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Storage Mechanisms For Health Commodities Management And Service Delivery: A Case Of Level 4 Public Hospitals In Western Kenya

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Abstract: ***Health commodities are stored and managed at the hospital warehouses and service delivery unit stores in level 4 hospitals to promote accessibility and availability at all times. Despite huge sums of money spent by county governments and other stakeholders to purchase health commodities in Kenya, service delivery interruptions due to inadequate health commodities is still recorded in public hospitals leading to patients dissatisfaction. The objective of this study was to establish the relationship between storage mechanisms used for health commodities at the hospital warehouse plus unit stores and service delivery at level 4 public hospitals in western Kenya. The target population was 99 level 4 public hospitals with NHIF codes within the region and 426 respondents. The hospitals were sampled using stratified sampling technique and the sample size calculated using Yamane formula (1967) giving 79 public hospitals. For the respondents both at the county and hospital levels, purposive sampling technique was used giving a sample size of 346 respondents. The respondents included nursing officers, medical laboratory technologists, pharmaceutical officers and warehouse personnel handling health commodities at the hospitals plus health administrators, finance officers and supply chain management officers at the county health management office in each county. Data collection instruments used were structured questionnaires, observation checklists and interview schedules whose reliability and validity were tested to ensure internal consistency at > 0.70. Descriptive statistics and regression analyses models were used to analyze the collected data. Data was presented in tables as was appropriate in the study. The findings obtained from the regression model were at R^2 value of 0.881, p = 0.000, β = 1.182 and F = 2215.867. This implied that 88.1% of variation in service delivery was determined by the storage mechanisms used at the hospital warehouses and unit stores and also indicating that a unit change in storage mechanisms at the hospital warehouses and unit stores led to an increased improvement of service delivery by 1.182 units at the level 4 public hospitals in western Kenya. The study therefore, conversely asserted that good storage mechanisms at the level 4 public hospitals was one of the key factors in determining the availability and accessibility of health commodities thus efficient service delivery to patients. The study recommended that every level 4 public hospital should have a designated hospital warehouse and unit stores with ideal storage conditions at each service delivery unit as per the guidelines.***

Keywords: ***Storage Mechanisms, Hospital Warehouse. Unit stores and service delivery***

I. INTRODUCTION

Public health landscape is changing rapidly throughout the world due to devastating health problems ranging from communicable diseases that are either bacterial, parasitic or viral to non-communicable conditions that are termed as lifestyle diseases among the population. To combat these problems of public health concern, huge resources like adequate infrastructure, human resource and effective, functional health commodities management systems are required. In Sub Saharan Africa where the disease burden is highest, demand at the hospitals to have adequate health

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commodities has greatly increased the complexity and burden on public health supply chains. Therefore to ensure health commodities security using the scarce resources, there is need for both developed and developing countries to take a holistic view of public health systems and optimize the supply chains (MSH, 2012 and USAID, 2011).

A. STORAGE MECHANISMS FOR HEALTH COMMODITIES

Storage mechanisms for health commodities at the hospital warehouse and service delivery units entails keeping of the products in a safe, secure and accessible location that will maintain the physical integrity and quality of the products awaiting use (USAID, 2008). Characteristics of good storage areas that were assessed and observed by the study at level 4 public hospitals include availability of adequate space, good ventilation, lockable, clean, dry, well arranged, accessible stores free of harmful insects and rodents. Other conditions include availability of cold chain systems, fire safety equipment, use of shelves and pellets to raise the products from the ground and separation of expired, damaged or obsolete health commodities (USAID, 2011). Availability of ideal storage facilities at the level 4 public hospitals reduce wastages, pilferage, theft, expiries and also help in maintaining quality and potency of the health commodities.

B. SERVICE DELIVERY AT LEVEL 4 PUBLIC HOSPITALS

The primary goal of any hospital is to offer quality services to patients seeking medical attention. Patients with different illness visit hospitals to receive medical attention to revert the conditions which may cause disabilities, spread of communicable diseases or death in case of delayed response (Ali, 2013 and WHO, 2000). Service delivery is an output of health workforce, health commodities and health finance. These inputs should be well coordinated, accessible and timely to meet the patients demand (Barouch, 2011 and American Health Association, 2000). Efficient service delivery according to WHO (2010), is one of the six health system strengthening pillars promoting quality health outcomes, therefore, for any hospital to record it, skilled personnel, appropriate infrastructure, adequate health commodities, effective communication strategy and standard operating procedures to guide the processes are very vital (Owino and Kinoti, 2015, Hodge and Brown, 2011 and Shaw, 2003). The indicators measured by the study under service delivery were accessibility, reliability, responsiveness, quality assurance and safety. Study was conducted at level 4 public hospitals guided by Government policies and guidelines.

C. STATEMENT OF THE PROBLEM

Quality patient management does not only depend on health workforce knowledge, skills and expertise but also on other support functions like effective and functional health commodities management systems. This will ensure availability and accessibility of health commodities at the service delivery to promote efficient service delivery. Despite huge expenditure for health commodities, several studies still indicate high cases of wastages, pilferages, theft and expiries leading to inadequate health commodities at service delivery units thus delayed response to different medical cases leading to patients dissatisfaction and sometimes death at level 4 public hospitals.

D. GENERAL OBJECTIVE

To establish the relationship between storage mechanisms used for health commodities management and service delivery at level 4 public hospitals in western Kenya.

a. SPECIFIC OBJECTIVES

- ✓ To assess the availability of hospital warehouse (central store) for storing all supplied health commodities at level 4 public hospitals
- ✓ To assess the availability of unit stores at each service delivery unit of casualty, laboratory and pharmacy for holding unit commodities from either the hospital warehouse or suppliers for use
- ✓ To evaluate availability of ideal storage conditions at the hospital warehouse and unit stores at level 4 public hospitals
- ✓ To determine knowledge and skills of the health commodities users on good storage mechanisms promoting availability and accessibility of health commodities at the service delivery units.

II. LITERATURE REVIEW

A. THEORETICAL REVIEW

The study adopted two theories Contingency theory and theory of constraints

a. CONTINGENCY THEORY

This is an organizational theory that was developed by Fred Fiedler in 1958 that rejects classical management theory of having only one best way of structuring and managing an organization but instead depend on various factors and contingency variables such as firm strategies and technology used (Holmes, 2013 and Donaldson, 2001). The theory states that the organization will not undergo structural adjustments in the event of any mismatch between the organization structure and contingent variables but the contingencies will dictate the explicit structure, activities and management style of an organization (Hicks, McGovern and Earl, 2001). Fiedler (1964) developed and evaluated a contingency model allowing mangers to always assess the changes in the environment and determine the appropriate decisions to promote efficient organization performance (Northouse, 2007). This can be adopted at level 4 public hospitals by commodities users and determined appropriate storage mechanisms that will ensure appropriate handling of health commodities to promote efficient service delivery at the units.

b. THEORY OF CONSTRAINTS

Theory of constraints was developed by Dr. Goldratt stating that there is always at least one constraint limiting organization performance (Goldratt, 2004). The theory is based on the principle that a chain is only as strong as the weakest link or constraint (Kazim, 2008). Level 4 public hospitals strong links are health workforce with wealth of technical expertise guided by well laid down policies, guidelines and procedures for quality patients management and better health outcomes. However there are still weakest links causing high rates of deaths, disabilities and spread of communicable diseases among patients seeking medical attention as reported by different surveys. This study was conducted in order to identify any constrain(s) in storage mechanisms used for health commodities at the hospital warehouses and unit stores of casualty, laboratory and pharmacy limiting efficient service delivery to patients then propose interventions and periodic performance evaluation that can be adopted by the public hospitals for improvement.

B. EMPIRICAL REVIEW

Hospital warehouses and unit stores are key component of the health sector supply chain that ensures availability and accessibility of health commodities at service delivery units. When properly managed and appropriately stocked, the hospital warehouses and unit stores apart from ensuring consistency in health commodities quantities will also ensure maintenance of the commodities potency thus promote efficient service delivery to patients.

A study was conducted in Canada by Blandine, Smail and Michael (2018) to assess current issues and future challenges on healthcare logistics and supply chain established that electronic information systems were a great source of improvement in medical stores and had impact on replenishment system performance. Also the study found out that significant time which could be used by nurses to provide quality care to patients was wasted at the central store therefore the study suggested need to decentralize nursing unit storage areas. Didier, Jacob, Corinne and Abdoulaye (2013), conducted a study in Benin to estimate how access to storage technologies and storage losses from insects affects a smallholder African farmers' decision to hold grain from production, in an environment of high price variability. The findings established that access to storage chemicals increases the average quantities of grains stored. It also highlighted various gaps and conclude that there was need to develop effective and accessible new or improved storage technology for small farmers in Sub-Saharan Africa.

A study on effectiveness of stores management on turnover performance was conducted by Namakajjo (2011) at the National Medical stores Uganda using a cross sectional research design methodology. The findings revealed that good storage practices had a strong effect on inventory turnover thus improve performance. A study was conducted by Akingeneye (2019) to assess storage conditions of pharmaceutical products in Rwanda using descriptive-analytical research design. Results indicated that warehouses were available in all the sites but did not meet the standard in terms of space, ventilation, security and storage conditions. Also, there was lack of staff refresher trainings and updates. Mwebia (2016), also conducted a study to analyze effects of effective storage and material handling on the tobacco company profitability in Migori, Kenya. The study established that cost reduction of production and improved profitability were attained using improved systems through effective storage mechanisms and material handling. The study recommended regular training and updates to material handlers plus store keepers and allocation of adequate funds for proper planning at the departments.

III. METHODOLOGY

The study adopted cross sectional research design and positivism philosophy to handle and address data from different sources. The target population was 99 level 4 public hospitals in western Kenya and 426 respondents comprising of nursing officers, medical laboratory technologists, pharmaceutical officers, store personnel and county health management teams consisting of health administrators, accountants and supply chain management officers. Stratified sampling technique was used to sample the level 4 public hospitals where each county formed a stratum from which samples were selected randomly using simple random technique. Yamane formula (1967) was used to calculate the sample size of 79 hospitals. Purposive sampling technique was used for the respondents both at the hospitals and county health management levels. Data was collected using questionnaires, observation checklists and interview schedules and analyzed by descriptive statistics and inferential analysis. Both bivariate and multivariate linear regression model were used and study hypotheses were tested and would be rejected if $p > 0.05$.

IV. STUDY FINDINGS

Descriptive statistics and inferential analysis were conducted and results summarized as shown in the tables below

	Interviews	**Questionnaires**	**Observation Checklists**
Target	30	316	79
Completed	28	301	77
Proportion	93.3%	95.3%	97.5%

Source: Survey Data, (2021)

Table 4.1: Survey Response Rate from Interviews, Questionnaires and Checklists

Table 4.1 indicates that the overall response rate of the study was at 95.4% where the interview schedules data contributed to 93.3% while the questionnaires and observation checklists contributed to 95.3% and 97.5% respectively. The researcher and research assistants failed to administer two observation checklists and eight questionnaires since two of the selected level 4 public hospitals had been turned into COVID 19 treatment sites. Also, seven healthcare providers at

the hospitals and two county health managers declined to participate in the study.

Observation Checklists	Yes		No	
	Freq.	%	Freq.	%
Availability of designated hospital warehouse	31	40.3	46	59.7
Availability of good storage conditions at the designated hospital warehouse	7	22.6	24	77.4
Availability of designated service delivery unit stores	63	81.8	14	18.2
Availability of good storage conditions at the designated service delivery unit stores	22	34.9	41	65.1
Availability of hospital room thermometer at the hospital warehouse and unit stores	26	33.8	51	66.2
Availability of well documented temperature charts for monitoring cold chain health commodities	6	7.8	71	92.2
Availability of Expiry Monitoring chart at the hospital warehouse and unit stores	38	49.4	39	50.6
Availability of well marked expiry monitory chart displayed on each store wall	6	15.8	32	84.2
FEFO/FIFO rule being observed at the hospital warehouse and unit stores	74	96.1	3	3.9
Availability of stock/bin card for each health commodities at the hospital warehouse or unit stores	49	36.4	28	63.6
Proper documentation on the available stock/bin cards at the stores	29	40.8	20	59.2
Availability of appropriately filled accountability tools like S11 at the hospital warehouse and unit stores	67	87.0	10	13.0
Availability of monthly physical count records at the hospital warehouse and unit stores	27	35.1	50	64.9

Source: Research Study, 2021

Table 4.2: Frequency of Storage Mechanisms

From table 4.2 above, only 40.3% of the level 4 public hospitals had designated hospital warehouses out of which 77.4% did not have good storage conditions as per the standards. 81.8% of the hospitals had service delivery unit stores or commodities holding areas however 65.1% of the unit stores did not meet standard storage conditions. It was also noted that despite availability of cold chain systems for health commodities that require refrigeration, 92.2% of the hospitals were not monitoring and documenting temperatures on the charts. 49.4% of the hospitals had expiry monitoring charts at the hospital warehouse and unit stores however only 15.8% of these hospitals especially in laboratories had well marked expiry charts displayed on the walls. 63.6% of the hospital warehouses and unit stores did not have stock/bin cards assigned for each health commodity. Out of the available stock/bin cards, 59.2% were poorly filled. 87% of the hospitals had accountability tools like S11 and delivery notes which were appropriately filled and filed however 64.9% of the hospitals were not conducting monthly physical count as per the guidelines.

The key informants reported that *"the level 4 hospitals lack adequate storage space to accommodate the pharmaceuticals, non-pharmaceuticals, diagnostic reagents, equipment and other health commodities. Also > 50% of these hospital warehouses double as the central Sub County storage units for the rural health facilities making control of health commodities in the hospitals very difficult. At the service delivery units, cupboards, cabinets and shelves have been improvised as stores and the storage conditions like control temperatures, good ventilation and lighting, availability of shelves and pellets for proper arrangement of the commodities are inadequate. This has promoted theft, pilferages, expiries and loss of potency at the stores creating health commodities management breakdown. If funds can be available, each level 4 hospital should have one big hospital warehouse for all health commodities storage and small unit stores to act as holding areas once the commodities are taken to the service delivery units for use. This will create easy monitoring and evaluation, reduce pilferages and theft".*

		Descriptive Statistics				
Items	N	Frequency		Min.	Max.	Mean (M)	Standard Deviation (SD)
		Agree	Disagree				
Designated hospital warehouse (central store) for storing all the procured or supplied health commodities not available in the hospital	301	285 (95)	16 (5)	3.00	5.00	4.385	0.592
The available hospital warehouse lack good storage conditions in terms of space, ventilation, adequate lighting, pellets, refrigerators for commodities requiring cold chain systems, room thermometers and lockable doors and windows for safety	301	193 (64)	108 (36)	1.00	5.00	3.545	1.567

Service delivery units (casualty, laboratory and pharmacy) lack ideal unit stores for holding the health commodities received for use at the unit	301	213 (71)	88 (29)	1.00	5.00	4.070	1.113
The available unit stores lack ideal storage conditions in terms of space, ventilation, adequate lighting, pellets, refrigerators for commodities requiring cold chain systems, room thermometers and lockable doors and windows for safety at the hospital warehouse and unit stores	301	193 (64)	108 (36)	1.00	5.00	3.615	1.608
FEFO/FIFO rule is being observed by commodities focal persons while distributing health commodities for use from the hospital warehouse to service delivery unit stores or from the unit stores to service delivery points within the units	301	260 (86)	41 (14)	2.00	5.00	4.276	0.744
The hospital warehouse and unit stores do not have well marked Expiry Monitoring Charts displayed on the walls	301	193 (64)	108 (36)	2.00	5.00	3.847	1.182
Temperatures for refrigerators for storing health commodities under cold chain systems are not regularly monitored nor well documented at the designated charts	301	185 (61)	116 (39)	1.00	5.00	3.781	1.331
Room thermometers are not available for monitoring temperatures at the hospital warehouse and unit stores	301	193 (64)	108 (36)	2.00	5.00	3.927	1.201
The hospital warehouse has designated day and time for service delivery units to collect health commodities for use and storage at the unit stores	301	208 (69)	93 (31)	3.00	5.00	4.103	0.844
There is lack of systematic arrangements of the health commodities at the hospital warehouse that is no designated areas for pharmaceuticals, non pharmaceuticals and laboratory reagents or medical equipment but commodities received are mixed up at the warehouse	301	189 (63)	112 (37)	1.00	5.00	3.837	1.269
Accountability tools like S11 are filled in duplicate and being used to collect health commodities from the hospital warehouse and redistribute to various service delivery points within the unit	301	289 (96)	12 (4)	1.00	5.00	4.655	0.698
Health commodities focal persons at each unit are trained on proper storage mechanisms	301	298 (99)	3 (1)	3.00	5.00	4.648	0.485
Individual specified stock or bin cards are not filled for each health commodity but filled in a batch	301	223 (74)	78 (26)	1.00	5.00	4.047	1.015
Safety of the hospital warehouse and unit stores are reinforced and there is a designated officer to handle the key and control access	301	269 (89)	32 (11)	2.00	5.00	4.542	0.690
Regular monthly physical count for health commodities not conducted both at the hospital warehouse and unit stores	301	239 (79)	62 (21)	1.00	5.00	4.259	0.969

Source: Research Data June, 2021

Table 4.3: Descriptive statistics on Storage Mechanisms and Service Delivery

Table 4.3 illustrates that 95% of the respondents agreed that level 4 public hospitals in western Kenya lacks hospital warehouses at (M = 4.385 and SD = 0.592). However, not all the available hospitals warehouses had good storage conditions as was confirmed by 64% of the respondents at (M = 3.545 and SD = 1.567). 71% of the respondents agreed that service delivery units were lacking designated unit stores at (M = 4.070 and SD = 1.113). 64% of the respondents further confirmed that the available unit stores do not have ideal storage conditions at (M = 3.615 and SD = 1.608). FEFO/FIFO rule was being observed at the level 4 public hospitals as shown by 86% respondents at (M = 4.276 and SD = 0.744) however well marked expiry monitoring charts were not displayed on the walls of the stores as per the guidelines as was confirmed by 64% of the respondents at (M = 3.847 and SD = 1.182).

Even though room and refrigerator thermometers were available, monitoring and charting the temperatures were recorded as a challenge, 61% of the respondents agreed that temperatures for cold chain health commodities were not being monitored at (M = 3.781 and SD = 1.331) while 64% of the respondents confirmed that room temperatures were not monitored and documented at (M = 3.927 and SD = 1.201). 69% of the respondents agreed that the hospital warehouses had a designated day and time for the service delivery units to request and collect health commodities at (M = 4.103 and SD = 0.844). Only 37% of the respondents accepted that the hospital warehouse has designated areas for each health commodities like pharmaceuticals, non pharmaceuticals and laboratory reagents supplied to the hospital at (M = 3.837 and SD = 1.262). This leads to easy access and distribution,

monitoring and evaluation of each commodity in the hospital warehouse.

96% of the respondents agreed that accountability was observed at the hospital warehouse and unit stores through appropriate filling and filing relevant tools at (M = 4.655 and SD = 0.698). 74% of the respondents agreed that stock/bin cards are filled in batches not individually for each health commodities at the hospital warehouse or unit stores as per the guidelines at (M = 4.047 and SD = 1.015). Safety at both the hospital warehouses and unit stores were reinforced as was confirmed by 89% of the respondents at (M = 4.542 and SD = 0.690). Monthly physical count and documentation of health commodities is recommended as ideal by the guidelines however, 79% of the respondents confirmed that this is not regularly conducted at level 4 public hospitals at (M = 4.259 and SD = 0.969). 99% of the respondents confirmed being trained on proper storage mechanisms at (M = 4.648 and SD = 1.015).

Model Summary

R	R Squared	Adjusted R Squared	Standard Error of the Estimate	R Squared Change	F Change	df1	df2	Sig. F Change
0..939[a]	0.881	0.881	0.341	0.881	2115.867	1	299	0.000

ANOVA

	Sum of Squares	df	Mean Squared	F	Sig.
Regression	257.620	1	257.3202215.867		0.000[b]
Residual	34.762	299	0.116		
Total	292.382	300			

a. Dependent Variable: Service Delivery

b. Predictors: (Constant): Storage Mechanism

Regression Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Standard Error	Beta		
1	(Constant)	0.851	0.105		8.086	0.000
	Storage Mechanism	1.182	0.025	0.939	47.0730.000	

Table 4.4: Regression Analysis of Storage Mechanisms and Service Delivery

Table 4.4 shows regression analysis between storage mechanisms used for health commodities and service delivery at level 4 public hospitals. The correlation coefficient R^2 value of 0.881 was realized by the study implying that 88.1% of variation in service delivery is determined by the storage mechanisms used at the hospital warehouses and unit stores of the level 4 public hospitals in western Kenya. The p value and F statistics were both significant at p <= 0.000 and F value at 2215.867 respectively. This implied that the model was reliable in predicting the relationship between storage mechanisms and efficient service delivery. The regression coefficient (β) was at 1.182 indicating that a unit change in storage mechanisms at the hospital warehouses and unit stores of the level 4 public hospitals led to an increased improvement of service delivery by 1.182 units.

Model Summary

Model	R	R Squared	Adjusted R Squared	Standard Error of the Estimate	R Squared Change	F Change	df1	df2	Sig. F Change
1	0.946[a]	0.895	0.893	0.323	0.895	628.412	4	296	0.000
2	0.948[a]	0.899	0.897	0.317	0.004	522.322	1	295	0.001

ANOVA[a]

Model		Sum of Squares	Df	Mean Squared	F	Sig.
1	Regression	261.579	3	65.395	628.412	0.000[b]
	Residual	30.803	272	0.104		
	Total	292.382	275			
2	Regression	262.707	5	52.541	522.322	0.000[c]
	Residual	29.675	295	0.101		
	Total	292.382	300			

Regression Coefficients

Models		Unstandardized Coefficients		Standardized Coefficients		**Sig.**
		B	**Standard Error**	**Beta**	**t**	
1	(Constant)	1.243	0.177		7.035	0.000
	Storage Mechanisms	0.588	0.101	0.467	5.822	0.000
2	(Constant)	1.336	0.176		7.594	0.000
	Storage Mechanisms	0.675	0.103	0.536	6.577	0.000
	Interaction Term (POL * HCM)	0.235	0.070	0.142	3.349	0.001

a) Dependent Variable: Service Delivery;
b) Predictors: (Constant), Storage Mechanisms, Interaction (Gov. Policies *Health Commodity Management); and
c) Significance level, p<0.05

Source: Research Data, June 2021

Table 4.5: Multiple regression analysis of independent, dependent and moderating variables

The findings in table 4.5 shows that the correlation coefficient R^2 value of 0.895 was obtained indicating relationship between storage mechanisms used for health commodities management as independent variable and service delivery as dependent variable. Considering moderating effects of the Government policies and guidelines, the correlation coefficient R^2 value changed from 0.895 to 0.899 indicating a net positive improvement with R^2 change of 0.004 which is significant. Generation of moderating effects of Government policies and guidelines gave an interaction term of regression coefficient (β) of 0.235. Storage mechanisms also recorded an increase in the regression coefficient (β) from 0.588 to 0.675 and p=0.000 which were significant. From the multiple linear regression results above, there was sufficient evidence that storage mechanisms used for health commodities management at the hospital warehouse and unit stores had a significant positive relationship on service delivery at the level 4 public hospitals.

The findings were similar with findings of a study conducted by Mwebia (2016) which established that efficient storage mechanisms and material handling led to production cost reduction and improved profitability. Also converged with the findings of a study conducted in Uganda by Namakajjo (2011) at the National Medical stores which revealed that good storage practices had a strong effect on performance. The findings however diverged with those of Akingeneye (2019) which established that lack of refresher trainings and updates to the staff led to poor storage conditions

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for pharmaceutical products as the current study established that > 90% of the respondents had been trained on good storage mechanisms.

V. CONCLUSION

The study focused on establishing the relationship between storage mechanisms used for health commodities management at the hospital warehouse plus unit stores and service delivery at level 4 public hospitals in western Kenya. The results indicated positive significant relationship leading to a conclusion that designated stores for health commodities with ideal storage conditions and good storage practices at level 4 public hospitals promotes availability and accessibility of health commodities at the service delivery units thus efficient service delivery to patients.

VI. RECOMMENDATION

There is need to build designated hospital warehouse and unit stores with ideal storage conditions in every level 4 public hospital to reduce pilferages, wastages, theft, expiries and loss of potency.

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