress levels.

Table 8.
Relationship between Lighting and Job Stress.

Lighting	Work Stress								Total	Asymp. Sig.
	No Stress		Mild Stress		Moderate Stress		Severe Stress			
	n	%	n	%	n	%	n	%		
It is not in accordance with	34	28.1	41	33.9	12	9.9	0	0	87	
In accordance	17	14	14	11.6	3	2.5	0	0	34	0.504
Total	51	42.1	55	45.5	15	12.4	0	0	121	

The analysis results showed that under conditions of inadequate or inadequate lighting, most respondents were in the no to mild stress category, and no severe stress was found. The chi-square test yielded a p-value of 0.504 (p > 0.05), thus concluding that there was no significant relationship between lighting and work stress levels.

Table 9.
Relationship between Temperature and Work Stress

Temperature	Work Stress								Total	Asymp. Sig
	No Stress		Mild Stress		Moderate Stress		Severe Stress			
	n	%	n	%	n	%	n	%		
It is not in accordance with	16	13.2	36	29.8	8	6.6	0	0	60	0.002
In accordance	35	28.9	19	15.7	7	5.8	0	0	61	
Total	51	42.1	55	45.5	15	12.4	0	0	121	

The analysis results indicate that respondents working in ambient temperatures that do not meet standard conditions experience higher levels of mild to moderate work stress compared to those working in environments with standard temperatures. The chi-square test yielded a p-value = 0.002 (p < 0.05), so it can be concluded that there is a significant relationship between work ambient temperature and work stress levels, where temperature mismatch has the potential to increase work stress.

3.3. Multivariate Analysis

Table 10.
Test of Parallel Lines.

Model	-2 Log Likelihood	Chi-Square	df	Sig.
Null Hypothesis	139.282			
General	127.642	11.693	11	0.391

Based on the results of the parallel lines test above, the Chi-Square value is 11.693, and the p-value is 0.391. Since the p-value is > 0.05, H0 is accepted, meaning that the proportional odds assumption is met. This means that the slope coefficient is considered the same for all categories of work stress levels.

Table 11.
Model Fitting Information.

Model	-2 Log Likelihood	Chi-Square	df	Sig.
Intercept Only	180.524			
Final	139.282	41.242	11	0.000

Note: Link function: Logit.

Based on the results of the simultaneous test calculation with *the Fitting Information Model*, the Chi-Square value was obtained at 41.242 with *a p-value* of 0.000. Since the p-value <0.05, H0 is rejected. This indicates that the simultaneous ordinal logit regression model is significant, so that the independent variables included in the model jointly influence the level of work stress. Thus, the resulting model is better than the model without independent variables.

Table 12.
Goodness of Fit.

	Chi-Square	df	Sig.
Pearson	104.813	113	0.696
Deviance	104.956	113	0.693

Note: Link function: Logit.

Based on the results of the model fit test with Goodness-of-Fit, it shows that the Pearson Chi-Square test value is 104.813, and the p-value is 0.696. The Deviance test Chi-Square value is 104.956, and the p-value is 0.693. Because both p-values are > 0.05, then H0 is accepted. Thus, the ordinal logit regression model used can be said to be appropriate and worthy of use as a prediction tool.

Table 13.
Pseudo R-Square.

Cox and Snell	0.289
Nagelkerke	0.336
McFadden	0.174

Note: Link function: Logit.

Based on the results of the determination coefficient calculation above, the *Pseudo R-Square value* shows that the Cox and Snell value is 0.289, the Nagelkerke value is 0.336, and the McFadden value is 0.174. The Nagelkerke value of 0.336 indicates that the ordinal regression model has a fairly strong explanatory ability related to variations in work stress levels.

Table 14.
Parameter Estimates.

		Estimate	Std. Error	Wald	df	Sig.	95% Confidence Interval	
							Lower Bound	Upper Bound
Threshold	[Stress = 1]	-0.607	1.298	0.218	1	0.640	-3.151	1.938
	[Stress = 2]	2.290	1.313	3.040	1	0.081	-0.284	4.864
Location	[Age=1]	0.084	0.453	0.034	1	0.853	-0.803	0.971
	[Age=2]	0 ᵃ	.	.	0	.	.	.
	[JK=1]	-1.875	0.544	11.880	1	0.001	-2.941	-0.809
	[JK=2]	0 ᵃ	.	.	0	.	.	.
	[Education=1]	0.169	0.440	0.147	1	0.701	-0.694	1.032
	[Education=2]	0.741	0.545	1.846	1	0.174	-0.328	1.809
	[Education=3]	0 ᵃ	.	.	0	.	.	.
	[MK=1]	0.364	0.554	0.433	1	0.511	-0.721	1.450
	[MK=2]	0 ᵃ	.	.	0	.	.	.
	[SP=1]	1.819	1.016	3.209	1	0.073	-0.171	3.810
	[SP=2]	0.222	0.905	0.060	1	0.806	-1.552	1.996
	[SP=3]	0 ᵃ	.	.	0	.	.	.
	[BKM=1]	-3.821	1.230	9.644	1	0.002	-6.232	-1.409
	[BKM=2]	-1.565	0.938	20783	1	0.095	-3.404	0.274
	[BKM=3]	0 ᵃ	.	.	0	.	.	.
	[Lighting=1]	0.727	0.480	20294	1	0.130	-0.214	1.669
	[Lighting=2]	0 ᵃ	.	.	0	.	.	.
	[Temperature=1]	1.156	0.422	70494	1	0.006	0.328	1.983
	[Temperature=2]	0 ᵃ	.	.	0	.	.	.

Note: Link function: Logit.
a. This parameter is set to zero because it is redundant.

The results of multivariate analysis using ordinal logistic regression showed that there were three variables that significantly influenced the level of nurses' work stress, namely gender, mental workload, and work environment temperature. Gender had a significant effect with a p-value = 0.001 and a positive coefficient (β = 1.875), which indicated that male nurses tended to have a lower level of work stress than female nurses. Low mental workload also had a significant effect on work stress (p = 0.002; β = 3.821), which indicated that low mental workload significantly reduced the likelihood of nurses having a higher level of work stress, while moderate mental workload showed the same tendency but was not significant. Meanwhile, work environment temperature had a significant effect with a p-value = 0.006 and a negative coefficient (β = −1.156), which indicated that non-standard work temperature conditions increased the tendency of nurses to experience work stress. The variables of age (p > 0.05),

education (p > 0.05), length of service (p > 0.05), marital status (p > 0.05), and lighting (p > 0.05) did not show a significant influence on work stress, so it can be concluded that nurses' work stress is more influenced by mental workload factors and certain physical work environment conditions than other demographic characteristics.

Table 15.
Odds Ratio Values of Significant Independent Variables.

Variables	Odds Ratio
Gender Male (JK=1)	6.52
Low Mental Workload (BKM = 1)	45.70
Medium Mental Workload (BKM = 2)	4.78
Unsuitable Working Environment Temperature (Temperature = 1)	0.31

The results of ordinal logistic regression showed that male nurses had a greater chance of having lower levels of job stress than female nurses (OR = 6.52) after controlling for confounding variables. Furthermore, low mental workload significantly reduced the odds of having higher levels of job stress (OR = 45.70), while inappropriate work environment temperature increased the risk of job stress (OR = 0.31).

3.4. Discussion

This research discussion positions nurses' work stress as a multifactorial phenomenon that is determined more by the interaction between job demands, environmental conditions, and individual assessment and adjustment processes than by demographic characteristics alone, in accordance with the transactional stress model that views stress as an adaptive response arising from individual-environment interactions through cognitive assessment and adjustment strategies [20, 21]. Age is not a major determinant of work stress because nurses' adaptation and the hospital work system make stress exposure relatively uniform, reflected in the insignificant relationship between age and work stress in bivariate analysis (p = 0.544) and ordinal logistic regression (OR = 1.09; 95% CI: 0.45–2.64; p = 0.853), and is in line with Mustakim and Putri [22]. Conversely, gender was not significant in bivariate analysis (p = 0.161), but after controlling for confounding variables, it showed a significant effect (OR = 0.15; 95% CI: 0.05–0.45; p = 0.001), indicating that gender differences in stress vulnerability only become apparent when occupational and work environment factors are taken into account [16]. The influence of gender on stress is highly contextual and can be mediated by psychological factors and work unit characteristics; conceptually, social role theory explains how the accumulation of role demands can increase stress vulnerability in women in certain situations, but remains within the framework that stress arises from individual-environment interactions, not just demographics [21].

Marital status is not a major determinant of work stress and only has an effect in certain contexts, such as work-family conflict or the presence of moderating factors, so this relationship is contextual and indirect [22, 23]. Length of service is also not an independent predictor of work stress because length of experience does not automatically affect stress levels when job demands and resources are relatively balanced. These findings are in line with Hapsari et al. [24] and can be explained through the Job Demands–Resources Theory, which views stress as the result of an imbalance between job demands and available resources, where length of service plays an indirect role through an increase in personal resources such as skills, self-confidence, and coping strategies [18]. This is also in line with the theory of clinical competency development "from novice to expert," which states that increased work experience can improve nurses' skills, resilience, and adaptability, so that the relationship between length of service and stress is non-linear and difficult to see directly [19].

Formal education does not determine variations in work stress because clinical demands and work pressure are relatively similar at various levels, so assessment and coping are more influenced by experience, continuous learning, and work environment support [6, 10]. Conversely, mental workload is a major determinant of work stress because high cognitive and emotional demands and clinical

responsibilities directly trigger stress responses if not balanced by adequate resources [14]. In terms of the physical work environment, not all factors have the same influence; lighting is not always a direct predictor of work stress because its impact is often mediated by individual perceptions and other psychosocial factors such as workload and social support [10], although several other studies emphasize the importance of adequate lighting for work comfort and safety [2, 8]. Conversely, workplace temperature is more consistently considered a physical stress factor because thermal discomfort can reduce concentration, increase fatigue, and exacerbate psychological disorders, as reported in various ergonomics and occupational safety and health studies. Integratively, work stress is understood as a multifactorial phenomenon arising from the interaction between individual factors, workload, and the physical work environment, in line with the views of Lazarus & Folkman and Cooper & Marshall, and reinforced by the religious perspective in QS Al -Baqarah verse 155 and Ibn Kathir's interpretation, which interprets pressure as a test that requires active patience, in line with scientific efforts to strengthen personal resources and manage work demands proportionally.

4. Conclusion

Based on the results of the study, it can be concluded that work stress among nurses at Mamuju Regional General Hospital is influenced by various interrelated factors. Individual factors generally do not have a significant effect on work stress, except for gender. Mental workload has been proven to have a significant effect, where a lower mental workload can reduce the risk of work stress at higher levels. In terms of the physical work environment, lighting does not have a significant effect on work stress, while room temperature has a significant effect, where uncomfortable temperature conditions increase the level of work stress among nurses. Simultaneously, individual factors, workload, and the physical work environment have a significant effect on the level of work stress among nurses at Mamuju Regional General Hospital. The implications of these findings suggest that hospital management needs to make comprehensive efforts to control work stress, particularly through the management of proportional mental workload, the regulation of workplace temperature to meet comfort standards, and the provision of a work environment that supports the psychological health of nurses. In addition, the development of stress management programs, stress coping training, and increased individual awareness among nurses in managing stress are strategic steps to reduce the risk of work stress. Further research is recommended to include other variables that have not been examined, such as social support, leadership, work shifts, and job satisfaction, as well as using more in-depth research designs, such as longitudinal or qualitative approaches, to gain a more comprehensive understanding of the dynamics of work stress among nurses.

Transparency:

The authors confirm that the manuscript is an honest, accurate, and transparent account of the study; that no vital features of the study have been omitted; and that any discrepancies from the study as planned have been explained. This study followed all ethical practices during writing.

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