Reevaluating the Weekend Effect on SAH: A Nationwide Analysis of the Association Between Mortality and Weekend Admission

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Introduction

Mortality rates of patients admitted on the weekend were first analyzed in a 10-year review of acute care admissions from emergency departments in Ontario, Canada.¹ Their conclusion, that patients admitted on the weekend with “serious medical conditions” are more likely to die than if they were admitted on a weekday, was described as the ‘weekend effect’ phenomenon.

Fueled by a mortality rate approaching 50% within 30 days and a prognosis of full recovery in only one-third of cases, subarachnoid hemorrhage (SAH) remains a topic of debate in terms of surgical intervention. Historically, 80 to 85% of spontaneous SAH were secondary to ruptured aneurysms with 10-15% of patients dying prior to hospitalization.² Of the patients hospitalized for subarachnoid hemorrhage, up to 15% will have neurologic deterioration in the immediate hours following a SAH, indicating aneurysmal rebleeding.³ After the initial 24-hours, the approximated risk of rebleeding is evenly distributed over the next 4 weeks.⁴ Of the patients that experience aneurysmal rebleeding, 80% of these will either die or remain disabled.⁵

Our study, utilizing a larger population and more recent data from the Nationwide Inpatient Sample (NIS) database (n= 54,703), attempts to analyze whether there is a ‘weekend effect’ as it relates to SAH and to explore possible factors contributing to these outcomes.

Materials and Methods

National Inpatient Sample Database

This study analyzed data extracted from the National Inpatient Sample (NIS), The NIS is the largest publicly available all-payer inpatient healthcare database in the United States, representing a 20% random stratified sample of all discharges from U.S. community hospitals, excluding rehabilitation and long-term acute care hospitals and yielding national estimates of hospital inpatient stays.

Cohort Population

Using the International Classification of Diseases, Ninth Edition, Clinical Modification (ICD-9 CM) Diagnosis Code 430, we generated our cohort sample consisting of inpatients admitted with a diagnosis of SAH between 2006 and 2014. We included all patients who had complete data available in the NIS and excluded those who lacked complete data needed for the statistical analysis. (Table 1)

Statistical Analysis

Our primary outcome measure was all-cause in-hospital mortality, defined as deaths that occurred during the initial hospitalization, on the day of admission, or on the discharge date, provided the length of stay was ≤ 30 days. All statistical testing was two-sided with a p-value of 0.05 used as a marker of statistical significance.

		Weekday, n(%)	Weekend, n(%)
Sample size, n		40422	14281
Age (mean + SD)		59.47 +/- 17.75	59.17 +/- 17.61
Length of stay (mean + SD)		11.63 +/- 14.15	11.51 +/- 13.71
Female		24095 (59.61)	8508 (59.58)
Race	White	26120 (64.62)	8982 (62.89)
	Black	5841 (14.45)	2141 (14.99)
	Hispanic	4796 (11.86)	1790 (12.53)
	Asian	1805 (4.47)	647 (4.53)
	Native Am.	197 (0.49)	73 (0.51)
	Other	1663 (4.11)	648 (4.54)
Teaching Status/Location	Rural	1309 (3.24)	467 (3.27)
	Urban Non-teaching	9473 (23.44)	3183 (22.29)
	Urban Teaching	29640 (73.33)	10631 (74.44)
Income quartiles by zip code	1 st	11313 (27.99)	4017 (28.13)
	2 nd	10044 (24.85)	3621 (25.36)
	3 rd	9638 (23.84)	3344 (23.42)
	4 th	9427 (23.32)	3299 (23.1)

Table 1. Cohort Characteristics

Results

	OR	95% CI	p value
Admission Day			
Weekday	Reference		
Weekend	1.07	1.02, 1.12	0.005
Teaching Status/Location			
Rural	Reference		
Urban non-teaching	0.87	0.78, 0.97	0.014
Urban teaching	0.72	0.64, 0.80	<0.001
Age*	1.02	1.02, 1.09	<0.001
Gender			
Male	Reference		
Female	1.05	1.00, 1.09	0.032
Race			
White	Reference		
Black	1.01	0.95, 1.08	0.678
Hispanic	0.96	0.89, 1.08	0.214
Asian	1.31	1.19, 1.44	<0.001
Native American	0.89	0.65, 1.21	0.442
Other	1.05	0.95, 1.17	0.350
Income Quartile by zip code			
1 st	Reference		
2 nd	0.99	0.93, 1.05	0.671
3 rd	0.87	0.82, 0.92	<0.001
4 th	0.86	0.81, 0.91	<0.001
* Likelihood (Odds Ratio) increase per additional year of age			

Table 2. Multivariate logistic regression model: In-Hospital Mortality

- Multivariate analysis showed that weekend admissions had significantly higher mortality when compared directly to weekday admissions. (Table 2)
- Patient characteristics with significantly increased odds of in-hospital mortality: older patients, female sex, Asian race, and increased age. (Table 2)
- Comorbidities with significantly increased odds of in-hospital mortality: congestive heart failure (CHF), coagulopathy, uncomplicated diabetes, drug abuse, liver disease, lymphoma, fluid and electrolyte disorders, metastatic cancer , renal failure, and non-metastatic solid tumors.
- Patients in the highest income quartiles based on the zip code, the third and fourth quartiles, had significantly lower likelihood of in-patient mortality. (Table 2)
- Both urban teaching and non-teaching hospitals have decreased rates of in-hospital mortality compared to rural hospitals for SAH patients. Teaching hospitals have the lowest mortality of any group. (Table 2)

Conclusion

- Our study demonstrates that the ‘weekend effect’ is present for patients admitted for SAH. Our results showed significantly increased risk of mortality for those admitted during the weekend when compared to patients admitted during the week.
- Additionally we found that in-hospital mortality during the weekend was significantly higher for non-teaching hospitals versus teaching hospitals.
- Multiple studies have shown improved outcomes by establishing a protocol that treats SAH within 24 hours.^{6,7} Much of the prognostic improvement between early- and late-aneurysmal intervention is thought to be related to the increased risk of aneurysmal rebleeding in patients with a poor-grade SAH.
- A national review aimed at identifying barriers to treatment and creating a formal treatment protocol for SAH would most likely aid in alleviating the discrepancy of weekday versus weekday mortality outcomes.

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