



Determining Length of Stay Patterns in Psychiatric Care: A Survival Analysis Approach at Kisumu County Referral Hospital

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Abstract

Length of stay is a crucial metric in healthcare management, reflecting the duration a patient occupies a hospital bed. According to the Kenya National Commission of Human Rights, around 25% of outpatients and 40% of inpatients are affected by mental health disorders. Kisumu County Referral Hospital (KCRH) is a key provider of mental healthcare services in western Kenya. However, there is a lack of robust data analysis regarding patient flow and length of stay within the psychiatric unit. This study intended to fit a Kaplan-Meier survival model to the length of stay data for psychiatric patients at KCRH. The study used monthly secondary data covering 2018 to 2022, obtained from psychiatric patients' records at Kisumu County Referral Hospital using a secondary data capture form. The study found the overall median survival time was 8 days. There was no difference in length of time to discharge between males and females ($p = 0.66$).

Subject Areas

Psychiatry, Psychology

Keywords

Survival Analysis, Bipolar and Related Disorders, Psychiatry, Kaplan Meier, Psychosis

1. Introduction

1.1. Background

Length of stay (LOS) in psychiatric care is a critical statistical measure that reflects the duration of hospitalization and significantly impacts healthcare management

and resource allocation [1]. The analysis of LOS is particularly relevant in the context of rising mental health disorders, with approximately 25% of outpatients and 40% of inpatients in Kenya affected [2]. This increasing prevalence necessitates rigorous statistical methodologies to analyze LOS patterns, which can inform operational efficiencies and quality of care.

Statistical methods have traditionally relied on linear regression and multiple regression analyses to explore LOS data. However, these methods often fall short in capturing the complexities of psychiatric patient trajectories, given the multifaceted nature of mental health conditions and their treatment responses [3]. The variability in LOS is influenced by individual patient characteristics, treatment intensity, and resource availability, creating a dynamic landscape that requires advanced analytical techniques to elucidate discharge patterns effectively [4].

Survival analysis has emerged as a robust statistical approach for examining LOS in psychiatric settings, providing tools that account for right-censored data and the non-linear nature of patient discharge trajectories. The Kaplan-Meier estimator, in particular, offers a non-parametric method for estimating survival probabilities and visualizing LOS distributions over time [5] [6]. This technique allows researchers to analyze the time until an event occurs—such as patient discharge—while controlling for various covariates that may influence LOS.

1.2. Problem Statement

Mental health represents a critical yet frequently overlooked component of global healthcare systems. In Kenya, access to mental health services is particularly constrained for populations residing outside major urban areas. The field of mental health care is often underrepresented in robust statistical analyses, particularly in low-resource settings like Kenya. The Kisumu County Referral Hospital (KCRH) serves as a key provider of mental health services; however, there is a significant gap in detailed statistical insights regarding patient flow and LOS within its psychiatric unit. This lack of comprehensive analysis hampers effective resource allocation and capacity planning, ultimately undermining the quality of care provided to patients.

This study aimed to employ survival analysis, to analyze LOS data for psychiatric patients admitted to KCRH. The application of survival analysis facilitated the estimation of the probability of patients remaining hospitalized for designated periods and identified covariates that influence discharge timing. Such insights were essential for understanding patient recovery trajectories and predicting future bed occupancy rates, thereby informing hospital management strategies.

1.3. Objective of the Study

To fit a Kaplan-Meier survival model to the length of stay (LOS) data for psychiatric patients at Kisumu County Referral Hospital.

2. Literature Review

The application of survival models in understanding length of stay (LOS) for psy-

chiatric patients has gained attention in recent research.

Pearlmuter *et al.* (2017) [7] conducted a cross-sectional observational study involving 871 consecutive patients requiring mental health evaluations in ten unaffiliated emergency departments in Massachusetts. The study aimed to quantify the burden of mental health boarding and to define the influence of insurance, along with demographic, social, and comorbid factors, on the length of stay in the emergency department. At multivariate survival analysis, it was observed that uninsured patients who were hospitalized and transferred spent considerably more time boarding at the emergency department compared to those with private insurance. Furthermore, their findings indicated that the median length of stay in the emergency department significantly fluctuated according to disposition, predominantly influenced by emergency department boarding duration. Patients who were admitted and transferred experienced larger delays compared to those who were discharged, with durations of 5.63, 9.32, and 1.23 hours, respectively. The duration of medical clearance (1.40 hours) constituted merely 10.5% of the total length of stay in the emergency department and exhibited minimal variation based on insurance type.

Broderick *et al.* (2020) [8] examined clinical and demographic variables to elucidate their association with hospital length of stay for patients involuntarily committed to California state psychiatric hospitals under the state's incompetent to stand trial (IST) statutes by conducting a retrospective analysis of all patients admitted as IST to California state psychiatric hospitals from 2010 to 2018 (N = 20,041). The primary diagnosis, total count of violent incidents during hospitalization, age at entrance, treating hospital, functional level at admission, ethnicity, sex, and prior state hospital admission were assessed using a parametric survival model. Their findings indicated that the primary characteristics associated with duration of stay were diagnosis, frequency of violent incidents during hospitalization, and age at admission. A longer length of stay was specifically correlated with a diagnosis of schizophrenia or neurocognitive impairment, the occurrence of one or more violent acts, and an older age at admission.

Shahsavariipoor *et al.* (2022) [9] performed a retrospective cohort study involving all patients hospitalized to the Iran Psychiatric Hospital and the Psychiatric Ward of Rasoul-e-Akram Hospital in Tehran in 2011. The study variable and post-discharge readmission status throughout a seven-year period till 2018 were obtained by checking patients' clinical files, conducting telephone interviews, or examining patients' records at Roozbeh Hospital. Subsequently, clinical parameters such as Length of Hospital Stay (LOS), diagnosis, and medication adherence were assessed using statistical tests, including the Kaplan-Meier survival analysis. The findings indicated that the average duration until readmission for patients was 24.94 months. Likewise, among the demographic and clinical characteristics, an extended duration of stay, multiple prior hospitalizations, use of inpatient physical restraint, noncompliance with therapy, and a diagnosis of psychotic illnesses have elevated the likelihood of readmission.

Addisu *et al.* (2015) [10] examined the length of stay of psychiatric admissions in a general hospital in Ethiopia using a retrospective study design. Their findings provided empirical evidence on determinants influencing psychiatric inpatient duration, highlighting the role of clinical and demographic characteristics in shaping hospitalization outcomes.

Adegunloye *et al.* (2009) [11] investigated correlates of length of stay among psychiatric in-patients in a tertiary health institution in Nigeria. The study identified socio-demographic and clinical factors that significantly influenced hospitalization duration, reinforcing the importance of contextual determinants in sub-Saharan Africa.

Brick *et al.* (2024) [12] analyzed determinants of acute psychiatric inpatient length of stay in Ireland. Their findings underscored the influence of health system structure, patient characteristics, and service organization on psychiatric LOS.

Jacobs *et al.* (2015) [13] examined determinants of hospital length of stay for individuals with serious mental illness in England using regression analysis. Their results emphasized variations in LOS associated with demographic and institutional characteristics, with implications for healthcare payment systems.

3. Materials and Methods

3.1. Area of the Study

This study used data from Kisumu County referral. Kisumu County has glaring mental health limitations as revealed by the findings of a study on the status of mental health policy, rights, financing, and service delivery including under staffing of mental health practitioner, lack of mental health policy framework, and inadequate financing of mental health services and infrastructure such as beds.

3.2. Inclusion and Exclusion Criteria

The data obtained from the patients met the inclusion and exclusion criteria including patients admitted and diagnosed with psychiatric cases between 2018 and 2022 and patients aged 18 years and above. Patients that lost their lives and those that were transferred to other facilities were censored.

The data tracked individuals for thirty days following the initial event, which was hospital admission. The primary outcome observed was hospital discharge. This study spanned 60 months and included 705 participants. The day of hospital admission was recorded as day zero (the starting point).

3.3. Ethical Considerations

This study utilized secondary data and adhered to several research ethics, emphasizing that it was conducted solely for academic purposes. A key ethical concern

was maintaining confidentiality; therefore, all data extracted from patient records were de-identified and coded. Written permission to access the data was obtained from the Kisumu County Department of Health.

Definition of variables (See [Table 1](#))

Table 1. Definition of variables.

Variable	Type of variable	Data Source	Measurement	Data Type
LOS at discharge	Dependent	Patients' records	Days	Numerical
Age	Independent	Patients' records	Years	Numerical
Sex	Independent	Patients' records	Male/Female	Categorical
Time interval	Independent	Patients' records	Days	Numerical
Type of diagnosis	Independent	Patients' records	Schizophrenia spectrum and other psychotic disorders. Bipolar and related disorder. Epilepsy & Dementia. psychotic disorders/Depression	Categorical
Type of treatment	Independent	Patients' records	Medication. Medication and therapy Therapy.	Categorical

3.4. Data Collection and Mode of Analysis

The research used data of secondary nature, obtained from psychiatric patients' records from Kisumu County Referral Hospital. Authenticated data from individual psychiatric patients were extracted from psychiatric patients' records through a secondary data capture form containing the variables defined in ([Table 1](#)). Data validity and reliability are determined by how effectively the data address the pre-determined objectives and their ability to withstand both internal and external verification tests [14]. In this case, psychiatric patients' records were identified to have important and necessary data.

To address this objective, the study utilized Kaplan-Meier survival analysis to estimate the survival function for the length of stay (LOS) data [5]. This analytical approach provided valuable insights into the distribution of length of stay among psychiatric patients, enabling the estimation of survival probabilities over time.

Similarly, when the survival curves were stratified by covariates, differences between groups were statistically tested using the log-rank test, providing insights into the impact of these factors on hospitalization duration [15].

4. Results

4.1. Descriptive Statistics

The mean age of the patients was 33.6 years with a median of 31 years. Moreover, majority of the patients (43.8%) were aged below 30 years, 33.3% were aged between 30 and 40 years while only 22.7% were aged above 40 years. Males comprised the majority of psychiatric patients constituting 61.1% with females only accounting for 38.9%. On average, the patients stayed in the hospital for a period of 10.3 days; median = 8 days. These figures indicate that both age and length of stay were positively skewed (mean > median) (Figure 1). According to the diagnosis, majority had been diagnosed with schizophrenia spectrum and other psychotic disorders (77.4%) while 20.7% were diagnosed with bipolar and other related disorders with only 1.8% being diagnosed with epilepsy and dementia. The patients were subjected to either medication only (87.2%), therapy only (9.9%) or a combination of medication and therapy (2.7%). Within a period of 30 days, 650 (92.2%) had been discharged with 55 (7.8%) staying longer than 30 days in hospital (Table 2).

Table 2. Descriptive statistics of sample characteristics.

Variable	Total (N = 705)
Age (yrs)	
Below 30	309 (43.8%)
30 - 40	235 (33.3%)
Above 40	161 (22.8%)
Sex	
Female	274 (38.9%)
Male	431 (61.1%)
Diagnosis Type	
Bipolar And Related Disorders	146 (20.7%)
Epilepsy & Dementia	13 (1.8%)
Schizophrenia Spectrum and Other Psychotic Disorders	546 (77.4%)
Treatment Type	
Medication	615 (87.2%)
Medication and Therapy	19 (2.7%)
Therapy	71 (9.9%)
Time to discharge (days)	
Mean (SD)	10.3 (7.17)
Median [Min, Max]	8.00 [1.00, 30.0]
Status at 30 days	
Not discharged	55 (7.8%)
Discharged	650 (92.2%)

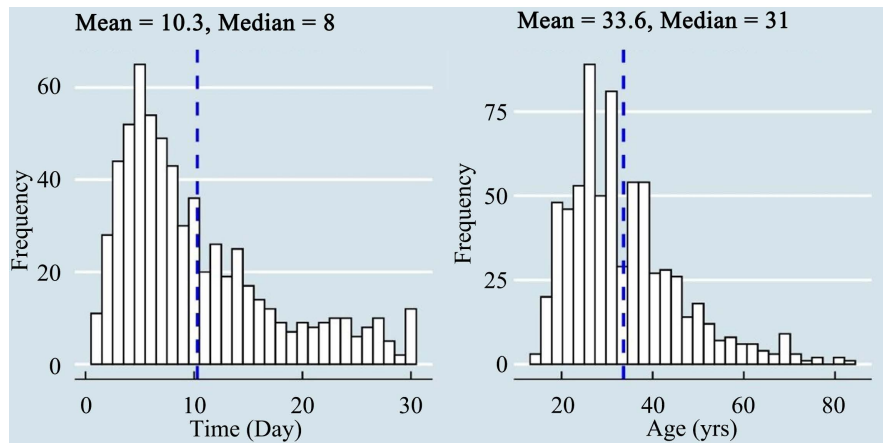


Figure 1. Histograms for length of stay and age of the patients.

4.2. To Fit a Kaplan-Meier Survival Model to the Length of Stay (LOS) Data for Psychiatric Patients at Kisumu County Referral Hospital

Kaplan-Meier survival curves were used to describe the time to discharge. Out of the 705 patients, 650 experienced the event (discharge) while 55 were right censored, having stayed longer than the 30 days. The overall median survival time (time to discharge) was 8 days (Figure 2). There was no difference in length of time to discharge between males and females ($p = 0.66$) as shown by the survival curves in Figure 3.

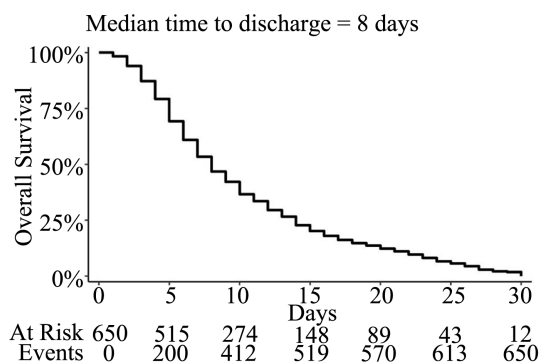


Figure 2. Overall Kaplan-Meier survival curve.

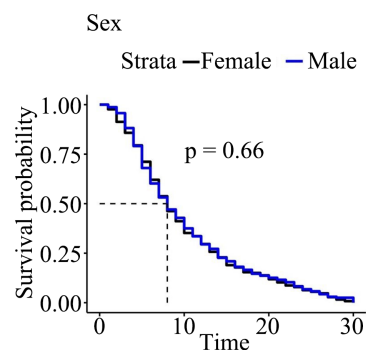


Figure 3. Kaplan-Meier survival curves by sex.

Moreover, the survival curves were not different statistically across age groups, an indication that the time to discharge was not different across age groups ($p = 0.850$) (Figure 4). Figure 5 on the other hand shows the survival curves for patients diagnosed with different forms of psychotic disorders. While there was no significant difference in overall survival time among the patients on different diagnosis ($p = 0.720$), the median survival time for those diagnosed with epilepsy and dementia was higher compared to those diagnosed with bipolar and schizophrenia (Figure 5). Patients who were subjected to both medication and therapy were more likely to be discharged faster compared to those who were subjected to therapy only or medication only ($p = 0.00025$). However, the median survival time was highest among those who underwent both therapy and medication, followed by medication only and lastly therapy only (Figure 6).

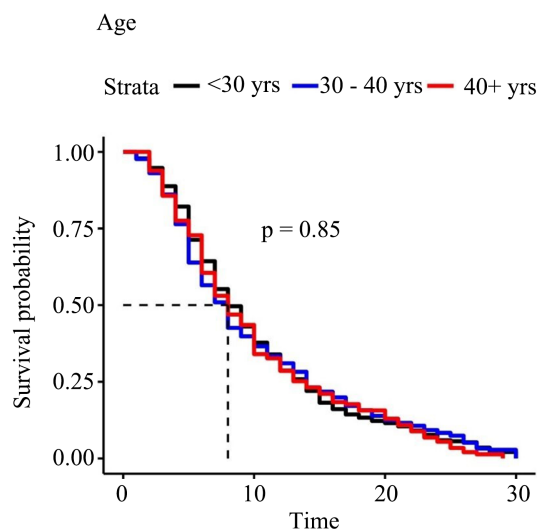


Figure 4. Kaplan-Meier survival curves by age.

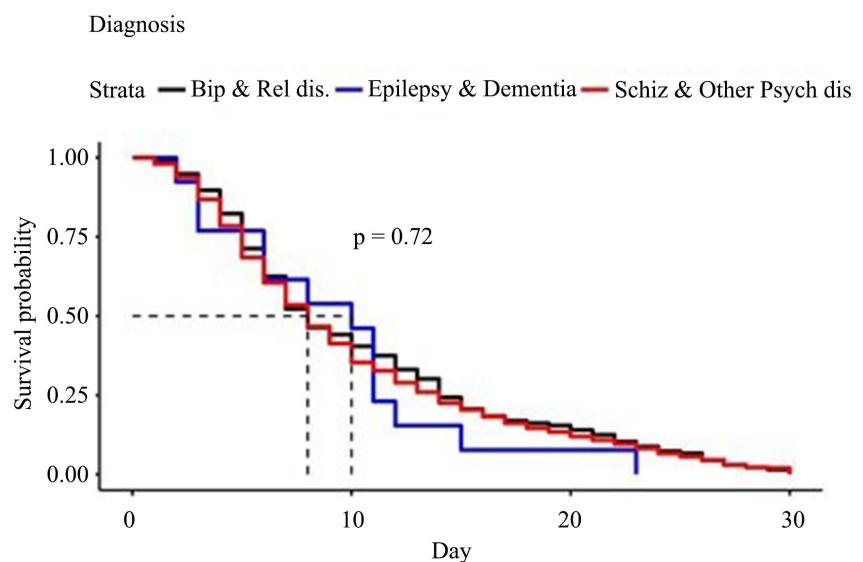


Figure 5. Kaplan-Meier survival curves by type of diagnosis.

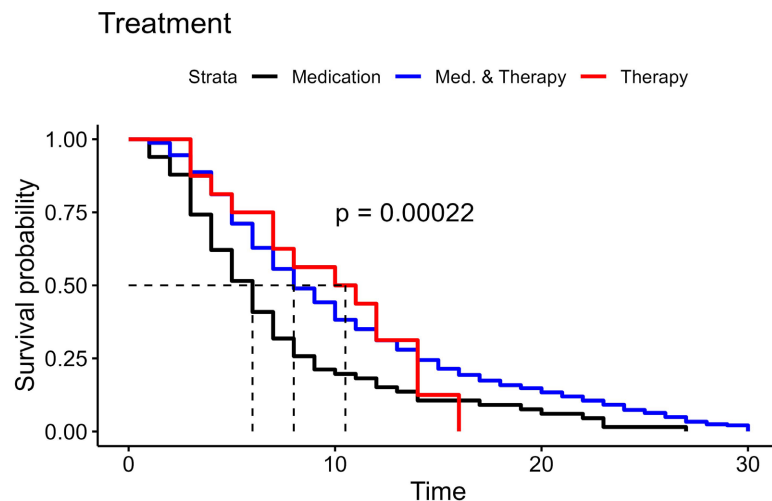


Figure 6. Kaplan-Meier survival curves by type of treatment.

5. Discussion

Fitting Kaplan-Meier Survival Model to the Length of Stay (LOS) Data for Psychiatric Patients at Kisumu County Referral Hospital

The objective was assessed using Kaplan-Meier survival analysis. The Kaplan-Meier method accounts for incomplete follow-up by incorporating censored data, ensuring that the analysis includes patients still hospitalized at the time of study completion without making assumptions about their eventual discharge time [5]. However, when survival curves are stratified by covariates, differences between groups can be statistically tested using the log-rank test, providing insights into the impact of these factors on hospitalization duration [15].

The results showed that the median time to discharge among these patients was 8 days. This length of stay is lower than that reported in two tertiary health institutions in Nigeria at different times [11]; and another retrospective study conducted in Southwest Ethiopia [10] but comparable to that reported earlier in South Africa [14]. This disparity could be attributed to differences in the development of health infrastructure with better infrastructure and proper planning leading to a reduced length of stay. In most cases, better infrastructure reduces hospital length of stay as well as bed pressure through enhanced patient diagnosis capabilities and improved patient movement or flow in the facilities.

There was no significant difference in time to discharge among the patients across age, gender and type of diagnosis. However, patients that were treated through therapy only were likely to be discharged faster compared to those treated using medication only. The lack of association between age, gender and length of hospital admission corroborates with the findings following a 10-year retrospective study in Ethiopia [10]. Another study involving patients with serious mental illness in England reported no association between gender and length of hospital stay although it reported that older people were likely to stay longer [13]. Yet, a more recent study conducted between 2015 and 2019 among acute psychiatric

adults in Ireland found that older patients compared to younger patients and females compared to males were associated with a longer length of stay in hospital. The study further posits that patients diagnosed with schizophrenia were more likely to stay longer in hospital [12].

6. Conclusions

Survival Analysis on the Length of Stay (LOS) Data for Psychiatric Patients Admitted to Kisumu County Referral Hospital

Kaplan-Meier survival curves were used to describe the time to discharge. Out of the 705 patients, 650 experienced the event (discharge) while 55 were right censored, having stayed longer than the 30 days. The overall median survival time (time to discharge) was 8 days. There was no difference in length of time to discharge between males and females ($p = 0.66$) as shown by the survival curves. Moreover, the survival curves were not significant across age groups, an indication that the time to discharge was not different ($p = 0.850$).

In conclusion, the study underscores the varied survival outcomes among psychiatric patients in the hospital, with specific demographic and clinical factors playing pivotal roles. These findings not only enhance the understanding of psychiatric care but also call for tailored approaches in patients' management.

Conflicts of Interest

The authors declare no conflicts of interest.

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