The 'weekend effect': What is the evidence?

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The ‘weekend effect’

- Background
- My work
- Explanations
- Next steps
Increased mortality associated with weekend hospital admission: a case for expanded seven day services?

Nick Freemantle and colleagues discuss the findings of their updated analysis of weekend admissions and the implications for service design.

Nick Freemantle professor of clinical epidemiology and biostatistics, Daniel Ray professor of health informatics, David McNulty medical statistician, David Rosser medical director, Simon Bennett director, clinical policy and professional standards, Domenico Pagano professor, cardiac surgery.

Any modern, effective healthcare system should prevent premature deaths from treatable causes, improve quality of life for people with long term conditions, aid recovery from acute conditions, and ensure safe care. At the same time it should provide patients with as positive an experience as reasonably possible. A positive patient experience is a reduced provision of healthcare at a level that creates a sense of trust with patients. These domains of care are often linked, and excess mortality risk differs between hospital stay at weekends and during the week.

Survivorship models

We used identical methods to those in the previous analysis apart from incremental improvements in modelling strategy. We used survivorship models that accounted separately for day of admission and days of the week of hospital stay following patients for the first 30 days after admission. These analyses used a dependent covariate to estimate the effect of days of stay, identifying the day of the week for all hospital admissions. We adjusted for the starting day of the week as an independent covariate.
Freemantle et al.

• Update of their 2012 paper on 2009/10 admissions for 2013/14
• Compared with Wednesday

Fig 2 Hazard ratio (95% confidence interval) for death within 30 days by day of admission compared with Wednesday

• Combines elective and emergency admissions
• Choice of disease specific analyses (Oncology and cardiovascular)
• Day of death analysis
Over 100 papers
• Mortality among patients admitted to hospital on weekends as compared with weekdays Canadian study, acute care from ER departments in Ontario, Canada.
• 3.8 million admissions
• Looked at specific conditions (AAA, acute epiglottis, PE, AMI, Stroke and #NOF) plus the 100 conditions that were the most common causes of death.
• Significant weekend effect for AAA (OR 1.28), epiglottis (OR 5.47) and PE (OR 1.19), plus 23 out of the 100 leading causes of death.
• No conditions associated with significantly lower mortality rates at the weekend.

Kostis et al. 2007

- Weekend versus weekday admission and mortality from myocardial infarction
- Acute Myocardial Infarction, all admissions in New Jersey 1987-2002
- 231,164 admissions
- In the interval from 1999 to 2002 (59,786 admissions), mortality at 30 days was significantly higher for patients admitted on weekends (12.9% vs. 12.0%, P = 0.006).
- Persisted at 1 year (1% absolute difference in mortality).
- Associated with lower rate of invasive procedures

Barba et al. 2006

- Mortality among adult patients admitted to the hospital on weekends
- All acute admissions to tertiary acute care hospital in Spain (1999-2003)
- 35,993 hospital admissions
- All in-hospital deaths OR = 1.1, but not significant. Deaths within 48 hours OR=1.4

Other studies

• Hamilton et al found higher weekend neonatal mortality (OR= 1.42) in Texas 1999-2000.
• Schmulewitz et al found no weekend effect in a single Scottish hospital
• Wunsch et al used ICNARC to examine 75,621 admissions to 102 ICUs across England, Wales and NI and found admissions on weekend days (Friday, Saturday, Sunday) or in the evening/night were associated with higher odds of crude hospital death, but this was accounted for by case mix.

The increased mortality associated with a weekend emergency admission is due to increased illness severity and altered case-mix

O Mikulich, E Callaly, K Bennett, B Silke & DO’ Riordan

Key Points
1. Mortality for medical emergency admissions, differed by weekday or weekend admission (weekend 11% higher).
2. The case mix differed at weekends with more respiratory and neurological diagnoses.
3. A predictive score (illness severity), based on age and disturbance in biochemistry, predicted a higher mortality for patients admitted at weekends.
4. The factors that were predictive of a death by day 30 were: illness Severity Score, the Charlson Co-Morbidity Index, the serum albumin, oxygen saturation on presentation to ED and serum troponin status (negative or positive).

Abstract: A weekend emergency medical admission has been associated with a higher mortality. We have examined all weekend admissions to St James’ Hospital, Dublin between 2002 and 2009.

Methods: We divided admissions by weekday or weekend (Saturday or Sunday) presentation. We utilised a multivariate logistic model, to determine whether a weekend admission was independently predictive of 30 day outcome.

Results: There were 49,337 episodes recorded in 25,883 patients; 30-day inhospital mortality at the weekend was 3.0% (95% CI 2.9% - 3.1%) and at the weekdays was 1.6% (95% CI 1.5% - 1.7%; p=0.057). In the full risk model, weekend admission was not an independent predictor of mortality (odds ratio 1.05, 95% CI: 0.88, 1.26; p=0.56). The case mix differed at weekends with more respiratory and neurological diagnoses.

(presentations)
Mikulich et al

- St. James Hospital, Dublin
- 49,337 episodes of inpatient care
- 30 day in-hospital mortality at the weekend (9.99% vs. 9.0%)
- Wide confidence intervals (small sample)
  - Unadjusted OR 1.11 (CI 0.99-1.23)
  - Adjusted OR 1.05 (CI 0.88-1.24)
- Entirely consistent with other papers showing weekend effects
Weekend mortality for emergency admissions. A large, multicentre study

P Aynin, A Yunus, A Bottle, A Majeed, D Bell

ABSTRACT

Background Several studies have identified higher mortality for patients admitted as emergencies at the weekend compared with emergency admissions during the week, but most have focused on specific conditions or have had a limited sample size.

Methods Using routinely collected hospital administrative data, we examined in-hospital deaths for all emergency inpatient admissions to all public acute hospitals in England for 2005/2006. Odds of death were calculated for admissions at the weekend compared to admissions during the week, adjusted for age, sex, socioeconomic deprivation, comorbidity and diagnosis.

Results Of a total of 4,317,666 emergency admissions, we found 215,054 in-hospital deaths with an overall crude mortality rate of 5.0% (5.2% for all weekend admissions and 4.9% for all weekday admissions). The overall adjusted odds of death for all emergency admissions was 1.16 (95% CI 1.10 to 1.21) in those patients admitted at the weekend compared with patients admitted during a weekday (p<0.001).

Conclusions This is the largest study published on weekend mortality and highlights an area of concern in relation to the delivery of acute services.

Previous North American studies have found that mortality among patients admitted on weekends was higher than for those patients admitted on weekdays. These papers focused on specific conditions, and in each case, poorer access to services at the weekend was implicated as a possible explanation. A recent European study suggested that although all-cause mortality was similar in patients admitted during the week and at weekends, higher for medical conditions at a level not generally applicable to more general emergency hospital care.

We aimed to take advantage of the large numbers of records available within routinely collected hospital admissions data in England and compared mortality for emergency admissions occurring at weekends with that occurring during the rest of the week in England for a wide range of diagnoses.

METHODS

We obtained an extract of all finished consultant episodes of care for inpatients in all acute public hospitals in England from the NHS Wide Clearing Service with discharge dates between 1 April 2005 and 31 March 2006. A finished consultant episode is defined as a period of admitted patient care under a consultant or allied healthcare professional within an NHS hospital trust. There may be more than one finished consultant episode within an admission and, by linking episodes of care, our unit of analysis was an admission. We excluded day cases (day surgery) and admissions occurring in non-acute trusts, and focused on emergency inpatient admissions. As we did not have time of admission, we defined weekend admissions as those that started on a Saturday or Sunday by date. We derived the main diagnosis from the primary diagnosis of the first episode of care. If that diagnosis was vague or non-specific, then the primary diagnosis in the subsequent episode of care (if present) was used. All admissions were coded to one of 288 Clinical Classification System (CCS) diagnostic groups. We assigned an area-level socioeconomic deprivation score (index of multiple deprivation 2004) to each patient using their postcode of residence. We also assigned a Charlson comorbidity index.
Weekend mortality for emergency admissions

• All emergency admissions in England for 2005/6
• Examined top 50 diagnoses leading to death and all cause admissions.
• Adjusted for age, sex, socioeconomic deprivation, comorbidity and diagnosis
• Odds of death were calculated for admissions at the weekend compared to admissions during the week
Weekend mortality for emergency admissions

- 4,317,866 admissions with 215,054 in-hospital deaths
- Crude mortality
  - 5.2% for weekend admissions
  - 4.9% for weekday admissions
- 17 out of 50 diagnosis groups associated with significantly higher odds of death ($p<0.001$) including stroke (OR 1.13), AMI (OR 1.08)
- Overall adjusted odds of death was 10% higher (OR = 1.10, 95% CI 1.08-1.11) in those patients admitted at the weekend compared with patients admitted during a weekday ($p<0.001$)
### Table 2: Top 50 causes of death (by volume) for weekend and weekday emergency admissions to acute NHS hospitals 2005/2006

<table>
<thead>
<tr>
<th>Condition</th>
<th>No. of admissions</th>
<th>Mortality rate</th>
<th>Mortality % (number of deaths)</th>
<th>p Value</th>
<th>OR (95% CI)†</th>
</tr>
</thead>
<tbody>
<tr>
<td>All admissions</td>
<td>4,317,866</td>
<td></td>
<td></td>
<td>&lt;0.001†</td>
<td>1.10 (1.08 to 1.11)</td>
</tr>
<tr>
<td><strong>Medical</strong></td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Acute and unspecified renal failure (CCS 157)</td>
<td>14,134</td>
<td>25.6 (2,924)</td>
<td>33.3 (909)</td>
<td>&lt;0.001†</td>
<td>1.45 (1.32 to 1.60)</td>
</tr>
<tr>
<td>Acute bronchitis (CCS 125)</td>
<td>103,224</td>
<td>5.3 (4,142)</td>
<td>5.6 (1,409)</td>
<td>0.920</td>
<td>1.00 (0.94 to 1.07)</td>
</tr>
<tr>
<td>Acute cerebrovascular disease (CCS 109)</td>
<td>70,500</td>
<td>27.5 (14,451)</td>
<td>30.2 (5,437)</td>
<td>&lt;0.001†</td>
<td>1.13 (1.09 to 1.18)</td>
</tr>
<tr>
<td>Acute myocardial infarction (CCS100)</td>
<td>68,932</td>
<td>13.5 (6,803)</td>
<td>14.4 (2,650)</td>
<td>0.002*</td>
<td>1.08 (1.03 to 1.14)</td>
</tr>
<tr>
<td>Aspiration pneumonitis, food/vomitus (CCS 129)</td>
<td>6,233</td>
<td>49.2 (2,222)</td>
<td>49.1 (843)</td>
<td>0.640</td>
<td>0.97 (0.86 to 1.10)</td>
</tr>
<tr>
<td>Cardiac arrest and ventricular fibrillation (CCS 107)</td>
<td>2,576</td>
<td>64.9 (1,238)</td>
<td>68.1 (455)</td>
<td>0.048*</td>
<td>1.22 (1.00 to 1.48)</td>
</tr>
<tr>
<td>Cardiac dysrhythmias (CCS 106)</td>
<td>86,134</td>
<td>1.9 (1,270)</td>
<td>2.4 (453)</td>
<td>&lt;0.001†</td>
<td>1.31 (1.17 to 1.47)</td>
</tr>
<tr>
<td>Chronic obstructive pulmonary disease and bronchiectasis (CCS 127)</td>
<td>106,951</td>
<td>7.7 (6,174)</td>
<td>7.6 (2,005)</td>
<td>0.840</td>
<td>1.00 (0.94 to 1.05)</td>
</tr>
<tr>
<td>Chronic ulcer of skin (CCS 199)</td>
<td>9,402</td>
<td>10.3 (831)</td>
<td>11.5 (154)</td>
<td>0.104</td>
<td>1.17 (0.97 to 1.42)</td>
</tr>
<tr>
<td>Congestive heart failure non-hypertensive (CCS 108)</td>
<td>56,394</td>
<td>17.9 (7,944)</td>
<td>19.6 (2,351)</td>
<td>&lt;0.001†</td>
<td>1.11 (1.05 to 1.17)</td>
</tr>
<tr>
<td>Coronary atherosclerosis and other heart disease (CCS 101)</td>
<td>91,836</td>
<td>2.4 (1,676)</td>
<td>2.8 (583)</td>
<td>0.008*</td>
<td>1.14 (1.04 to 1.26)</td>
</tr>
<tr>
<td>Deficiency and other anaemia (CCS 59)</td>
<td>30,422</td>
<td>3.5 (951)</td>
<td>4.2 (152)</td>
<td>0.015*</td>
<td>1.25 (1.04 to 1.49)</td>
</tr>
<tr>
<td>Fluid and electrolyte disorders (CCS 55)</td>
<td>17,436</td>
<td>9.6 (1,359)</td>
<td>11.3 (365)</td>
<td>0.013*</td>
<td>1.17 (1.03 to 1.33)</td>
</tr>
<tr>
<td>Gastrointestinal haemorrhage (CCS 153)</td>
<td>57,937</td>
<td>7.3 (3,196)</td>
<td>7.8 (1,087)</td>
<td>0.042*</td>
<td>1.08 (1.00 to 1.17)</td>
</tr>
<tr>
<td>Intestinal infection (CCS 135)</td>
<td>40,519</td>
<td>2.9 (886)</td>
<td>2.7 (274)</td>
<td>0.385</td>
<td>0.94 (0.81 to 1.09)</td>
</tr>
<tr>
<td>Liver disease, alcohol-related (CCS 150)</td>
<td>10,401</td>
<td>18.5 (1,576)</td>
<td>20.4 (382)</td>
<td>0.042*</td>
<td>1.14 (1.01 to 1.30)</td>
</tr>
<tr>
<td>Other circulatory disease (CCS 117)</td>
<td>20,659</td>
<td>6.1 (1,015)</td>
<td>7.0 (280)</td>
<td>0.025*</td>
<td>1.18 (1.02 to 1.36)</td>
</tr>
<tr>
<td>Other gastrointestinal disorders (CCS 155)</td>
<td>50,774</td>
<td>3.9 (1,535)</td>
<td>4.4 (485)</td>
<td>0.114</td>
<td>1.09 (0.98 to 1.22)</td>
</tr>
<tr>
<td>Other liver diseases (CCS 151)</td>
<td>13,376</td>
<td>9.8 (1,107)</td>
<td>13.1 (276)</td>
<td>&lt;0.001†</td>
<td>1.40 (1.20 to 1.62)</td>
</tr>
<tr>
<td>Other lower respiratory disease (CCS 133)</td>
<td>23,515</td>
<td>6.7 (1,239)</td>
<td>8.6 (432)</td>
<td>&lt;0.001†</td>
<td>1.26 (1.12 to 1.42)</td>
</tr>
<tr>
<td>Peripheral and visceral atherosclerosis (CCS 114)</td>
<td>43,47</td>
<td>28.9 (1,018)</td>
<td>38.4 (315)</td>
<td>&lt;0.001†</td>
<td>1.61 (1.36 to 1.90)</td>
</tr>
<tr>
<td>Pleurisy, pneumothorax pulmonary collapse (CCS 130)</td>
<td>23,000</td>
<td>7.6 (1,442)</td>
<td>10.1 (403)</td>
<td>&lt;0.001†</td>
<td>1.42 (1.26 to 1.60)</td>
</tr>
<tr>
<td>Pneumonia (CCS 122)</td>
<td>102,465</td>
<td>24.3 (18,619)</td>
<td>25.4 (6,574)</td>
<td>0.899</td>
<td>1.00 (0.97 to 1.04)</td>
</tr>
<tr>
<td>Pulmonary heart disease (CCS 103)</td>
<td>16,314</td>
<td>9.1 (1,200)</td>
<td>11.0 (349)</td>
<td>0.046*</td>
<td>1.15 (1.00 to 1.31)</td>
</tr>
<tr>
<td>Residual codes, unclassified (CCS 259)</td>
<td>54,004</td>
<td>4.6 (1,922)</td>
<td>4.8 (575)</td>
<td>0.069</td>
<td>1.10 (0.99 to 1.21)</td>
</tr>
<tr>
<td>Respiratory failure, insufficiency arrest (adult) (CCS 131)</td>
<td>38,384</td>
<td>41.0 (11,75)</td>
<td>41.6 (406)</td>
<td>0.909</td>
<td>1.01 (0.86 to 1.18)</td>
</tr>
<tr>
<td>Senility and organic mental disorders (CCS 68)</td>
<td>34,290</td>
<td>9.2 (2,371)</td>
<td>8.2 (691)</td>
<td>0.014*</td>
<td>0.89 (0.82 to 0.98)</td>
</tr>
<tr>
<td>Septicaemia (except in labour) (CCS 2)</td>
<td>16,719</td>
<td>38.6 (4,827)</td>
<td>39.4 (1,656)</td>
<td>0.321</td>
<td>1.04 (0.96 to 1.13)</td>
</tr>
<tr>
<td>Skin and subcutaneous tissue infections (CCS 197)</td>
<td>86,786</td>
<td>1.4 (975)</td>
<td>1.3 (227)</td>
<td>0.687</td>
<td>1.03 (0.89 to 1.20)</td>
</tr>
<tr>
<td>Syncope (CCS 245)</td>
<td>66,769</td>
<td>2.1 (1,018)</td>
<td>2.0 (361)</td>
<td>0.301</td>
<td>0.94 (0.83 to 1.06)</td>
</tr>
<tr>
<td>Urinary tract infections (CCS 159)</td>
<td>62,371</td>
<td>4.0 (3,286)</td>
<td>5.1 (1,132)</td>
<td>0.702</td>
<td>1.01 (0.95 to 1.06)</td>
</tr>
</tbody>
</table>
Limitations

• Multiple statistical tests
• No out of hospital deaths
• Fewer admissions at weekend, so casemix might be different
Day of week of procedure and 30 day mortality for elective surgery: retrospective analysis of hospital episode statistics

P Aylin clinical reader in epidemiology and public health, R Alexandrescu research associate, M H Jen research associate, E K Mayer Walton clinical lecturer, A Bottle senior lecturer in medical statistics

1Dr Foster Unit at Imperial College, Department of Primary Care and Public Health, School of Public Health, Imperial College, London W6 8RP, UK; 2Department of Surgery and Cancer, St Mary’s Hospital, Imperial College, London W2 1NY, UK

Abstract

Objectives To assess the association between mortality and the day of elective surgical procedure.

Design Retrospective analysis of national hospital administrative data.

Setting All acute and specialist English hospitals carrying out elective surgery over three financial years, from 2008-09 to 2010-11.

Conclusions The study suggests a higher risk of death for patients who have elective surgical procedures carried out later in the working week and at the weekend.

Introduction

A substantial number of patients die as a result of unsafe medical care. Of these patients, many died after surgery.
Methods

• All acute and specialist English hospitals carrying out elective surgery over three financial years, from 2008-09 to 2010-11
• Planned operating room planned procedures based on AHRQ patient safety indicator\(^1\)
• Exclude day cases
• 30 day post op deaths (including out of hospital deaths linked to ONS death data)
• Adjusted for age, sex, ethnic group, socio-economic deprivation, co-morbidities, number of emergency admissions in the last 12 months, year and procedure risk quintile

\(^1\) Bottle A, Aylin P, 2009, Application of AHRQ patient safety indicators to English hospital data, Quality & Safety in Health Care, Vol:18, ISSN:1475-3898, Pages:303-308
Results

- 27,582 deaths within 30 days following 4,133,346 inpatient admissions for elective operating room procedures (6.7 per 1000).
- Compared with Monday, adjusted odds of death were 44% and 82% higher, respectively, if the procedures were carried out on Friday (odds ratio 1.44, 95% confidence interval 1.39 to 1.50) or a weekend (1.82, 1.71 to 1.94)

Adjusted odds of death and 95% confidence intervals by day of procedure in English hospitals for 2008-9 to 2010-11. (Crude rate 0.67%)


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Discussion

- Not able to use more recent data
- Mortality low for elective procedures (6.7 per 1000)
- Monday benchmark
- Hypothesis that post-op care may have contributed to mortality
  - Same picture in 2 day mortality
  - Fall in Sunday mortality
Adjusted odds of death and 95% confidence intervals by day of procedure in English hospitals for 2008-9 to 2010-11.

(exc. day cases and deliveries)
Discussion

- Not able to use more recent data
- Mortality low for elective procedures (6.7 per 1000)
- Monday benchmark
- Hypothesis that post-op care may have contributed to mortality
  - Same picture in 2 day mortality
  - Fall in Sunday mortality
- Are junior consultants more likely to operate on a Friday?
Proportions of procedures carried out by consultant experience by day of procedure in English hospitals for 2008-9 to 2010-11.

Additional adjustment by consultant experience

- Adjustment makes little difference.

- Friday effect increases from OR = 1.44 to 1.48
Interpretation

- Key is higher mortality on Friday with no apparent difference in casemix
- 48 hours following surgery
- Frailer patients, with a high burden of co-morbidity are at higher risk of mortality at the weekend.
“……The biggest increase in mortality in those operated on over Friday through to Sunday may perhaps be due to the seemingly ubiquitous practice of drastically reducing the number of doctors, in particular junior doctors, working out of hours and at weekends. A single foundation year 1 (FY1) doctor may cover a number of wards, as many as 60-100 patients. Their immediate senior, the SHO may cover twice that number or more, and so on up the ladder.”
Dying for the Weekend

A Retrospective Cohort Study on the Association Between Day of Hospital Presentation and the Quality and Safety of Stroke Care

William L. Palmer, MA, MSc; Alex Battle, BSc, MSc, PhD; Charlie Davies, MD; Charles A. Vincent, PhD; Paul Attia, MD, CH, FFPH

Objective: To examine the association between day of admission and measures of the quality and safety of the care received by patients with stroke.


Setting: English National Health Service (NHS) hospitals.

Patients: Patients during the study period accounted for 43,821 admissions. We used logistic regression to adjust the outcome measures for case mix.

Main Outcome Measures: Quality and safety measures using 5 indicators spanning the hospital care pathway, from timely brain scans to emergency readmissions after discharge.

Results: Performance across 6 of the 5 measures was significantly lower on weekends (95% confidence level, 99%).

Previous studies from a range of countries have identified higher mortality in patients admitted on weekends across a range of medical conditions. A phenomenon termed the weekend effect. This phenomenon calls into question the idea that quality of care is equal irrespective of when you present at the hospital. Similarly, a small number of international studies have investigated the effect specifically in stroke care and have suggested poorer access to treatments and worse outcomes on weekends, including increased mortality and fewer patients returning to their usual place of residence. However, other studies have not identified a significant association between the day of admission and mortality rates due to stroke. Therefore, debate remains concerning the existence and extent of the weekend effect in stroke care. The studies on stroke care outside regular working hours are limited in number, and most of these studies focus primarily on short-term mortality and therefore do not capture other aspects of the quality and safety of care.

The present study is unique in providing a comprehensive and current assessment of the degree to which the quality and safety of stroke care are affected by whether a patient is admitted during the weekend. The study uses national routine hospital admission data and thereby highlights the potential for identifying clinically important issues using this readily available resource.
Methods

- English patients admitted to hospital with a stroke (ICD I60-I64) from April 2009 to March 2010
- Look at 6 process and outcome indicators
  - Brain scan on day of admission
  - Thrombolysis treatment
  - Aspiration pneumonia
  - Seven-day in-hospital mortality
  - Discharge to usual place of residence within 56 days
  - Thirty day emergency readmission (all cause)
- Adjusted for age, sex, socio-economic deprivation, previous emergency admissions, co-morbidities, ethnic group, source of admissions and stroke type.
Results

- 93,621 stroke admissions
  - 9.3% died within 7 days, and 17.1% died within 30 days
  - 46.5% had same day brain scan
  - 2.6% received thrombolysis
  - 5.2% had aspiration pneumonia
  - 72.6% were discharged to their normal place of residence
  - 11% readmitted within 30 days
Adjusted odds of stroke indicators and 95% CIs weekend versus weekday, England 2009/10
Association between day of delivery and obstetric outcomes: observational study

William L Palmer, A Bottle, P Aynin

ABSTRACT

STUDY QUESTION
What is the association between day of delivery and measures of quality and safety of maternity services, particularly comparing weekend with weekday performance?

METHODS
This observational study examined outcomes for maternal and neonatal records (1332835 deliveries and 1349599 births between 1 April 2010 and 31 March 2012) within the nationwide administrative dataset for English National Health Service hospitals by day of the week. Groups were defined by day of admission (for maternal indicators) or delivery (for neonatal indicators) rather than by day of complication. Logistic regression was used to adjust for case mix factors including gestational age, birth weight, and maternal age. Staffing factors were also investigated using multilevel models to evaluate the association between outcomes and level of consultant presence. The primary outcomes were perinatal mortality and—for both neonate and mother—infections, emergency readmissions, and injuries.

STUDY ANSWER AND LIMITATIONS
Performance across four of the seven measures was significantly worse for women admitted, and babies born, at weekends. In particular, the perinatal mortality rate was 7.3 per 1000 babies delivered at weekends, 0.9 per 1000 higher than for weekdays adjusted odds ratio 1.02 (95% confidence interval 1.01 to 1.03).

WHAT THIS STUDY ADDS
This study provides an evaluation of the “weekend effect” in obstetric care, covering a range of outcomes. The results would suggest approximately 770 perinatal deaths and 470 maternal infections per year above what might be expected if performance was consistent across women admitted, and babies born, on different days of the week.

FUNDING, COMPETING INTERESTS, DATA SHARING
The research was partially funded by Dr Foster Intelligence and the National Institute for Health Research (NIHR) Imperial Patient Safety Translational Research Centre in partnership with the Health Protection Research Unit (HPRU) in Healthcare Associated Infection and Antimicrobial Resistance at Imperial College London. WIP was supported by the National Audit Office.

Introduction
Previous studies, across a range of countries, have identified higher mortality in patients admitted on weekends (compared with weekdays) across a range of medical conditions—a phenomenon termed the “weekend effect.” This calls into question the idea that quality of care is equal irrespective of when someone presents at hospital. However, not all studies have identified an association between poor outcomes and out of hours periods.

MacFarlane published a paper in 1978 that showed a cycle in birth numbers across England (and Wales) between 1969 and 1977. He found that the birth rate was higher among women born on the weekdays of the so-called “weekend effect” scenarios. MacFarlane suggested that the birth rate was higher among women born on the weekdays of the weekends. MacFarlane suggested that the birth rate was higher among women born on the weekdays of the weekends.
Daily trends

- Perineal tears
- Puerperal infections
- Maternal readmissions
- In-hospital perinatal mortality
- Injury to neonate
- Selected neonatal infections
- Neonatal readmissions
Summary

- Babies born at the weekend have an increased risk of being still born or dying in hospital within the first 7 days.
- Increased complication rates at weekends, with higher rates of puerperal infection, injury to neonate and 3-day neonatal emergency readmissions
- “No consistent association between outcomes and staffing was identified”
Re: Association between day of delivery and obstetric outcomes: observational study

I wish to express my concerns about why a paper capable of causing such huge media impact has been accepted for publication without being peer-reviewed, and would be grateful if the reason for this could please be clarified.

Another aspect which I am interested to know is on what basis was this study commissioned.

I would welcome a response from the authors.

Competing interests: No competing interests
Re-analysis following comments

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Adjusted OR (95% CI) – original paper</th>
<th>Excluding elective caesareans</th>
<th>Adjusting for induction labour</th>
<th>Excluding antenatal stillbirths</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perineal tear</td>
<td>1.00 (0.98 to 1.03)</td>
<td>-</td>
<td>1.00 (0.98 to 1.02)</td>
<td>-</td>
</tr>
<tr>
<td>Puerperal infection</td>
<td>1.06 (1.01 to 1.11)</td>
<td>1.05 (1.00 to 1.09)</td>
<td>1.07 (1.02 to 1.12)</td>
<td>-</td>
</tr>
<tr>
<td>3-day maternal readmissions</td>
<td>0.93 (0.84 to 1.02)</td>
<td>0.92 (0.83 to 1.02)</td>
<td>0.93 (0.84 to 1.03)</td>
<td>-</td>
</tr>
<tr>
<td>In-hospital perinatal mortality</td>
<td>1.07 (1.02 to 1.13)</td>
<td>1.07 (1.02 to 1.12)</td>
<td>-</td>
<td>1.09 (1.02 to 1.16)</td>
</tr>
<tr>
<td>Injury to neonate</td>
<td>1.06 (1.02 to 1.09)</td>
<td>1.05 (1.02 to 1.08)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Selected neonatal infections</td>
<td>1.01 (0.98 to 1.04)</td>
<td>1.00 (0.97 to 1.03)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>3-day neonatal readmissions</td>
<td>1.04 (1.00 to 1.08)</td>
<td>1.03 (0.99 to 1.07)</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>
After excluding elective caesareans, the odds of death if born at the weekend compared with weekdays

\[ \text{OR} = 1.3 (1.0 - 1.7) \]

Odds of dying from anoxia at weekend compared with weekdays

\[ \text{OR} = 1.5 (1.1 - 2.1) \]

“About one in four deaths from intrapartum anoxia at term could be prevented if all women attempting vaginal birth could be delivered during working weekdays.”
What’s the explanation?

• Conflicting evidence?
What’s the explanation?

• Conflicting evidence?
• Coding?
• Statistical artefact?
Junior doctors row: Jeremy Hunt's claims of NHS weekend effect 'based on flawed data', Oxford University study finds

'It really is an excellent example of how poor quality data, badly interpreted, can lead to the wrong answer'

Oliver Wright Political Editor | @oliver_wright | 2 hours ago | 4 comments

365 shares

Accident & Emergency

NOTO

UNTS STUPIDITY
“His team studied 1,693 stroke hospital admissions and found 638 (38%) were lower-level incidents that had been put in the wrong category.”

“The new research based on the Oxford Vascular Study - which has been sent to the British Medical Journal but not published - comes as the BMA union starts five days of fresh talks over the junior doctors' contract.”
ABSTRACT
OBJECTIVES
To determine the accuracy of coding of admissions for stroke on weekdays versus weekends and any impact on apparent outcome.

DESIGN
Prospective population based stroke incidence study and a scoping review of previous studies of weekend effects in stroke.

SETTING
Primary and secondary care of all individuals registered with nine general practices in Oxfordshire, United Kingdom (OXVASC, the Oxford Vascular Study).

PARTICIPANTS
All patients with clinically confirmed acute stroke in OXVASC identified with multiple overlapping methods of ascertainment in 2002-14 versus all acute stroke admissions identified by hospital diagnostic and mortality coding alone during the same period.

MAIN OUTCOMES MEASURES
Accuracy of administrative coding data for all patients with confirmed stroke admitted to hospital in OXVASC. Difference between rates of “false positive” or “false negative” coding for weekday and weekend admissions. Impact of inaccurate coding on apparent case fatality at 30 days in weekday versus weekend admissions. Weekend effects on outcomes in patients with confirmed stroke admitted to hospital in OXVASC and impacts of other potential biases compared with those in the scoping review.

RESULTS
Among 92,728 study population, 2373 episodes of stroke were ascertained in OXVASC, of which major events were managed without hospital admission, 60 (2.5%) occurred out of the area or abroad, and 195 (8.2%) occurred in hospital during an admission for a different reason. Of 1292 local hospital admissions for acute stroke, 973 (75.3%) were correctly identified by administrative coding. There was no bias in distribution of weekend versus weekday admission of the 319 strokes missed by coding. Of 1693 admissions for stroke identified by coding, 1055 (62.3%) were confirmed to be acute strokes after case adjudication. Among the 638 false positive coded cases, patients were more likely to be admitted on weekdays than at weekends (536 (61.0%) v 102 (26.5%); P<0.001), partly because of weekday elective admissions after previous stroke being miscoded as new stroke episodes (267 (49.8%) v 26 (25.5%); P<0.001). The 30 day case fatality after these elective admissions was lower than after confirmed acute stroke admissions (11 (3.8%) v 233 (22.1%); P<0.001). Consequently, relative 30 day case fatality for weekend versus weekday admissions differed (P<0.001) between correctly coded acute stroke admissions and false positive coding cases. Results were consistent when only the 1327 emergency cases identified by “admission method” from coding were included, with more false positive cases with low case fatality (35 (14.7%)) being included for weekday versus weekend admissions (190 (19.5%) v 48 (13.7%); P=0.02). Among all acute stroke admissions in OXVASC, there was no imbalance in baseline stroke severity for weekends versus weekdays and no difference in case fatality at 30 days (adjusted odds ratio 0.85, 95% confidence interval 0.63 to 1.15; P=0.30) or any adverse “weekend effect” on modified Rankin score at 30 days (0.78, 0.61 to 0.99; P=0.003) one year (0.76, 0.59 to 0.98; P=0.03) among incident strokes.

CONCLUSION
Prospective studies of UK administrative hospital coding data confirm that, when coding conditions, such as location, are considered, certain administrative coding methods provide an accurate picture of the incidence of stroke.
we considered only cases identified by codes I60-I68 as the primary diagnosis for coding identified cases. We also reported the number of false negative cases that could be identified by coding if other diagnostic positions were used.
Rothwell et al. Administrative classification

Classification
- Hospital admissions
- Elective admissions
- Subdural/extradural haemorrhage
- Inpatient events after emergency admission
- Inpatient events after elective admission
- Transfers from hospital
- Episodes?
- Spells?
- Superspells?

Apparent “incorrect coding”
- Only admitted patients
- Elective admissions (293)
- Subdural/extradural haemorrhage (55)
- Inpatient events after emergency admission (9)
- Inpatient events after elective admission (39)
- Transfers from hospital (34)
- Admission date wrong (24)
- GP information wrong (20)
- Unknown (12)
- Cancelled admission (15)
Higher mortality rates amongst emergency patients admitted to hospital at weekends reflect a lower probability of admission

Rachel Meacock¹, Laura Anselmi¹, Søren Rud Kristensen¹, Tim Doran² and Matt Sutton¹

Abstract

Objective: Patients admitted as emergencies to hospitals at the weekend have higher death rates than patients admitted on weekdays. This may be because the restricted service availability at weekends leads to selection of patients with greater average severity of illness. We examined volumes and rates of hospital admissions and deaths across the week for patients presenting to emergency services through two routes: (a) hospital Accident and Emergency departments, which are open throughout the week; and (b) services in the community, for which availability is more restricted at weekends.

Method: Retrospective observational study of all 140 non-specialist acute hospital Trusts in England analyzing 12,670,788 Accident and Emergency attendances and 4,656,586 emergency admissions (940,859 direct admissions from primary care and 3,715,727 admissions through Accident and Emergency) between April 2013 and February 2014. Emergency attendances and admissions to hospital and deaths in any hospital within 30 days of attendance or admission were compared for weekdays and weekends.

Results: Similar numbers of patients attended Accident and Emergency on weekends and weekdays. There were similar numbers of deaths amongst patients attending Accident and Emergency on weekend days compared with weekdays (378.0 vs. 388.3). Attending Accident and Emergency at the weekend was not associated with a significantly higher probability of death (risk-adjusted OR: 1.010).

Proportionately fewer patients who attended Accident and Emergency at weekend were admitted to hospital (27.5% vs. 38.0%) and it is only amongst the subset of patients attending Accident and Emergency who were selected for admission that probability of dying was significantly higher at the weekend (risk-adjusted OR: 1.054).

Methods in the community were 61% lower on weekend days compared to weekdays (35.9% vs. 22.7%) and the probability of dying was lower (risk-adjusted OR: 1.212) due to
Meacock et al.

- Examined A&E attendances as well as admitted patients.
- “There are fewer deaths following hospital admission at weekends. “
- “Higher mortality rates at weekends are found only amongst the subset of patients who are admitted.”
- “Fewer and sicker patients are admitted at weekends than during the week.”
- Paper shows a higher mortality rate for patients admitted at the weekend
  - True for both admissions via A & E and direct admissions from the community. In line with previous work.
- “Fewer and sicker patients are admitted at weekends than during the week.
  - Their own figures suggest patients admitted at weekend not sicker - younger, fewer co-morbidities etc.
  - A&E attendances - a questionable choice of denominator
What other explanations are there?

Nurse staffing and education and hospital mortality in nine European countries: a retrospective observational study

Linda H. Aiken, Douglas M Sloane, Luk Bruyneel, Koen Van den Heede, Peter Griffiths, Reinhard Busse, Marianna Dimidow, Juha Ylinen, Maria Kózsa, Emmanuel Lesaffre, Matthew D McHugh, M T Moreno-Casales, Anne Marie Paffery, René Schwendimann, P Anne Scott, Carol Tishelman, Theo van Ackerberg, Walter Sermeus, for the RN4CAST consortium

Summary

Background Austerity measures and health-system redesign to minimise hospital expenditures risk adversely affecting patient outcomes. The RN4CAST study was designed to inform decision making about nursing, one of the largest components of hospital operating expenses. We aimed to assess whether differences in patient to nurse ratios and nurses' educational qualifications in nine of the 12 RN4CAST countries with similar patient discharge data were associated with variation in hospital mortality after common surgical procedures.

Methods For this observational study, we obtained discharge data for 422,730 patients aged 50 years or older who underwent common surgical procedures in 310 hospitals in nine European countries. Administrative data were coded with a standard protocol (variants of the ninth or tenth versions of the International Classification of Diseases) to estimate 30 day in-hospital mortality by use of risk adjustment measures including age, sex, admission type, 43 dummy variables suggesting surgery type, and 17 dummy variables suggesting comorbidities present at admission. Surveys of 26,516 nurses practising in study hospitals were used to measure nurse staffing and nurse education. We used generalised estimating equations to assess the effects of nursing factors on the likelihood of surgical patients dying within 30 days of admission, before and after adjusting for other hospital and patient characteristics.

Findings An increase in a nurses' workload by one patient increased the likelihood of an inpatient dying within 30 days of admission by 7% (odds ratio 1.068, 95% CI 1.031-1.106), and every 10% increase in bachelor's degree nurses was associated with a decrease in this likelihood by 7% (0.923, 0.886-0.973). These associations imply that patients in hospitals in which 60% of nurses had bachelor's degrees and nurses cared for an average of six patients would have almost 30% lower mortality than patients in hospitals in which only 30% of nurses had bachelor's degrees and nurses cared for an average of eight patients.

Interpretation Nurse staffing cuts to save money might adversely affect patient outcomes. An increased emphasis on bachelor's education for nurses could reduce preventable hospital deaths.

Funding European Union's Seventh Framework Programme, National Institute of Nursing Research, National Health Service, the Norwegian Nurses Organisation and the Norwegian Knowledge Centre for the Health Services.
Nursing and outcomes

• “An increase in a nurses’ workload by one patient increased the likelihood of an inpatient dying within 30 days of admission by 7% (odds ratio 1·068, 95% CI 1·031–1·106), and every 10% increase in bachelor's degree nurses was associated with a decrease in this likelihood by 7% (0·929, 0·886–0·973).”

• “These associations imply that patients in hospitals in which 60% of nurses had bachelor's degrees and nurses cared for an average of six patients would have almost 30% lower mortality than patients in hospitals in which only 30% of nurses had bachelor's degrees and nurses cared for an average of eight patients.”
Conclusions

• Mortality outcomes after stroke are associated with the intensity of weekend staffing by registered nurses but not 7-d/wk ward rounds by stroke specialist physicians.

• The findings have implications for quality improvement and resource allocation in stroke care.

Background: Several studies have reported higher mortality for patients admitted on weekends. It is not known whether this “weekend effect” is mediated by a lack of nurse staffing or by周末 physician staffing.

Methods and Findings: We conducted a prospective cohort study of 103 stroke units in England. Data of 56,666 patients with stroke admitted between 1 January and 31 December 2012 were extracted from a common registry of stroke care in England. SU characteristics and staffing levels were extracted from a national survey. Case mix, organisational care, SU characteristics and staffing levels were extracted from a national survey. Case mix, organisational care, and care quality variables. After adjusting for confounders, there was no significant association between staffing and care quality variables. After adjusting for confounders, there was no significant association between staffing and care quality variables.

Conclusions: Mortality outcomes for stroke are associated with the intensity of weekend staffing by registered nurses but not 7-d/wk ward rounds by stroke specialist physicians. Further studies are needed to confirm these findings.
Weekend specialist intensity and admission mortality in acute hospital trusts in England: a cross-sectional study

Casie Aldridge, Julian Bion, Amanpreet Boyal, Yen-Fu Chen, Mike Clancy, Tim Edwards, Alan Gleng, Januarie Lord, Russell Monkton, Phe Rees, Chris Rosemore, Gavin Rodger, Jamaal Sury, Carolyn Tarrant, Mark Temple, Sam Watson, Richard Aved, and the EISAC Collaborative

Summary

Background Increased mortality rates associated with weekend hospital admission (the so-called weekend effect) have been attributed to suboptimal staffing levels of specialist consultants. However, evidence for a causal association is elusive, and the magnitude of the weekend specialist deficit remains unquantified. This uncertainty could hamper efforts by national health systems to introduce 7 day health services. We aimed to examine preliminary associations between specialist intensity and weekend admission mortality across the English National Health Service.

Methods Eligible hospital trusts were those in England receiving unsolicited emergency admissions. On Sunday June 15 and Wednesday June 18, 2014, we undertook a point prevalence survey of hospital specialists (consultants) to obtain data relating to the care of patients admitted as emergencies. We defined specialist intensity at each trust as the self-reported estimated number of specialist hours per ten emergency admissions between 0800 h and 2000 h on Sunday and Wednesday. With use of data for all adult emergency admissions for financial year 2013–14, we compared weekend to weekday admission risk of mortality with the Sunday to Wednesday specialist intensity ratio within each trust. We stratified trusts by size quintile.

Findings 127 of 141 eligible acute hospital trusts agreed to participate; 115 (91%) trusts contributed to the point prevalence survey. Of 54350 clinicians surveyed, 15 537 (45%) responded. Substantially fewer specialists were present providing care to emergency admissions on Sunday (1647 [11%]) than on Wednesday (6105 [42%]). Specialists present on Sunday spent 40% more time caring for emergency patients than those present on Wednesday (mean 5-74 h [SD 3-37] vs 3-97 h [3-31]; however, the median specialist ratio was less than 0.7 in 104 [90%] of the contributing trusts. Mortality risk among patients admitted at weekends was higher than among those admitted on weekdays odds ratio 1-18, 95% CI 1-08–1-31; p<0.0001). There was no significant association between Sunday to Wednesday specialist intensity ratios and weekend to weekday mortality ratios (r=−0.042, p=0.654).

Interpretation This cross-sectional analysis did not detect a correlation between weekend staffing of hospital specialists and mortality risk for emergency admissions. Further investigation is needed to evaluate whole-system secular change during the implementation of 7 day services. Policy makers should exercise caution before attributing the weekend effect mainly to differences in specialist staffing.

Funding National Institute for Health Research Health Services and Delivery Research Programme.

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Introduction Provision of 7 day health services is a key policy for the UK Government, a strategic objective for the English National Health Service (NHS), and a topic of potential interest to hospital managers and commissioners. Hospital trusts have focused on maximising the use of hospital staff to deliver planned services, but trusts have focused less on ensuring all services are available in emergency situations. The consequences of weekend staffing are complex, with both potential benefits and risks. Both the UK Secretary of State for Health and the Department of Health have explicitly attributed the weekend effect to reduced availability of hospital doctors. Particularly in emergency departments, changes to doctors’ employment contracts will be needed. In 2013, NHS England published new standards for 7 day services, relating to emergency admissions at weekends, to be supported by emergency admissions at weekends, to be supported by £6915 million of additional funding (Department of Health 2013). We aimed to examine the association between specialist intensity and mortality risk during the implementation of 7 day services.
Is the presence of medical trainees associated with increased mortality with weekend admission?

Rocco Ricardi*, Jason Nelson, Patricia L. Roberts, Peter W. Marcello, Thomas E. Read and David J. Schoetz

Abstract

Background: Several studies have demonstrated increased inhospital mortality following weekend admission. We hypothesized that the presence of resident trainees reduces the weekend mortality trends.

Methods: We identified all patients with a non-elective hospital admission from 1/1/2003 through 12/31/2008. We abstracted vital status on discharge and calculated the Charlson comorbidity score for all inpatients. We compared odds of inpatient mortality following non-elective admission on a weekend day as compared to a weekday, while considering diagnosis, patient characteristics, comorbidity, hospital factors, and care at hospitals with resident trainees.

Results: Data were available for 48,252,968 patient discharges during the six-year study period. The relative risk of mortality was 15% higher following weekend admission as compared to weekday admission. After adjusting for mortality diagnosis, age, sex, race, income level, payer, comorbidity, and weekend admission the overall odds of mortality was higher for patients in hospitals with fewer nurses and staff physicians. Mortality following a weekend admission for patients admitted to a hospital with resident trainees was significantly higher (17%) than hospitals with no resident trainees (p < 0.001).

Conclusions: Low staffing levels of nurses and physicians significantly impact mortality on weekends following non-elective admission. Conversely, patients admitted to hospitals with more resident trainees had significantly higher mortality following a weekend admission.

Keywords: Mortality, Weekend, Trainees, Non-elective

Background

A growing number of studies have demonstrated increased mortality on weekends for patients suffering from several urgent medical and surgical diagnoses [1,2]. Increasingly, there is evidence suggesting that patient care, especially for those with time-sensitive conditions [3], is compromised during weekends and that patients are more vulnerable on weekends. No clear difference exists; however, fewer specialized diagnostic, procedural, and treatment options on the weekend [2].

One of the greatest concerns regarding weekend staffing is that fewer nurses and staff physicians are available, while less-experienced caregivers provide the bulk of care. In addition, resident physicians or trainees often provide many urgent care services on nights and weekends. Given the often front line role that resident physicians have in patient care on weekends, we performed an analysis to delineate the potential effect of resident physicians in patient care on weekends. Our analysis revealed that resident physicians are often more involved in patient care on weekends. Our analysis also showed that resident physicians are often involved in patient care on weekends. Our analysis also showed that resident physicians are often involved in patient care on weekends.
Summary

• Lots of literature supporting the weekend effect (using variety of clinical and administrative data)
• Not explained away by casemix or data quality
  • Clinical datasets
  • Relationships with other factors
• Pattern not just in mortality
• Differences in patterns of care
• Mechanism still unclear
  • Failure to rescue?
• Further work required on staffing levels (difficult to do), and other contributing factors.
• Interventions
Risk-adjusted survival for adults following in-hospital cardiac arrest by day of week and time of day: observational cohort study

Emily J Robinson,1 Gary B Smith,2 Sarah G Power,1 David A Harrison,1 Jerry Nolan,1 Jasmeet Soar,1 Ken Spearpoint,5 Carl Gwinnutt,6 Kathryn M Rowan1

ABSTRACT

Background Internal hospital cardiac arrest (IHCA) data and scores for patients admitted at weekends and at night. Data from the UK National Cardiac Arrest Audit (NCAA) indicate that in-hospital cardiac arrest (ICD) is more common at weekends and at night. It is uncertain whether this is due to differences in attendance and patient distribution, or to differences in the provision of care.

Objective To describe features of IHCA in the UK from 2008 to 2012 and to compare the associated rates of survival to discharge, survival to hospital discharge, and IHCA survival to discharge, adjusted for age, sex, and IHCA survival to hospital discharge, and to determine the effects of IHCA risk and treatment parameters on observed differences in survival.

Methods We performed a prospective audit of IHCA data from 27,700 patients aged ≥16 years who were treated with chest compressions at hospital cardiac arrest and attended by a hospital-based response team: in response to a cardiac arrest (27,700) of the 146 UK acute hospitals.

Results Risk-adjusted outcomes (OR (95% CI)) were worse on the first 2 days of the week (Tuesday to Thursday) when compared with the weekend and weekday daytimes. Nighttime (23:00 to 07:59) had worse outcomes on all days of the week when compared with the weekend. IHCA survival to hospital discharge was 18.7% lower on Saturday and Sunday compared with Monday to Thursday, with a greater difference on the weekend (24.5% vs 20.8%).

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Risk-adjusted survival for adults following in-hospital cardiac arrest by day of week and time of day: observational cohort study

National Cardiac Arrest Audit (NCAA)

27,700 in-hospital cardiac arrest

Odds of surviving weekend daytime vs. weekday daytime = 0.72 (0.68–0.76)
Stroke mortality England 2008-2014
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