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Comparison of Patients Discharged on Weekdays and Weekend/Holidays In 2019 At A Medicine Department of a Tertiary Hospital in Saudi Arabia and its Determinants

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Abstract

Purpose: To compare hospital discharges on weekday and weekend at medicine department of a tertiary hospital of Saudi Arabia and review determinants. Methods: This was retrospective cohort study. Patients discharged on weekend and holidays (Gr-1) were cases and those discharged on weekdays (Gr-2) of 2019 were controls. Age, gender, length of hospital stay (LOS) and sub-units medicine department were compared in two groups. The readmission in 30 days after discharge, mortality rate after discharge to home were also estimated.Results: Of the 2,543 annual discharges, 2,114 were sent home. Patients shifted to other hospital and rehabilitation centre were 81 (13.7%) on weekend and 319 (16.9%) during weekdays. Gr-1 and Gr-2 had 557 (26.4%) and 1,557 (73.6%) respectively. The discharge rates in Gr-1 and Gr-2 were 5.4 and 6 per day. The discharge rate was significantly higher in Gr-2 than Gr-1 (Rate Ratio: 0.398, 95% CI 0.36; 0.44, P <0.0001). Age (P= 0.68), Gender (P = 0.86), LOS (Mann Whitney P = 0.77), presence of ulcer (P = 0.49) and mortality after discharge (P = 0.53) were not significantly different in two groups. Discharge rate in two groups varied significantly by subspecialty of medicine. ($\chi 2 = 16.8$, P <0.001). The readmission in 30 days after discharge was 3.6% and 23% in Gr-1 and Gr-2. (P = 0.11). Conclusions: The patient discharge rate was affected by 'weekend effect' in a tertiary medical hospital of Saudi Arabia. It varied by subspeciality units but not by LOS, age and gender.

Keywords: *Hospital Discharge, Length of Stay, Weekend Effect, Readmission, Subspeciality of Medicine.*

Introduction

Since 1990, the burden of non communicable diseases (NCDs) and injuries is stable, but they contribute half of the disease burden especially in 50 years and older population. In view of increasing aging population, member countries of UN have adopted universal health access and implemented different strategies to improve quality of life of people suffering from such ailments[1,2]. Prompt action is urged among Arab countries to implement global strategies to prevent, treat and rehabilitate persons with NCD to reduce mortality and morbidities[3]. NCDs are estimated to cost Saudi Arabia US$18.6 billion per annum, or 2.8% of GDP[4]. As a part of the Health Sector Transformation Program of Saudi Arabia, improving the quality and efficiency of health services is one of the goals[5]. The Ministry of Health, Saudi Arabia, through Ada'a Health,

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evaluates the health services periodically to strengthen the efficiency of service delivery. The tertiary hospitals including King Fahad Medical city (KFMC) hospital use performance indicators (KPIs) to evaluate entities' progress such as Hospital Length of Stay (LOS)[6].

The inpatient service of the main KFMC hospital caters medical subspecialty care to adult Saudi patients since 2004. With referrals from all over the Kingdom, the inpatients services even though are adequate, remain in demand. The 'in-house' consultant and his/her team is available all the time to provide care to admitted patients. The discharges are carried out for transferring stable patients to community care, back to referring hospitals or to other rehabilitation services of the same medical city[7].

To review the efficiency of the inpatient services of the hospital, one of the indicators used is LOS. This is known to be affected by 'Weekend effect'[8,9]. Hospital staffing is usually high during weekdays and minimum coverage is ensured during holidays and weekends. This could affect both quality of care in admissions and discharge. The later can increase LOS and cost to the hospital[10]. Thus, surgical, critical care units and medical services periodically review discharges during weekdays and weekends to identify differences, its effect on services and recommend solutions to overcome identified barriers[11,12-15]. There is evidence of a 'weekend effect' in UK hospitals, with patients admitted during the weekend had 7% higher odds of mortality compared to weekday admissions (Honeyford et al). Furthermore, the 'Weekend effect' on patient admitted for urgent general operations on weekends, experience worse outcomes compared to those operated on during the weekdays. This includes increased postoperative complications, longer LOS and higher hospital charges, where patients operated on during the weekend had significantly higher hospital charges by approximately $185 compared to those operated on the weekdays (Zapf, M. A. C.). Chen et al. (2019) conducted a systematic review and meta-analysis to quantify the magnitude of this effect and explore the underlying factors. They found that weekends hospital admissions are associated with a 16% increase in mortality odds compared to weekdays admissions, highlighting a significant disparity in patient outcome (Chen et al., 2019). In Saudi Arabia, surgical services in a hospital were evaluated to review the 'Weekend effect'[16]. To the best of our knowledge, patients admitted for medical conditions in a tertiary hospital have not been evaluated for 'Weekend effect' in Saudi Arabia.

We present discharge rates during weekend + holidays compared to weekdays and its determinants in medical unit of a tertiary hospital. Based on the outcomes, we proposed remedial measures to improve the efficiency of discharge system in the study area.

Methods

The research and ethics committee of the institute approved of this study. Since it was retrospective review of health records, informed patients' consent was waived. The study strictly abided the norms of Helsinki declaration and personal identity of patients was delinked from other information before analysing the data. Adults aged 15 to 99 years with medical conditions admitted in medical units of our hospital that were discharged/shifted to other care units during 1st January to 31st December 2019 were our study population. Those discharged to go home were further grouped into Gr-1 if discharged on weekends and holidays. The patients discharged on weekdays were grouped in Gr-2.

To calculate the sample size of a cohort study, we assumed that the rate of readmission among patients discharged on weekends will be 3.2%. While odds ratio of readmission in weekend

discharge will be 2.25 compared to weekday discharge[16]. To achieve 95% confidence interval and 90% power to the cohort study with 1:3 ratio, we need to review at least 498 patients discharged on weekends (Gr-1) and 1,494 patients discharged on weekdays (Gr-2). We used Statcalc of Open Epi software for this sample size estimation[17].

The electronic health records of the hospital were used to collect the information on patients discharged during the study period. Demographic information included, age, gender, subspeciality unit where care was given, date of discharge, consultant giving care and final diagnosis at discharge. Destination of discharged patient included home, other hospitals, rehabilitation centres and death. Based on the date of discharge, the day of the week was allotted to each patient for defining the day of discharge. If discharge was on Friday or Saturday, it was grouped as weekend (Gr-1). In addition, national holidays in 2019 (two Eid and national day holidays) were also added in Gr-1. In 2019, there were 104 days with holidays when patients were discharged with 'weekend effect' and were placed in Gr-1. With 261 weekdays, patients discharged on these days were placed in Gr-2. The patients discharged on Sunday to Thursdays were grouped as Gr-2. Length of stay (in days) in hospital was calculated based on date of admission and date of discharge.

The outcome variable was discharging rate. For Gr 1, the discharge rate = number of discharges for home/ 104 (Thursdays and Friday and national holidays). Discharge rate on weekdays was defined as number of discharges for home in 261 working weekdays.

The data was collected in spreadsheet of Microsoft XL®. After consistency check, the personal identity was removed, and the rest of the data was transferred into spreadsheet of Statistical Package for Social Studies (SPSS 25) (IBM, NY, USA). The qualitative variables were presented as frequency and percentage proportion. The quantitative variable was first plotted to review its distribution. Normally distributed variable was presented as mean and standard deviation. If distribution was not normal, we estimated the median, inter quartile range and minimum and maximum values. To compare variables in Gr-1 and Gr-2, we used univariate analysis by parametric method. To validate the comparison, we estimated Odds Ratio, its 95% confidence interval and two-sided P value. For more than two variables, we estimated chi square value, degree of freedom and two-sided P value. For numerical variables with normal distribution, we estimated the difference of mean, its 95% confidence interval and two-sided P value. For numerical variables with uneven distribution, we used Mann Whitney U test and calculated two-sided P values. A P value of <0.05 was considered statistically significant.

Results

During 2019, 2,543 patients were discharged from the medical department of KFMC hospital. The distribution of these patients is displayed in the flow chart (in **Figure 1**). The ratio of Gr-1 and Gr-2 was 1:3.3. Among Gr-1 and Gr-2, the mortality rate was 1.4% and 1.1% respectively.

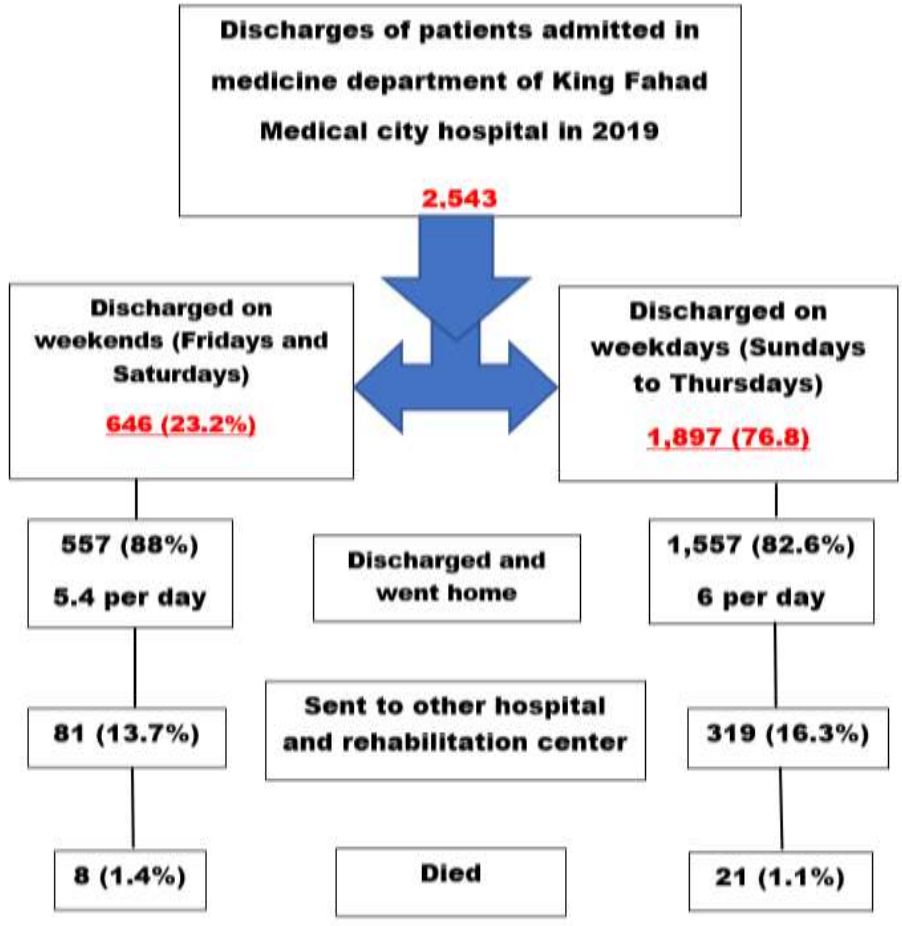

Figure 1. Flow Chart of Study Population, Medical Patients Discharged on Weekends and Weekdays at Tertiary Hospital of Saudi Arabia

The number of discharges on each day of week is displayed in **Figure 2**. The discharges on Fridays and Saturdays were less than other week days. However, discharges on Sunday even though a working day were less. The discharge rates in Gr-1 and Gr-2 were 5.4 and 6 per day. The discharge rate was significantly lower in Gr-1 than Gr-2 (Rate Ratio: 0.398, 95% CI 0.36; 0.44, P <0.0001).

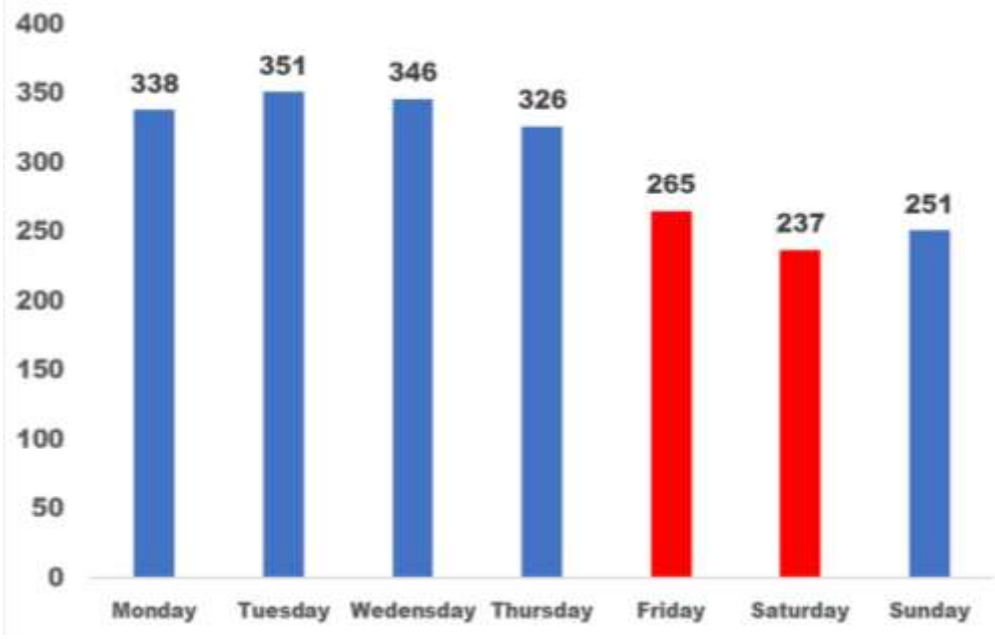

Figure 2. Discharges from the Medical Department of A Tertiary Hospital on Different Days of Week in 2019.

Note: X axis depicts different days of week; Y axis depicts number of patients discharged from hospital to go to home; Red coloured bar are weekends and holidays; and Blue coloured bar are weekdays.

The demographic determinants and other variables related to admitted patients in Gr-1 and Gr-2 were compared in **Table 1.** Age (P= 0.68), Gender (P = 0.86), LOS (Mann Whitney P = 0.77) and presence of ulcer (P = 0.49) were not significantly different in two groups. Discharge rate in two groups varied significantly by subspecialty of medicine. (χ^2 = 16.8, P <0.001).

		Weekend + holidays (N = 557)		**Weekdays (N = 1,557)**		Validation
		Number	Percentage	Number	Percentage	
Gender	Male Female	249 308	44.7 55.3	703 854	45.2 54.8	OR = 0.98 (95% CI 0.8; 1.2), P = 0.86
Age (years)	Mean SDV	51.2 22.6		50.7 22.2		Diff of mean 0.46 (95% CI -

						1.7; 2.6) P = 0.68
Length of stay (days)	Median Inter quartile range Minimum - Maximum	4 2, 9 0 - 152		4 2, 9 0 - 315		Mann Whitney U P = 0.77
Subspecialit y Unit	Internal Medicine Endocrinology Gastroenterolog y Pulmonology Rheumatology Infectious Diseases Nephrology Other	227 47 97 75 26 14 49 22	40.8 8.4 17.4 13.8 4.7 2.5 8.8 3.9	540 114 279 211 36 46 210 121	34.7 7.3 17.9 13.6 2.3 3.0 13.5 7.8	Chi square = 16.8 Degree of freedom = 7, P ‘0.001
Pressure ulcer in patients	Yes No	29 528	5.2 94.8	70 1,487	4.5 95.5	OR = 1.17, (95% CI 0.7; 1.8) P = 0.49

Table 1. Comparison of Patients Discharged for Home on Weekdays + Holidays Vs Weekend from Medical Department of a Tertiary Hospital In 2019.

Among Gr-1, 20 (3.6%) patients were readmitted in 30 days after discharge. Among Gr-2, 36 (2.3%) patients were readmitted. The readmission rate was similar in both groups. (OR = 1.6 (95% CI 0.9; 2.7, P = 0.11) Among Gr-1 and Gr-2 one patient died. The mortality rate after discharge was not significantly different in two groups. (OR = 2.8 (95% CI 0.2; 44.8), P = 0.528).

The LOS of more than 30 days was in 17 (3.05%) patients of Gr-1 and 48 (3.08%) patients of Gr-2. Their distribution by subspeciality is given in **Table 2**. Apart from infectious diseases unit, all other subunits discharged patients equally or in more number patients with more than 30 days stay during weekdays.

	Weekend + holidays discharges (N =17)		Weekdays discharges (N = 48)		Validity
	Number	Percentage	Number	Percentage	
Endocrinology	1	5.9	1	2.1	Chi square = 0.27 DF = 8 P = 0.6
Gastroenterology	3	17.6	6	12.5	
Haematology	0	0.0	2	4.2	
Infectious Diseases	3	17.6	1	2.1	
Internal Medicine	3	17.6	21	43.8	
Nephrology	0	0.0	3	6.3	
Pulmonology	6	35.3	10	20.8	
Rheumatology	1	5.9	3	6.3	

Other	0	0.0	1	2.1	

Table 2. Patients With 30 Plus Days of Hospital Stay and Discharged on Weekends Vs Weekends and Subspeciality Units.

Discussion

We noted 'weekend effect' on discharges of stable patients sent home after giving care in medical department of a tertiary hospital. The indicators like readmission, mortality among discharged patients and length of the stay in hospital suggested that patients leaving hospital on weekdays and weekend were not deprived of services and care compared to those leaving on weekdays. The difference of discharge rate although lower on weekends, they were not associated to demographic factors. It varied significantly among subunits of medicine department.

The study site, medical department of KFMC hospital is unique. System of internal reference to other units of the medical city for rehabilitation, transferring patients to the referring hospital after patient is stable and availability of consultants on holidays in the study site seem to have resulted in the high discharge rate even in weekends. The indicators like readmissions and mortalities suggest high level of patient selection and care for discharges even on the weekends and holidays. The electronic health records and experienced manpower to provide health care enabled to generate information to study weekend effect.

In our study, more than one fourth of total annual discharges were on the weekends and holidays. This was more than 20% reported discharges on weekends and holidays of patients after cardiac surgeries[18]. Weekend discharges of patients recovering from stroke in Australia was 8.6% only[11]. Discharges in hospitals of California state of USA in 2012 suggested that 22.5% of them were on weekends[9]. Patients undergoing surgeries in a study in Saudi Arabia had 16.8% of patients discharged on weekends[16]. One should not that patients discharged to home only were accounted in present study while other studies could also have included discharged patients before shifting to other hospitals.

The discharge rate on weekends was significantly lower than weekdays in our study. To the best of our knowledge, discharge rates per day have not been documented in literature. Rinne et al although distributed discharges per each day of the week, discharges on weekdays and weekends were 4,279 vs 1,922 patients[14]. The surge of discharge on last day of working in a week noted by Rinne et al did not matched with our study. Even distribution of discharges on last four working days is encouraging but lower discharge rates on 1st day of week should be further explored. Perhaps, workload of admission and revising care regimen on 1st day after weekend could have resulted in low discharge rates on Sundays in our study.

LOS is an accepted appraisal indicator to review hospital efficiency of hospital[19]. We did not find difference of LOS among patients discharged during weekends and weekdays in our study. This reflects availability of efficient services even in weekends. Grandhi et al noted mean LOS of 7.8 days of patients treated for ischemic stroke and discharged during weekends but there was no significant difference in LOS compared to these discharged on weekdays[20]. Among patients of medicine department of hospitals of Canada who were discharged on weekends and weekdays, there was no significant difference in LOS[15]. In our study, there was mix of patients with infectious diseases and chronic non communicable diseases with complications. The LOS of later group is likely to be longer. However, after patient become stable policy of shifting the patient either to referring hospital or to rehabilitation unit if constant monitoring by subspecialist

is not required, seems to have resulted in low LOS in both groups. Availability of consultant for discharging even on weekends could have resulting in reducing LOS and saving cost to the hospital.

The gender was not associated to the discharges on weekends in our study. It is difficult to explain similar rates of discharges among male and females on weekends in our study. This also contrasted with findings in literature. Males are more likely to be discharged on weekends than females with coronary artery diseases admitted in hospitals of USA[21]. Cloyed et al noted higher readmission rates among male patients following major surgery and discharged on weekends[9].

There was no difference in age of patients discharged on weekends and weekdays in our study. In another study of Saudi Arabia, patients discharged after surgery on weekends were younger in ages compared to those discharged on weekdays[16]. Quick convalescence of young patients compared to aged patients with multiple comorbidities could result in weekend discharges with risk of unsupervised ambulatory process after surgery. This is less likely to be true in patients of mean 50 years of both groups in our study.

Patients given care by internal medicine, endocrinology and rheumatology units had significant more proportion of patients discharged in weekends and holidays than the proportion of discharges in weekdays. In contrast proportion of weekend discharge was lower than weekdays in nephrology unit. In literature, several studies of patients with specific health ailment and weekend effects[22,23,24]. A wide variety of subspecialities at study site and different chronic diseases with complications being given tertiary level of care could explain differential discharge rates of weekend and weekdays. Nevertheless, more review at subunit level is recommended to explore possibility of bridging gap of discharge rate on weekends vs weekdays.

The readmission in 30 days after discharge is one indicator used to study efficiency of discharging policies of hospital. It was similar in two groups in present study. This was also noted by Sanaiha et al among patients discharged after major cardiac surgery and Cloyed et al in California state[9,18]. Similar readmission rates in two groups in our study indicate high quality of care in counseling, prescribing medications at the time of discharge even on weekends and holidays[21].

The mortality rate after discharge was low and similar in both groups. This reflects high level of care offered to patients with medical ailments in adult Saudi patients discharged from tertiary hospital even on weekends. This also points at efficiency of hospital in reducing LOS by weekend discharges but without compromising quality of care. Those discharged on weekends after stroke were noted with higher long-term mortality rates[11]. Those discharged form Intensive Care Units on weekends also had higher mortality rates compared to those discharged on weekdays[25]. Interestingly, veterans with chronic obstructive pulmonary disease who were admitted for care when discharged on weekends had lower mortality rates than those discharged on weekdays[14]. Perhaps reduced risk of hospital infections in patients discharged on week ends due to their reduced hospital stay could have resulted in low mortality rates.

There were few limitations in present study. Although last day of week i.e., Thursday, is counted as weekday, patients discharged after 4 pm could be considered as weekend discharges. We did not have timing of discharges and thus a small proportion of cases could have been placed in weekdays group. We had not collected information in 14-days post-discharge follow up visits our study. This was an important indicator for weekend effect after surgery and discharge in

Saudi Arabia study[16]. The study was based on information of one institution and hence extrapolation of study outcomes beyond study site should be carried out with caution.

The weekend effect could also affect admissions in tertiary hospitals. We recommend to review admissions on weekends in such institutions to complement our study findings to recommend policy for improving hospital administrative policies and care. Care of patients with long stay in tertiary hospitals can be affected by holiday ratio. This indicator we had not collected and could be an area of further research for reviewing hospital efficiency[26].

In this study, we highlighted the need to review hospital efficiency in relation to weekend effect on discharges from medical department of a tertiary hospital. Consultant offering discharging service along with counseling and drug prescriptions on weekends is crucial to reduce LOS and thus cost to hospital and reduce weekend impact on readmissions and mortalities. Collaboration of shifting stable patients with chronic diseases from medical wards to referring hospitals and rehabilitation unit if could be strengthened on weekends and holidays, hospital efficiency could be further increased.

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