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Hygiene Practices and Prevention of Waterborne Infections for Sustainable Water Delelopment among Secondary School Students in Nkanu West L.G.A., Enugu.

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ABSTRACT

The study hygiene practices and prevention of waterborne infections for sustainable water development among students in Nkanu West LGA, Enugu State. Two research questions and two hypotheses in line with specific purposes guided the study. Descriptive survey research design was adopted for the study. The population for the study was 3644 secondary school students and the sample size was 360. The sample size was determined by using Taro Yamane formula, stratified sampling technique was used to sample nine schools out of twelfth secondary schools from Nkanu West LGA. The second stages involve the use of proportionate sample to sample (40) forty students from each of the nine coeducational schools that were sampled which gave the total number of 360, of this number 160(44.4%) are male and 200 (55.5%) are female. The instrument used for data collection was structured questionnaire. The instrument was validated by three experts. Kuder Richardson was used to compute the reliability while the overall reliability index was.86. Two research assistants helped to administer and collect the instrument directly from the respondents. The data collected were analyzed using frequency and percentage scores for answering the research questions while chi-square test statistics was used to test the hypotheses. The findings of the study revealed that there was negative hygiene practices and prevention of waterborne infections among students in public secondary schools in Nkanu West and also a negative water storage practices for the prevention of waterborne infections. Since the p-value was below .05 level of significance the null hypotheses was therefore rejected. Based on the findings, the study recommended among others that sensitization and health education programme should be organized by school management to educate in-school students on the need to practice good hygiene and improve the on ways of storing water so as to help in the prevention of waterborne infections among students in public secondary schools in the study area. This may lend a help to the achievement of sustainable development goals (SDGs).

Keywords: Water, Hygiene Practices, prevention, waterborne infections

INTRODUCTION

Globally water is one of the prime necessities of human existence and plays vital role in the maintainers of life. Water is recognized as one of the most abundant commodities on earth's surface that is made of two molecules of hydrogen and one molecule of oxygen (H_20), clean water may be colourless, tasteless, odourless and free from harmful substances of any sort including pathogenic organisms (American Water Works Association, (AWWA) 2017). Natural sources of water include rainfall, rivers, borehole, tap, spring, lake oceans and seas water and it is be consumed by both man and animal. When water is contaminated it carries communicable enteric diseases, some of the causative organisms maybe present and can result to waterborne infection. Water is indispensably required for domestic needs such as drinking, bathing, washing and cooking. Failures to ensure the safety of water expose it to contamination which leads to the risk of disease outbreaks (Ayoade, 2017). According to Jeffrey (2017), waterborne infection remains the leading cause of

human morbidity and mortality worldwide. Hence ensuring universal access to portable water remains the major action for the prevention of many diseases including waterborne infections.

Waterborne infections according to World Health Organization (WHO) (2020) over 2.6 billion people lack access to clean water, which is responsible for about 2.2 million deaths annually, of which 1.4 million are secondary school students. Nigeria as a country is facing many waterborne related challenges and it is disheartening that majority of the population does not have access to portable drinking water and most rely on the use of unsafe sources to satisfy basic needs (United Nations Children Education Fund (UNICEF) and World Health Organization (WHO) (2012). Consequently, accessible water sources in Nigeria include boreholes, wells, springs, streams, lakes, rainwater, and government distributed municipal water are not portable for usage, most of which fall within the category of unimproved drinking water which then may constitute to waterborne infections (UNICEF and WHO, 2012).
Waterborne infections according to Ezenwaji (2014) are caused by various bacteria, virus, protozoa and pathogenic microorganisms and usually occur as a result of poorly treated drinking water and wastewater or a natural disaster, like flooding and environmental pollutants. Waterborne infections outbreak may result in transmission of gastrointestinal diseases which includes *E. coli,* faecal streptococci, C. perfringes, Vibro cholera, Cryptosporidium, *Campylobacter*, *Salmonella Spp Shigella,* Chemical agents, Hepatitis A virus, Norovirus, *Giardia,* and other agents. The outbreak occurred either when drinking water supplies were not adequately treated after contamination with surface water or when surface waters contaminated with enteric pathogens have been used for recreational purpose (Karen & Anna, 2018). Many rivers, streams and wells worldwide are affected by fecal contamination, leading to increased health risks to persons exposed to the water and degradation of recreational and drinking water quality (Andi, 2019). Recently, cholera and other diarrheal disease outbreaks were reported in Enugu State, these outbreaks were attributed to contaminated drinking water and poor hygiene practice (Anyadike & Igu, 2022).

Good hygiene practice can help to improve quality of water. The set of practices associated with the preservation of health and healthy living is generally referred to as hygiene. Hygiene in a variety of settings plays an important role in preventing the spread of infectious diseases. According to Ajayi (2018) hygiene is the science of preserving and promoting one's health and it focuses on both personal health conducts. It includes procedures used in a variety of domestic situations such as hand hygiene, respiratory hygiene, food and water hygiene, general home hygiene (hygiene of environmental sites and surfaces).

Hygiene is based on identifying the routes of pathogen spread in the school and introducing hygiene practices at critical times to break the chain of infection. According to University of Maryland Medical Center UMMC (2018) hygiene is the conditions and practices that preserve the quality of good water to prevent contamination and waterborne infections. Sources of water and water storage play an important role in ensuring safety and avoiding poor hygiene practice in handling water because it is a vehicle for transfer of micro organisms.

Hygiene practices are the process to maintain health and prevent the spread of waterborne diseases. According to Centre for Diseases Control CDC (2020) hygiene practices have wide range of healthy

behaviours, such as hand washing and safe sewage disposal. One of the most important practices that are central to the prevention of the spread of waterborne infectious is proper hygiene practice. Murray (2015) noted that waterborne infections are usually severe. However, some can be serious and potentially life threatening. The hygiene practices under which water is stored is equally important, water hygiene is the process of filtering and purifying water. An example of water hygiene practice may be removing impurities from water although these practices are essential to overall purity and interrupting the spread of infections. Furthermore, it should be noted that adequate water storage is essential in ensuring safety water. Consequently, poor hygiene practices encourage waterborne infections and improving on hygiene practice reduces the chances of increasing infections which can be done through prevention (CDC, 2019).

Prevention is an essential component of public health. However, prevention is the science and art of preventing diseases, promoting health and prolonging life through organized effort of society (Achalu, 2015). According to Robert (2020) prevention is the act or practice of eradicating, stopping, avoiding occurrence of diseases. One of the goals of public health is to prevent waterborne infection among people especially that of male and female secondary school students, predicting and preventing the impact of any possible outbreak of diseases. Prevention refers to measure taken to prevent diseases instead of curing or treating the symptoms (prevention is better than cure). Prevention is the scientifically method of preventing diseases, it involves the acquisition of facts, information, descriptions or skills necessary to hinder the occurrence of waterborne infections may be prevented among secondary school students (Osagie, 2020). According to Steve (2020), prevention of water borne infections may be carried out through reducing the risk of contracting or transmitting disease causing pathogens by following these steps; washing of water storage and drinking containers thoroughly and regularly, disinfecting contaminated water before drinking or using for domestic purposes, practicing good hygiene from the water sources. Waterborne infections outbreaks focuses on containing the spread by protecting susceptible persons while managing the more advanced stages of the water borne infections cycle, namely the biological evidence of infection, clinical illness and progression of disease in infected persons. Biological evidence may be determined by microscopy of the water using low power objective. Such may reveal the presence of algae and protozoa. Assessing of this might help to determine the source of odour and taste in water that may have been contaminated through poor personal hygiene practice and poor water storage practice (CDC, 2020).

Personal hygiene practice is an important global issue. According to WHO (2016) poor personal hygiene practice may have attributed to high percentage of waterborne infection especially in secondary schools. Dong (2015) explained that personal hygiene practice is the process of maintaining cleanliness of one's own body. Good hygienic care as well as practices in term of personal hygiene may contribute to the factors relating to healthful living and prevention of waterborne infections. Personal hygiene practices according to Hassan (2012) may involve those activities performed by individual to prevent waterborne infections such as provision of portable drinking water not to be contaminated by improper feces disposal; having personal drinking container, washing the drinking container may be constant and regular hand washing. Therefore, personal hygiene practice is important for the

preventing the transmission of harmful organism and adequate water storage is essential in ensuring in prevention of waterborne infections.

Water storage practices refer to the scientific discipline describing the handling and storing water in a way to prevent waterborne infections organisms (American Water Works Association, AWWA 2017). UNICEF/WHO (2012) emphasis that water storage practices may be routines that may be adopted to avoid water contamination such as: purifying water from source, regular water testing, regular covering of water storage, thorough inspection of water from all the suppliers, avoid water pipe contamination, regular filtrations, preservation and purification of water. On the other hand, before water may be stored there should appropriate treatment measures filtration and purification (generally through chlorination) to avoid waterborne infections (Nwosu, 2015).

Nevertheless, with this coordinated effort water borne diseases may be prevented through various actions such as to ensure safe water supply in all secondary schools and suspicious water should always be avoided, there should be water sample testing from all sources as well as delivery points (sample check survey), chlorine estimation at various consumable points, cleaning of underground and overhead water tanks, provision of deep hand pumps where the scarcity of water is seen to occur, removal of shallow hand pumps if resistance is observed they are painted red with a slogan "Water not Fit for Drinking". Wherever drinking water is required, it will be supplied through NDMC water tankers to secondary schools (Nwosu, 2015) which can be achieve through Sustainable development goals.

Sustainable Development Goals (SDGs) are at the forefront of government initiatives across the world. The SDGs from part of the in the United Nations UN and Department of Economic and Social Affairs (UNDESA) provides substantive support and capacity-building for the SDGs and their related thematic issues, including water, energy, climate, oceans, urbanization, transport, science and technology, SDGs plays a key role in the evaluation of UN system wide implementation of the 2030 Agenda and on advocacy and outreach activities relating to the SDGs. In order to make the 2030 Agenda a reality, broad ownership of the SDGs must translate into a strong commitment by all stakeholders to implement the global goals (United Nation, 2023).

The rationale for sustainable development is to meet human needs while preserving the health practices and prevention so that these needs can be met not only in the present, but also for the generations to come. The 1987 World Commission on Environment and Development (WCED), otherwise known as the Brundtland Commission, viewed sustainable development as development that meets the needs of the present without compromising the ability of future generations to meet their own need. The report of this commission looked at sustainable development as a process of change in which the exploitation of resources, the direction of investments, the orientation of technological developments, and institutional change are all in harmony and enhance both current and future potential to meet human needs and aspirations (Esan and Adewunmi, 2022). Sustainable development goals consists 17 goals. One of the targets is to end the epidemic which waterborne infection is inclusive. Base on the findings of this study, many intervention of preventing the waterborne infection have not been sustained especially in secondary schools. Waterborne issues are major roadblocks to the achievement in health goals and

achievement of the Sustainable development goals (SDGs) may be mirage especially in secondary schools (Ani, 2023).

Secondary school is one of the critical aspects of the education of a child, it is the bridge between primary and higher institution. Secondary school may be considered as the heart of the nation's life in democracy. According to Jegede (2013), secondary school is the level of education made available for learners after primary education. It is one of the levels of education empowered by the government to make available to everyone in the country. The importance of secondary school in the Nigeria educational system cannot be overemphasized. Apart from serving as the link between primary and tertiary education, it provides opportunity for a child to acquire additional knowledge, skills and traits beyond primary education (Federal Republic of Nigeria, 2013). FRN further stated that secondary school students are neglected group that faced a lot of waterborne infections, which has been regarded as a serious public health challenges that affect both male and female students. It is against this backdrop that the present study was positioned to ascertain the hygiene practices and prevention of waterborne infections for sustainable water development among students in Nkanu West, Enugu state.

Statement of the Problem

Currently, there is serious scarcity of portable water supply in Nigeria especially in Enugu State. The problems associated with drinking water encountered in some parts of Nigeria have created a public health concern. Lack of portable drinking water may be the leading cause of waterborne infections in secondary schools. Nigeria is one of the countries suffering from the crippling burden of water related diseases. Waterborne infections are caused by drinking contaminated water by disease causing microbes or pathogens. Unsafe water supplies and unhygienic practices are still important causes of infectious disease such as Cholera, Leptospirosis, Giardiasis, especially in rural secondary schools in Enugu State. Water-borne infection may be described as microorganisms emerged from consumption of fecal-contaminated water which is divided into four subcategories, including enter viruses, bacteria, protozoa and helminthes. Despite the well-categorized water associated infections, few of them have been grouped as neglected tropical waterborne infectious diseases, including trachoma, schistosomiasis, leptospirosis, human African trypanosomiasis, dengue, lymphatic filariasis.

The inabilities of school authorities to provide good drinking water and proper storage system in the school have led to assessing hygiene practice and prevention of waterborne infections. Where water is provided, students share cups and water cans in such a manner that those having waterborne infections can easily transfer the diseases. Therefore, inability to practice proper hygiene practices and improper water storage have seriously attributed to waterborne infections. It is against the above discussion that the study tends to assess the hygiene practices and prevention of waterborne infections for sustainable water development among students in in Nkanu West LGA, Enugu State. The problem of this study is what are hygiene practices and prevention of waterborne infections among students in public secondary schools in Nkanu West LGA, Enugu State? The problem of the study lies in the health consequences of waterborne infections

Purpose of the Study

The purpose of the study was to assess the hygiene practices and prevention of waterborne infections for sustainable water

development among students in in Nkanu West. Specifically the study sought to:

1. assess the personal hygiene practices and prevention of waterborne infections among students in public secondary schools in Nkanu West.
2. assess the water storage practices for the prevention of waterborne infections among students in public secondary schools in Nkanu West.

Research Questions

The following research questions guided the study:

1. What are the personal hygiene practices for the prevention of waterborne infections among students in public secondary schools in Nkanu West?
2. What are the water storage practices for the prevention of waterborne infections among students in public secondary schools in Nkanu West?

Research Hypotheses

The following null hypotheses were formulated to guide the study and were tested at 0.05 level of significant.

Ho_1: There is no significant difference in the responses of male and female students in public secondary schools in Nkanu West on the personal hygiene practices for the prevention of waterborne infections

Ho_2: There is no significant difference in the responses of male and female students in public secondary schools in Nkanu West on the water storage practices for the prevention of waterborne infections

Methods

Descriptive survey research design was adopted. Nworgu (2015) defined descriptive survey research designed as one in which a group of people or items are studied by collecting and analyzing data from only a few of people or items considered being representative of the entire group. The design was suitable because the study was meant to gather information from a part of the population and the findings generalized to the entire population.

The population for the study consisted of 3644 students from twelve (12) public secondary schools (1639 male and 2005 female) in Nkanu West Local Government Area of Enugu State. The public secondary schools are preferred because of the uniform standard of programmes and students disposition which provided platform for uniform and accessible data. The sample size for this study was 360 respondents; the sample size was determined using Taro Yamane formula. To arrive to the respondents two sampling procedure was adopted in selecting the respondents. Firstly, purposive sampling technique was used to sample nine schools out of twelfth secondary schools from Nkanu West LGA. The second stages involve the use of proportionate sample to sample (40) forty students from each of the nine coeducational schools that were sampled which gave the total number of 360. Of this number 160(44.4%) are male and 200 (55.5%) are female.

The researchers developed structured questionnaire titled Hygiene Practices and Prevention of Waterborne Infections Questionnaire (HPPWIQ) is made of two sections. Section A deals with the demographic data of the respondents while section B contains items arranged according to the research questions that guided the study. The respondents were requested to tick in the box provided. Items under section B have response options, the respondents ticked under Yes or No as it applies to them. Before the validation, the questionnaire had (19) item statements but after the validation it increase to (23) items. To ascertain the internal consistency of the instrument, Kuder Richardson was used to compute the

reliability estimate of the items. At the end of this, reliability index of .76 and .84 were obtained for clusters A and B respectively. The instrument has an overall reliability index of .86 which indicates that it is reliable and therefore, considered appropriate for use.

The researchers with the help of two research assistants who are prospective graduates of Human Kinetics and Health Education Department in (ESUT) helped to administer the instrument directly to the respondents. The research assistants were briefed on the modality on how to administer and collect the instrument and to be polite to the respondents. Data collection last for one week. Copies of filled questionnaire were collected on the spot which gave 100% return rate. The research question was answered using frequency counts and percentages while chi-square was used to analyze the hypotheses. Therefore, 50 percent and above on the positive responses are regarded as positive practice (PP) while responses that are below 50 percent are regarded as negative practice (NP). The decision for Hypotheses is that do not reject if the calculated χ^2 value is less than the critical value if otherwise reject.

Research Question 1: What are the personal hygiene practices for the prevention of waterborne infections among students in public secondary schools in Nkanu West?

Table 1: Frequency and percentage scores on the personal hygiene practices for the prevention of waterborne infections among students in public secondary schools in Nkanu West

Personal hygiene practices for the prevention of waterborne infections **(n=360)**

S/N	Items	Yes		No		
		F	%	f	%	DEC.
1.	Proper feces disposal	127	35.3	233	64.7	NP
2.	Regular hand washing	136	37.8	224	62.2	NP
3.	Drinking portable water	82	22.8	278	77.2	NP
4.	Regular washing drinking containers before usage	101	28.1	259	71.9	NP
5.	getting water from clean sources NP	94	26.1	266	73.9	
6.	Hygiene sanitary conditions	119	30.1	241	66.9	NP
7.	Regular covering of drinking containers	90	25.0	270	75.0	NP
8.	Defection in open sources	220	61.1	140	38.**9**	NP
9.	Regular washing of drinking container	118	32.8	242	67.**2**	PP
10.	Having personal drinking container	142	39.4	218	60.**6**	NP
	Overall percentage	**33.9**			**66.1**	**NP**

Table 1 shows that proper faeces disposal (35.3%), regular hand washing (37.8%), provision of portable drinking water (22.8%), regular washing drinking containers before usage (28.1%), getting water from clean sources (26.1%), hygiene sanitary conditions (30.1%), regular covering of wells (25.0%), defection in open

sources (61.1%) regular washing of drinking container (32.8%), having personal drinking container (39.4%). The overall percentage of assessing personal hygiene practice for the prevention of waterborne infections was (33.9%) and (66.1%). The table showed that the respondents had negative practice for personal hygiene practices for the prevention of waterborne infections among students in public secondary schools in Nkanu West.

Research Question 2: What are the water storage practices for the prevention of waterborne infections among students in public secondary schools in Nkanu West?

Table 2: Frequency and percentage score on the water storage practice for the prevention of waterborne infections among students in public secondary schools in Nkanu West.

Water storage practice for the prevention of waterborne infections **(n=360)**

S/N	Items	Yes		No			
		F	%	f	%	DEC.	DEC.
11.	Good water preservation	107	29.7	253	70.3	NP	
12.	Regular water filtrations before storage	98	26.8	267	73.2	NP	
13.	Regular water purification before storage	102	30.7	253	69.3	NP	
14.	Avoidance of contaminated water	104	28.9	256	71.1	NP	
15.	Disinfecting water storage	34	9.3	331	90.7	NP	
16.	Purification of water before storage	58	15.9	307	84.1	NP	
17.	Storing water in dirty water can	104	39.5	221	60.5	NP	
18.	Regular water testing before storage	36	15.3	309	84.7	NP	
19.	Regular clearing of water storage tanks	25	6.8	340	93.2	NP	
20.	Regular supply of portable water for storage	69	18.9	296	81.1	NP	
21.	Thorough inspection of water from the supplier before storage	79	21.9	281	78.1	NP	
22	Procurement of clean water supply	130	36.1	230	639	NP	
23	Regular covering of water storage	108	30.0	252	70.0	NP	
	Overall percentage		**35.4**		**64.6**	**NP**	

Table 2 shows The Table indicates that good water preservation (29.7%), regular water filtrations before storage (26.8%), regular water purification before storage (30.7%), avoidance of contaminated water (28.9%), disinfecting water storage (9.3%), purifying water from source (15.9%), Storing water in dirty water can (39.5%), regular water testing before storage (15.3%), regular cleaning of water storage tanks (6.8%), regular supply of portable water for storage (18.9%), thorough inspection of water from the supplier before storage (21.9%), procurement of clean water supply (36.1%) and regular covering of water storage (30.0%). Therefore, the overall percentage of Yes (35.4%) and No (64.6%) on the water storage practice for the prevention of waterborne infections, the table showed that the respondents had negative practice for water storage practices for the prevention of waterborne infections among students in public secondary schools in Nkanu West.

Hypothesis 1: There is no significant difference in the responds of male and

female students' in public secondary schools in Nkanu West on the personal hygiene practices for the prevention of waterborne infections

Table 3: Chi-square Analysis of Null Hypotheses of there is no Significant Difference in Responses the personal hygiene practices for the prevention of waterborne infections among students in public on secondary schools in Nkanu West.

GENDER	Observed N	Expected N	Residual	χ^2	Df	Sig.	Decision
MALE	160	180.0	-20.0	4. 444	1	.035	Reject
FEMALE	200	180.0	20.0				

From table 3 above shows the Chi-square value with the corresponding p-value for hypothesis of significance difference on personal hygiene practices for the prevention of waterborne infections (χ^2 = 4.444. df=1, p=.035< .05). Since the p-value was below.05 level of significance the null hypothesis was therefore rejected. This implies that there is no significant difference in responses the personal hygiene practices for the prevention of waterborne infections among students in public on secondary schools in Nkanu West.

Hypothesis 2: There is no significant difference in the responses of male and female students in public secondary schools in Nkanu West on the water storage practices for the prevention of waterborne infections

Table 6: Chi-square Analysis of Null Hypotheses of there is no Significant Difference in Responses on the water storage practices for the prevention of waterborne infections among students in public secondary schools in Nkanu West.

GENDER	Observed N	Expected N	Residual	χ^2	Df	Sig.	Decision
MALE	160	180.0	-20.0	4. 444	1	.040	Reject
FEMALE	200	180.0	20.0				

From table 3 above shows the Chi-square value with the corresponding p-value for hypothesis of significance difference on water storage practices for the prevention of waterborne infections (χ^2= 4.444. df=1, p=.040< .05). Since the p-value was below .05 level of significance the null hypothesis was therefore rejected. This implies that there is no significant difference in responses the personal hygiene practices for the prevention of waterborne infections among students in public on secondary schools in Nkanu West.

Discussion of findings

The results of the study revealed that the respondents' shows negative responses to personal hygiene practice for the prevention of waterborne infections among students in public secondary schools in Nkanu West. This finding confirms with CDC (2020) explained that risk of waterborne infection is higher in areas with: Inadequate water supply, poor quality of water and sewage pipelines, poor sanitary conditions, and uncovered wells used as sources of drinking water, defecation in the open especially near sources of drinking water, contaminated

during supply and storage system. This also affirmed with WHO (2016) reported that poor hygiene practice may have attributed to high percentage of waterborne infection especially among secondary school students. However, results also revealed that the significant differences were (χ^2 = 4.444. df=1, p=.035< .05). Since the p-value was below.05 level of significance the null hypothesis was rejected. Therefore, Hassan (2012) advanced that students should be sensitized on how to prevent waterborne infections. This is disheartening because majority of secondary schools in the study area does not have access to portable drinking water which have lend to poor personal hygiene practice for the prevention of waterborne infections.

Further findings shows that there are negative responses to water storage practice for the prevention of waterborne infections among students in public secondary school in Nkanu West. This finding confirmed with the findings of UNICEF/WHO (2012) that observed water storage practices are routines that may be adopted to avoid water contamination. World Health Organization WHO (2020) also reported that the source of water and water storage play an important role in ensuring water safety hence avoidance of poor hygiene practice in handily water is very necessary since it is one of the vehicles for transfer of micro organisms. Further result revealed that the significant differences were (χ^2 = 4.444. df=1, p=.040< .05) then the p-value was below.05 level of significance the null hypothesis was rejected. Therefore, Nwosu (2015) reported that students should be carrying out regular hygiene practices for proper water storage practice for the prevention of waterborne infections. This is not surprising because water storage practices have not been adopted in the study area.

Conclusion

Based on the findings of the study, the following conclusions were drawn that Lack of clean water supply, sanitation and proper hygiene practices are major causes for the spread of waterborne diseases in secondary schools. Therefore, adequate personal hygiene practice and proper water storage practice are paramount important for the prevention of waterborne infections.

Recommendations

Based on the findings and conclusion of the study, the following recommendations were proffered:

1. School management should endeavor to contribute to the prevention of waterborne infections among public secondary schools in the study area.
2. The researcher also recommended that sensitization and health education programme should be organized by school management to educate in-schools on need to practice good hygiene and upgrade on ways of storing water so as to help in the prevention of waterborne infections among students in public secondary schools in the study area.

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