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The relationship of weekend admission and mortality on the public medical wards at a Kenyan referral hospital

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Background: Research has demonstrated disparities in the outcomes of patients admitted to hospital on weekends in high-income countries. No published research has evaluated if any similar discrepancy exists in low-resource settings.

Methods: To determine if any difference in mortality exists between weekend and weekday admissions on the public medical wards at a Kenyan referral hospital, we performed a retrospective observational study of inpatients over a 3-month study period.

Results: During the study period, 261 (27.3%) of the 956 patients were admitted over the weekend. The mortality rates for patients admitted on weekends and weekdays did not differ with 156 (22.4%) of the 695 patients admitted on weekdays dying compared to 55 (21.1%) of the 261 patients admitted on weekends. After adjusting for age, insurance status, co-morbid illness, HIV status, employment, referral status and gender, still no association existed between weekend admission and mortality.

Conclusions: Among adult patients on the medical wards, patients admitted on weekends had similar mortality rates to those admitted on weekdays. This similarity may reflect a stable level of care or a generalized shortage of resources and staffing that subsumes any impact of weekly variations. Future research examining optimal staffing and resource levels is needed in such settings.

Keywords: Africa, Health services, Hospital admissions, Hospital medicine

Introduction

A growing body of research has demonstrated significant differences in the outcomes of patients admitted to acute care hospitals on weekdays and weekends in high-income countries. This research has demonstrated an increased mortality for weekend admissions overall as well as for specific medical and surgical conditions including acute myocardial infarction, congestive heart failure, pulmonary embolism, acute kidney injury, intracerebral hemorrhage, and acute ischemic strokes.[1–8] These variations remain after adjusting for patient differences such as severity of illness and co-morbidities. Thus, researchers have hypothesized that the discrepancies seen may be attributed to decreased staffing and availability of hospital services on weekends.

Though hospitals in less-resourced areas such as Kenya have similar weekend variations in the staffing and availability of services on inpatient wards, no published research has yet evaluated if any similar discrepancy exists in mortality between weekend and weekday admissions. The objective of this study was to determine if any difference in mortality exists between weekday and weekend admissions to the public medical wards at a Kenyan referral hospital.

Materials and methods

Study design and setting

This study was a retrospective observational study of patients on the public medical wards at Moi Teaching and Referral Hospital (MTRH) for the 3-month period from October to December 2012. All patients who died or who were discharged from the

public medical wards at MTRH during the study period were eligible for inclusion in the study.

MTRH is a national referral hospital for western Kenya with approximately 750 beds. Divided into men's and women's wards, the medical wards together admit and discharge approximately 400 patients monthly. These wards are largely populated by those in the lowest socioeconomic strata. Nursing staff-to-patient ratios are unfavorable with each nurse usually attending to approximately 15 patients. Overnight, and on weekends, the number of patients per nurse may increase to over 30, and limited intensive care resources often necessitate critically ill patients remain on these general wards. Teams including medical officer interns, post-graduate registrars, and attending consultants provide medical staffing. On weekends, there is a very diminished presence of registrars and consultants compared to weekdays, and services such as imaging and labs are often very limited.

The study was approved by the local ethics committee at Moi University and was submitted and determined to be exempt from review by the institutional review board at Indiana University.

Data collection

Data was retrieved from the MTRH medical record database. Following each patient's death or departure from the hospital, the medical records department examined the patient's paper file recording demographic and clinical information. The primary outcome of interest was in-hospital death. The primary explanatory variable of interest was date of admission: weekend vs weekday. For purposes of analysis, the weekend was defined as beginning 18:00 h Friday evening and ending 23:59 h Sunday night. This definition was chosen based on the wards' staffing schedules and routine. All other times were defined as weekdays, and all admissions were categorized as either weekend or weekday based on this definition.

In addition to these variables, information on primary and secondary diagnoses (specified by ICD-10 codes[9]), insurance status, HIV status, age, gender, occupation, and length of hospitalization as determined from admission to medical discharge or death was also collected.

All patient identifiers were absent from abstracted data utilized for analysis for this study.

Statistical analysis

Descriptive statistics were used to summarize the data. Frequencies and percentages reported for categorical variables while means and standard deviations were utilized for continuous variables. The bivariate association between date of admission—weekend vs weekday—and mortality was examined using a χ^2 test. We then fit a logistic regression model to the data with in-hospital mortality as the dependent variable and weekend admission as the primary explanatory variable. We adjusted this estimate for age, gender, insurance status, employment status, presence of a secondary co-morbid illness, and HIV status (as gathered from primary or secondary diagnostic codes). Mortality rates per day of the week were calculated based on the number of deaths on each day and the total number of days during the study period. The average mortality rate per day on Saturday and Sunday combined was compared to the average of the remaining days of the week using a t-test for independence.

All analyses were conducted with IBM SPSS Statistics software version 21 (IBM Corp., Armonk, NY, USA).

Results

Population

Over the three-month period from 1 October 2012 and 31 December 2012, a total of 956 patients on the public medical wards at MTRH were discharged or died. The average age of patients during this time was 41.8 yrs (range 13–102, SD 18.9). Men represented 507 (53.0%) of these 956 admissions. Additionally, 551 (57.6%) of these patients were employed outside the household, and 101 (10.6%) of the patients had been referred from an outside facility. This population represented 324 different ICD-10 diagnoses with the leading primary diagnoses including HIV associated illnesses, congestive heart failure, pneumonia, hypertension, poisonings, gastroenteritis, anemia, diabetes mellitus, and psychiatric conditions (i.e., psychosis, depression). Of these patients, 195 (20.4%) had co-morbid illnesses indicated in addition to their primary reason for admission with HIV representing the most common—122 (62.6%) of 195 cases with a secondary diagnosis. Overall, 199 (20.8%) of the 956 admitted patients had HIV listed as either a primary or secondary diagnosis for their hospitalization. The average length of stay—defined from admission to medical discharge or death—was 8.6 days (range 1–100, SD 9.4).

Overall, 261 (28.3%) of the 956 patients admitted during the study period were admitted on the weekend, including 44 patients that were admitted on Friday evening between 18:00 h and 23:59 h. The patients admitted on the weekend were more likely to be female but otherwise did not differ from the patients admitted during the weekdays in age, employment status, referral status, insurance status, percentage HIV-positive, percentage with co-morbid secondary diagnoses and overall length of stay (Table 1).

Outcome

During the study period, 211 of the 956 patients died, giving an overall mortality rate on the medical wards over the study period of 22.1% (95% CI 19.5–24.7%). Of the patients admitted on weekdays, 156 of the 695 patients died and therefore the weekday mortality rate was 22.4% (95% CI 19.3–25.5%). For those admitted during the weekend, 55 of the 261 patients died representing a weekend mortality rate of 21.1% (95% CI 16.1–26.0%). There was no significant difference between the mortality rates for these two populations, and a χ^2 test for independence indicated no significant association between weekend admission and mortality (χ^2=0.14, p=0.71).

In standard multiple logistic regression examining the association between weekend admission, insurance status, age, gender, employment, presence of a secondary co-morbid illness, HIV status and mortality, the model containing all predictors was not statistically significant (p=0.93). As shown in Table 2, age, insurance status, referral status, and HIV status all made unique statistically significant contributions to the model. Weekend admission however was not a statistically significant predictor in the model.

During the study period, the average number of deaths per day of the week varied from 2 to 2.69 with daily averages of Sunday

Table 1. Study population

	Weekday	Weekend[a]	p-value
Number	694	261	NA
Age, years (range, SD)	41.2 (13–102, 18.4)	43.2 (15–100, 20.1)	NS
Male	387 (55.7%)	120 (46.0%)	0.01
Employed[b]	413 (59.4%)	138 (52.9%)	NS
Referred[c]	69 (9.9%)	32 (12.3%)	NS
Uninsured	537 (77.3%)	207 (79.3%)	NS
HIV	149 (21.4%)	50 (19.2%)	NS
Co-morbid illness[d]	140 (20.1%)	55 (21.1%)	NS
Length of stay, days (range, SD)	8.3 (1–69, 8.4)	9.4 (1–100, 11.7)	NS

NA: not applicable, NS: not significant.
[a] Friday 18:00 h until Sunday 23:59 h.
[b] Employment status categorized in binary fashion as employed outside home or not.
[c] Number of patients referred from outside facility to Moi Teaching and Referral Hospital.
[d] Number of patients with secondary diagnosis recorded.

Table 2. Multivariate logistic regression predicting mortality

	B[a]	p-value	OR	95% CI
Age	0.017	<0.001	1.02	1.01–1.03
Gender	0.004	NS	1.00	0.68–1.49
Insurance status	–0.929	<0.001	0.40	0.24–0.66
Employment status	0.407	NS	1.50	0.99–2.27
Co-morbid illness	–0.291	NS	0.75	0.46–1.23
HIV status	0.926	<0.001	2.53	1.59–4.00
Referred from other facility	0.56	0.034	1.75	1.04–2.93
Weekend admission	–0.155	NS	0.86 (1.004)[b]	0.58–1.27 (0.70–1.45)[b]

NS: not significant.
Results of standardized logistic regression with the dependent variable of patient mortality.
[a] logistic regression coefficient; [b] Crude unadjusted OR for weekend admission and mortality.

2.00, Monday 2.00, Tuesday 2.08, Wednesday 2.69, Thursday 2.54, Friday 2.08 and Saturday 2.69. The highest number of deaths occurred on Wednesday and Saturday with the lowest number occurring on Sunday and Monday. Saturday and Sunday combined had an average mortality of 2.35 that did not differ significantly from the overall rate of 2.28 for Monday to Friday combined (p=0.83).

Discussion

Analyzing data from 956 admissions over a 3-month period at a Kenyan referral hospital, our study demonstrates that individuals admitted on weekends had no significant difference in all-cause in-hospital mortality as compared with patients admitted on weekdays. The mortality rate for patients admitted on weekends was 22.4% compared to 21.1% for patients admitted on weekdays. Even after controlling for age, gender, insurance status, employment, presence of a secondary co-morbid illness and HIV status, weekend admission was not a predictor of mortality. Moreover, the average number of deaths per day of the week also did not differ significantly between weekend and weekday during the study period.

With decreased staffing, services and resources available during the weekend on the medical wards, this lack of association is highly intriguing and stands in contrast to numerous studies in more resource-rich settings.[1–8] Perhaps the lack of diagnostic tests and treatments for patients with acute conditions such as an ischemic stroke or pulmonary embolism who benefit greatly from time-sensitive interventions may in part explain

this difference. At this public referral hospital in Kenya, interventions such as thrombolysis or endoscopy are largely unavailable weekends or weekdays. Additionally, patients often present late in their illnesses, perhaps well beyond the early vital time period. These late presentations are likely due to a variety of factors including lack of transport, fear of health care costs and a limited medical knowledge.

Moreover, in this resource-poor setting with this patient population, it is possible the baseline patient-to-staff ratios are already so high and difficult to manage that weekend variation has minimal effect. Would a difference be seen if each nurse was only responsible for four to six patients as is the norm in more developed settings? Studies in developed settings have demonstrated that higher nursing staffing levels result in improved patient outcomes and decreased odds of nurses' job dissatisfaction and burnout.[10,11]

Or is it that there are other more significant factors in this setting associated with mortality than weekend staffing and resource variations? Our analysis demonstrated an independent association between in-hospital mortality and age, insurance status, referral status and HIV status. As we have described elsewhere, possession of health insurance may be a marker of socioeconomic status, and it also may impact care provision during the hospital stay by expediting diagnostic workup and treatment.[12] Furthermore, the population of patients referred from lower level health centers and hospitals, as well as those with HIV, may represent a more ill cohort.

The similarity in the number of deaths per day throughout the week is also intriguing. The total population on the wards varies little throughout the week as there are no elective admissions to these wards. In fact, there are fewer discharges on the weekend, 5.35 per weekend day compared to 9.18 per weekday during the study. This difference may actually lead to a slight increase in the total number of patients on the weekend making the lack of difference in mortality all the more striking. This similarity once again further supports the concept that weekly variations in staffing and services may not be impacting patient mortality in the current overwhelmingly resource-limited status.

Our study had a number of limitations. First, the sample size was limited thereby decreasing the power to detect a difference in mortality between the two populations. Studies in more resourced contexts have been able to utilize much larger datasets, unavailable in this context, to detect mortality differences even as small as 1% between those admitted on weekends and weekdays.[2–6,8,13–17] Our population did, however, represent a very broad range of diagnoses and conditions. It is possible in this context that weekend admission is significant for only certain conditions. A more extensive dataset would allow the power for such a subgroup analysis focusing on particular diagnoses. Moreover, our dataset did not contain any direct markers of the severity of illness such as vital signs or lab values upon admission as these assessments are not routinely collected for reporting by the hospital medical records department. Thus it is possible that weekend admissions differ in severity of illness from weekday admissions. The data also did not capture any delays in care provision that may have occurred due to the date and time of admission. For example, radiology tests such as CT scans or ultrasounds may have been delayed over the weekend due to staffing, but the data does not allow us to examine how many and what types of delays may have occurred. Lastly, the dataset did not contain total staffing or patient numbers during the study period. With these values, it would have been possible to examine if their variations as well as staff-to-patient ratios were associated with differences in mortality.

Conclusions

Among adult patients hospitalized on the medical wards at a public referral hospital in Kenya, patients admitted on weekends had a similar in-hospital mortality rate to those admitted on weekdays. This remains true even after controlling for several confounding factors. This similarity may reflect a stable level of care offered to all patients despite changes in staffing ratios and resource availability on weekends. However, with an overall mortality rate of approximately 22% and very high patient-to-staff ratios, this lack of difference may also reflect a generalized shortage of resources and staffing that supersedes any impact of weekly variations in supply and staff numbers. Future research examining optimal patient-to-staff ratios is needed in such resource-poor settings. Perhaps decreased ratios could reach a tipping point leading to decreased hospital mortality rates. Moreover, increasing staffing may have additional benefits such as improved staff morale and patient satisfaction. Furthermore, future research also needs to examine the effects of resource availability, including imaging, laboratory tests, medications and therapeutic procedures, on patient outcomes. In this setting for example, it may be found that expanding the supply of thrombolytics alone does not improve the outcomes of patients with acute ischemic strokes if patients present to the hospital beyond the timeframe to benefit from such treatment. These research efforts are needed for local and national leadership to inform decisions on resource allocation, and ultimately these research efforts are needed for those patients and communities served on hospital wards such as these in Kenya.

Authors' contributions: GSS, BC, WA, TT, TN, and TA conceived, designed, and coordinated the study. MS and BB collected the data from the Moi Teaching and Referral Hospital Medical Records Department. GSS and BC analyzed the data and drafted the initial manuscript together. WA, TT, TN, TA, MS, and TA critically revised the manuscript for content. All authors read and approved the final manuscript. GSS and BC are guarantors of the paper.

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