

TRENDS OF IN-PATIENT MORTALITY BETWEEN 2018 AND 2019 AT KISUMU COUNTY LEVEL FOUR HOSPITAL, KENYA

ABSTRACT

A lack of demand for the analyzed mortality data has contributed to dwindling data management on inpatient mortality. Due to insufficient information on patient mortality, healthcare planners rarely use local data in resource allocation and hospital management. This results in missed opportunities to build hospital capacity to address common causes of death, and also results in a poor hospital reputation, fewer patients seeking hospital care, increased medical errors, and increased inpatient mortality. Deaths due to medical error are unmeasured and prevention discussions take place in limited and confidential forums such as hospital death conferences or hospital mortality meetings. The main aim of this study was to determine trends of hospital mortality between 2018 and 2019 at Level Four Kisumu County Hospital, Kenya. The study was a cross sectional retrospective study design in which records of patients who died between January 2018 and December 2019 were randomly picked and examined across four departments: medical, pediatrics, surgery and reproductive health department. Sample size was determined using Yamane Taro formula which yielded 203 as sample size. According to the current study, medical ward had the highest 2-year in-hospital mortality at 13.86% while obstetrics and gynecology (reproductive health) had the least mortality at 0.47%. The current study found that infections caused 42% of deaths in patients aged below 35 years while non-communicable diseases caused 41% of hospital deaths in patients aged >60 years. The study found that there was a significant difference in the odds of a patient dying when a nurse and a doctor were all present (OR=0.697) meaning that presence of doctor and nurse protected the patient from death. Comorbidity was a significant factor associated with death among the patients who died in 2018 and 2019 ($p < 0.05$). Patient related factors such as age, education level and gender were not significantly associated with hospital deaths ($p > 0.05$). This research clearly illustrates that majority of hospital deaths among aged people is due to noncommunicable disease and deaths among young populations is due to infectious diseases but also raises the question of the need to enhance nurse-doctor relationship to reduce avoidable deaths among patients admitted in hospitals. This study was only conducted in one hospital and hence further research is needed to cover more hospitals before generalized conclusions can be drawn.

1. Introduction

Reliable and timely specific mortality data form the basis for the allocation of health planning resources and the timely evaluation of health care interventions. Inadequate quality health care data can misrepresent local health care problems making it difficult to develop good health care policies (Sifuna et al., 2011). In-patient mortality reflects the quality of healthcare. Information on the causes and trends in hospital mortality can improve hospital care for patients. Model-based estimates of mortality trends are widely used in sub-Saharan African countries but are subject to errors due to lack of information on hospital mortality. Examining patient and hospital trends can help identify those who are on-going and those who are lagging so you can strategize to address gaps in health care quality (Mboera et al., 2018). The risk of in-hospital mortality associated with specific comorbidities is relatively higher in surgical patients compared to those without specific comorbidities but the frequency of postoperative complications is increased in elderly patients with acute trauma such as hip fracture (Ma et al., 2017; Sifuna et al., 2011). The purpose of the current study was to generate evidence that can be used by hospital management to reduce avoidable deaths and optimize resources in the hospital.

2. Objective

To determine trends of all-cause in-patient mortality between January 2018 and December 2019 at Level Four Kisumu County Hospital, Kenya

Methodology

3. Research Approach

This study utilized quantitative methods and primary and secondary data sources to achieve the research objectives.

4. Research design

This study was a cross sectional retrospective study design that involved review of records of patients who died between 2018 January 1 and 2019 December 31, at Level Four Kisumu County hospital. This design was used because the data on patients who died during the study period could only be collected in health records department. Patient file review focused on the number of deaths during the study period. The collected information was segregated in terms of age, sex, length of stay and diagnosis at death certification. Demographic data including location of the patient was characterized as to whether the patient was a referral to hospital or not.

5. Target population

The target population in this study was records of all patients who died while receiving treatment at Kisumu County Level four hospital between January 1 2018 12 AM and December 2019 11:59PM.

6. Sampling methods

Systematic sampling and stratified sampling methods were used into order to avoid bias. In systematic sampling, all files for deceased patients who died between January 1 2018 12: 00 AM and December 31, 2019 11:59 were determined by counting (N). Files were then allocated numbers and listed in order of death occurrence per month from January 2018 to December 2019 and this constituted the sampling frame. The files were then segregated per department. After segregation per department, the files were serialized per month each year. The four departments included medical department, surgical department, pediatrics department and reproductive health department. By use of computer program, files serial numbers were picked randomly to arrive at the sample size of 203.

7. Data collection methods and procedures

In each file, information on date of admission, sex of the patient, date of death, diagnosis on admission, diagnosis at death time, address, other pre-existing medical condition were collected and recorded. The data was then entered into SPSS version 29 for windows and coded appropriately.

8. Data analysis techniques and procedures

Data analysis was done by SPSS for windows version 29. Chi-square was used to check association between age, education level, gender, comorbidities, sepsis, hospital acquired infection and mortality. Goodness of fit was run which confirmed that the data was normally distributed thus appropriate for ANOVA which was used to assess variation in ward mortalities and data presented as line graphs.

9. Ethical considerations.

This study was approved by the Mount Kenya University School of Graduate studies and ethical committee MKU/ISERC/2581. The study was also approved by National Commission for Science Technology and Innovation (NACOSTI) approval License number NACOSTI/P/23/23547. Authority to access data and conduct the study was obtained from Level four Kisumu County Hospital with approval letter ref number KDH/GEN/VOL. IV

(74) letter appendix. All information obtained from the study pertaining to individual patients was not shared. No identifiers were captured during the study.

RESULTS

Table 1: Sociodemographic characteristics

		sex		Total
		Male	Female	
Age	Below 10 years	18	16	34
	10 - 35 years	32	28	60
	36 - 59 years	38	18	56
	> 60 years	22	31	53
Total		110	93	203

Majority of deaths occurred between the ages of 10 and 35, 60 (29.6%), followed by 56 (27.6%) patients between the ages of 36 and 59, 53 (26.1%) patients over 60, and 34 (16.7%) patients under the age of 10. (**Table 1**). Given that the majority belong to an age category where there is a higher risk for infectious diseases, the findings of the current study may indicate that infectious diseases play a role in hospital mortality. The current study's findings concur with those of Zarullia et al. (2021) and Roth et al. (2018) that patients between the ages of 15 and 40 frequently die at rates that are three times higher than average, although this excess mortality is not the primary factor contributing to the life expectancy disparity. However, it should be emphasized that studies were conducted in western nations, which may be confounded by racial factors, and they did not focus on age-specific causes of death (Zarullia et al., 2021). According to the current study, fewer deaths occurred in younger adults, which is similar to study result by Zarullia et al. (2021). The current study discovered that 110 male deaths (54%) were higher than 93 female deaths (46%). (**Table 1**). These results concur with those of Al-Jarallah et al. (2022), who discovered that the male gender was a reliable predictor of in-hospital death. Although the current study concurs with Al-Jarallah et al. (2022), it should be kept in mind that the study only looked at 19 COVID patients who were hospitalized in Kuwaiti hospitals. This finding can be explained by the fact that men put off getting medical attention, and by the time they do, the condition may have advanced.

4.0 Trends and all-cause In-patient Mortality between January 2018 and December 2019

Table 2: Overall trends of all-cause in-patient mortality rate per ward

Ward	Admission	Admission%	Deaths	Deaths proportion	Overall Hospital death rate (%)
Medical ward	3904	40.4%	541	79.1%	13.86%
Surgical Ward	1477	15.3%	66	9.6%	4.47%
Paediatrics ward	2373	24.6%	68	9.9%	2.87%
Obstetrics/Gyn	1907	19.7%	9	1.4%	0.47%
Total	9661	100%	684	100%	7.08%

The total number of patients admitted in all the wards between January 2018 and December 2019 was 9661. Medical ward admitted majority 3904 (40.4%) of patients followed by 1477 (15.3%) in surgical ward, 2373 (24.6%) in pediatric ward and 1907 (19.7%) in obstetrics ward (**Table 2**). The overall hospital 2-year mortality was 7.08% (684 deaths) which is in contrast to a study by (Griffiths et al., 2019), who found hospital mortality to be 4.1% slightly lower than the current study. The findings may suggest that hospitals in developed countries may have a lower in-hospital mortality compared to Kenyan hospitals (developing countries). It should however, be kept in mind that (Griffiths et al., 2019) carried this study in a developed country which perhaps has better health systems as opposed to current study which was carried in resource limited settings. Another explanation for this result could be because the current study was conducted at a county hospital, which might have a smaller catchment area and a more constrained variety of services than in previous studies where the hospital's extensive range of services draws more admissions.

Of the recorded deaths, medical ward contributed most 79% (541), followed by pediatrics 68 (9.9%), surgical 66 (9.6%), and obstetrics and gynecology 9 (1.3%). Medical ward had the highest overall hospital mortality 541 (13.86%), followed by pediatrics 68 (9.9%), surgical ward 66 (4.47%) and gynecology 9 (1.4%) (**Table 2**). The current study findings agree with (Soffer et al., 2021) and (Kershaw et al., 2019) who found that general medical wards admit high risk patients and thus have the highest mortality. The results in the current study suggest that patients admitted in medical ward tend to be very sick at the time of admission. It should

however be noted that other studies (Kershaw et al., 2019) focused on patients who died within 48 hours of admission.

4.0.1 Monthly Mortality Rates Per ward in 2018 and 2019

In 2019, medical ward had a mean monthly mortality of 17.25, followed by pediatric and surgery with mean monthly mortality of 2.33 and 1.67 respectively. (Table 3). Obstetrics and gynecology recorded the least mean monthly mortality of 0.08. This can be explained by various monitoring mechanisms that are in place related to maternal health which includes notification of maternal deaths. Compared to most deaths that occurred in 2018, medical ward had a mean monthly mortality of 27.83, followed by surgery 3.83 and pediatrics at 3.33. Obstetrics and gynecology recorded least monthly mortality in 2018. (Table 3). There was significant difference between deaths in 2018 and 2019 at Kisumu County hospital. ($p < 0.05$)

Table 3: Mean Monthly mortality trends per Ward

Descriptive statistics		N	Mean	SD	SE	95% CI for Mean		Minimum	Maximum
						Lower	Upper		
Deaths in 2019	Medical Ward	12	17.25	16.821	4.856	6.56	27.94	0	46
	Pediatrics Ward	12	2.33	2.807	.810	.55	4.12	0	9
	Surgical Ward	12	1.67	2.535	.732	.06	3.28	0	8
	Obstetrics /Gynecology	12	.08	.289	.083	-.10	.27	0	1
	Total	48	5.33	10.891	1.572	2.17	8.50	0	46
Deaths in 2018	Medical Ward	12	27.83	15.514	4.479	17.98	37.69	0	57
	Pediatrics Ward	12	3.33	2.348	.678	1.84	4.83	0	7
	Surgical Ward	12	3.83	2.588	.747	2.19	5.48	0	8
	Obstetrics/Gynecology	12	.58	.515	.149	.26	.91	0	1
	Total	48	8.90	13.524	1.952	4.97	12.82	0	57

There was significant variation in ward mortality in 2018 ($p < 0.001$, $F 30.606$, $CI 95\%$, $df 3$) and also in 2019 ($p < 0.001$, $F 10.33$, $CI 95\%$, $df 3$). The findings of the current study may suggest that there could have been undiagnosed virulent disease in the year 2018 that caused more deaths in medical ward as compared to 2019. It may also be interpreted to mean that 2019 was well staffed in than 2018.

Mortality trends in 2018

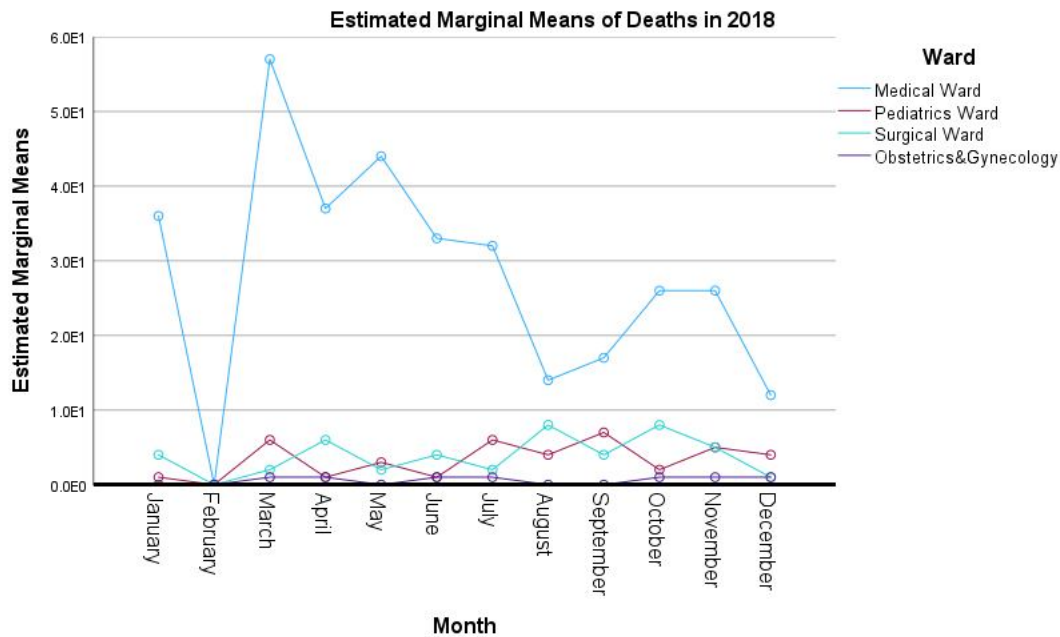


Figure 1: Mortality trends in 2018

The mortality for medical, pediatrics, surgery and obstetrics/gynecology wards were compared monthly during the year 2018. (Figure 1). Generally, patients died in the wards throughout the year except in February. More deaths occurred in medical ward all through the year, with a spike in deaths between February and August 2018. The trends in ward mortality are relatively lower in the surgical and pediatric wards throughout the year, with a slight spike in the number of deaths in both wards during March and April 2018 and again between August and December of the same year. The Obstetrics and Gynecology Department recorded the lowest monthly mortality of all time, with deaths recorded between March and April, June and July, and October and December 2018. The current study results may suggest that more deaths occurred during the rainy season between March and July. The current findings agree with (Chowdhury et al., 2018; Maisa et al., 2021). A possible explanation could be that during this time, more respiratory diseases are reported and other weather-aggravated diseases such as asthma can worsen. It could also be explained that during this season, most patients were not able to get to the hospital in time due to transport challenges during the rainy season.

Mortality trends in 2019

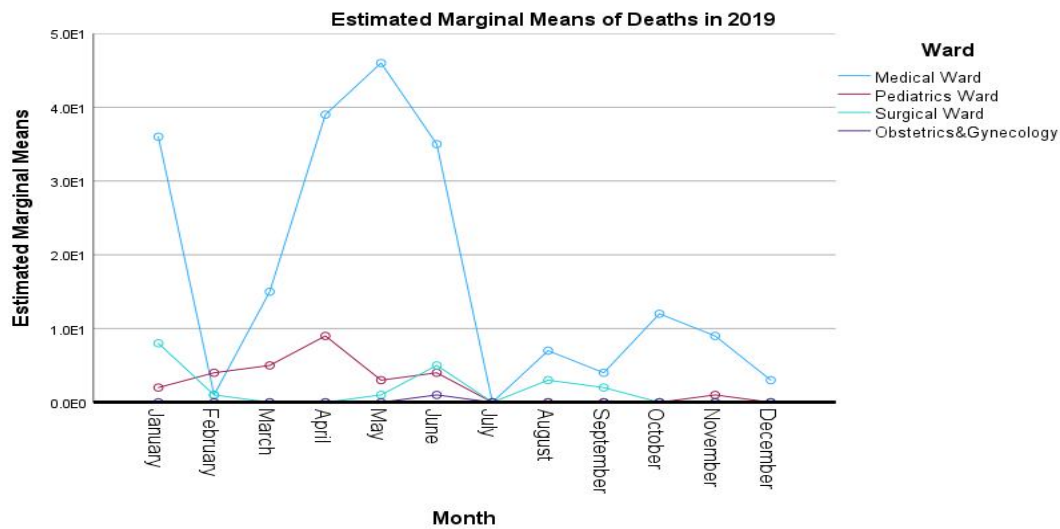


Figure 2: Mortality trends in 2019

Deaths occurred throughout the year, with the medical ward recording the highest number of deaths compared to other wards, and January had a high number of deaths, which dropped in February, and there is a sharp rise in number of deaths in February, which drops in July, and then steadily rises before sloping in December 2019. The pediatric ward had the second highest number of deaths, which shows a steady rise from January, peaks in April before sloping down in July, and maintains the low death record before slightly rising again in November 2019 and falling again in December 2019. There was a drop in mortality in the surgical ward in January, which continued through February and April before steadily rising again to reach peak in August and September. (**Figure 2**). The findings of the current may as well suggest that there is increased number in deaths during the winter rainy season perhaps underscoring the role of weather in respiratory disease (Chowdhury et al., 2018; Maisa et al., 2021).

4.0.2 Causes of Deaths

Majority of deaths occurred due to infections 86 (42.4%) and non-communicable 85 (41.9%). Injuries from trauma and accidents accounted for least causes of deaths at 2%. Other deaths 25 (12.3%) occurred due to other diseases. (**Table 4**). The current study findings contrast findings by (Roth et al., 2018) who reported that 73.4% of hospital death are due to non-communicable diseases while communicable and others accounted for 18.6%. The difference could be explained by the fact that Roth et al. (2018) carried out a global study involving

several countries. Another possible explanation is that countries like New Zealand have better health care to deal with infections, unlike the findings in the current study. It can also be argued that perhaps life expectancy and lifestyle in western countries are risk factors as opposed to infections in sub-Saharan African countries like Kenya.

Infections caused more deaths among patients aged 10 and 59 years than in patients at extreme of ages (below 10 years and more than 60 years). (**Table 4**). There was statistically significant variation in mortalities across ages in relation to causes of death ($P=0.135$). However, non-communicable diseases caused more deaths among the elderly (>60 years) than in any other age group ($p=2.84$)

Table 4: Distribution of deaths by age category based on non-communicable diseases

		Non-Communicable Diseases				Total
		Hypertension	Diabetes Mellitus	Cancer	Other	
Age	Below 10 years	0	0	0	9	9
	10 - 35 years	1	0	2	29	32
	36 - 59 years	2	1	2	20	25
	> 60 years	6	5	7	15	33
Total		9	6	11	73	99

In relation to age specific non-communicable diseases, hypertension, diabetes mellitus and cancer were more common among the elderly (>60 years) than in any other age group. Cancer was more prevalent followed by hypertension and diabetes mellitus. Other non-communicable diseases are listed in increasing frequency. (**Table 5**). The study found that cancer, hypertension and diabetes mellitus were the leading non communicable causes of deaths. Similar findings by (Nigri et al., 2022) reported that cardiovascular diseases and neoplasms are important causes of death among the aged hospitalized patients although there are other important non-communicable diseases observed such as severe anemia and heart failure.

Table 5: Other non-communicable diseases

NCD	Frequency	%
Severe anemia	16	21.9
Heart failure	10	13.7
Dehydration	5	6.8
Sickle cell disease	4	5.5
Stroke	4	5.5

Birth asphyxia	2	2.7
Malnutrition	2	2.7
Perforated PUD	2	2.7
RDS.	2	2.7
Appendicitis	1	1.4
Chronic kidney disease	1	1.4
Convulsive disorder	1	1.4
Hemorrhoids	1	1.4
Hepatic encephalopathy	1	1.4
Lymphoma	1	1.4
Severe burns	1	1.4
Shock	1	1.4
Others	18	24.7
	73	100

Deaths based on site of infection

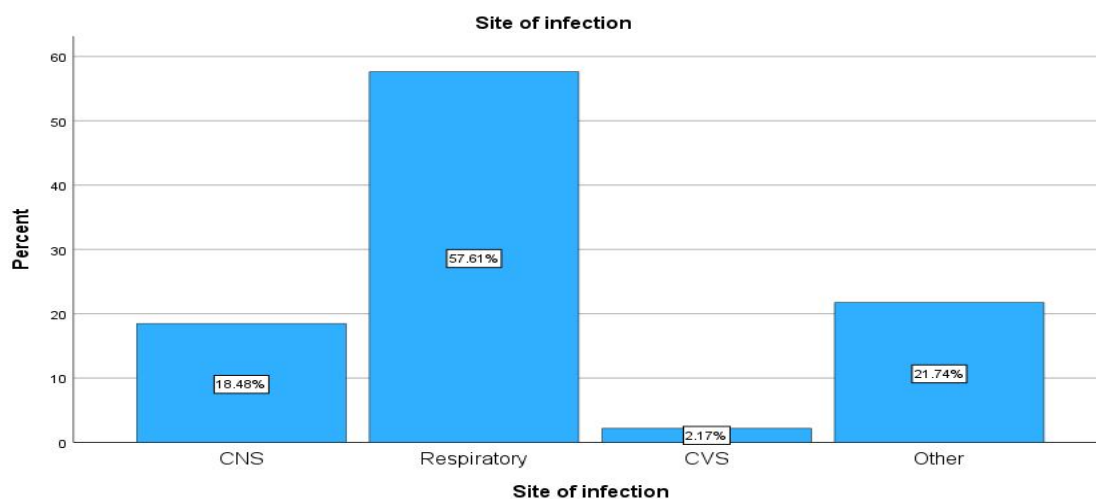


Figure 3: Site specific infection

Among patients who died due to infections, the current study found that the majority 50 (26.1%) had respiratory infections, 17 (8.4%) had CNS infections and 19 (9.4%) had other infections. **(Figure 3)**. The current study findings agree with Ball et al. (2018) and Dat et al. (2022), who found that respiratory infections were the leading cause of hospital mortality in 27.8% of cases. The results from the current study suggest that perhaps there are important risk factors for respiratory infections that need further research. Another possible explanation is that perhaps COVID-19 existed before the first case was discovered. While the current

study findings agree with Ball et al. (2018) and Soffer et al. (2021), it should be kept in mind that these were large studies involving several hospitals.

Death category based on Specific Infection

The leading specific respiratory infection was pneumonia 22 (10.8%) and pulmonary tuberculosis 16 (7.9%). HIV/AIDs and Meningitis accounted for 9 (4.4%) and 14 (6.9%) of deaths respectively during the study period. (Table 6). The findings agree with (Ball et al., 2018; Dat et al., 2022) who found that the most common diagnoses were diseases of the respiratory system like pneumonia. The current findings may suggest that perhaps there is significant air pollution that predisposes to respiratory diseases. It also suggests that more HIV testing is needed since it is a single most risk factor for pulmonary tuberculosis and pneumonia. Respiratory infections contributed to 56% of deaths. Pneumonia and pulmonary tuberculosis were the leading respiratory infections in the patients who died in 2018 and 2019. Similar findings by (Aragón & Chalkley, 2018) and (Ogawa et al., 2021) indicated that the leading causes of death in hospitals include respiratory diseases such as pneumonia. Perhaps preventive interventions during rainy season could be justified.

Table 6: Specific infection

		HIV/AIDS	Tuberculosis	Pneumonia	Meningitis	Other	Total
Age	Below 10 years	0	2	8	3	6	19
	10 - 35 years	5	7	4	4	6	26
	36 - 59 years	4	4	2	6	10	26
	> 60 years	0	3	8	0	5	16
Total		9	16	22	13	27	87

The current study findings agree with (Griffiths et al., 2019) who found that pneumonia was the single most common diagnosis. Other infections are listed. (Table 7)

Table 7: Other infections

Infection	Frequency	%
Others	10	37.04
Severe malaria	4	14.81
Hepatitis	3	11.11
Septicemia	3	11.11
Encephalitis	2	7.41
Brain abscess	1	3.70

Cystitis	1	3.70
Esophageal candida	1	3.70
Gastritis	1	3.70
PJP	1	3.70
TOTAL	27	100

Conclusions and recommendations

The study aimed to find out factors associated with all-cause inpatient mortality at Kisumu County level four hospital between 2018 and 2019. Based on the study findings, it can be concluded that more deaths occurred in medical ward from infectious diseases such as pneumonia and pulmonary TB among patients aged <35 years while non-communicable diseases such as cancer, hypertension and diabetes mellitus were important causes of death among the people aged >60 years. The results seem to suggest that more deaths occurred during rainy season between February and August. Patient factors such as age, sex and education level were not significantly associated with hospital mortality. Comorbidities particularly the non-infectious diseases were associated with more deaths. This research clearly illustrates that hospital deaths among aged people is due to noncommunicable disease and deaths among young populations is due to infectious diseases but also raises the question of the need to enhance nurse-doctor relationship to reduce avoidable deaths among patients admitted in hospitals. More research is needed to determine the extend of doctor-nurse relationship on patient treatment outcome.

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