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## Higher mortality in weekend admissions to hospital: true, false or uncertain?

Concern about ~~patients having a~~ higher risk of dying if admitted to an ~~acute~~ hospital on Saturday or Sunday, the so-called 'weekend effect', has taken on great political importance in England over the past year. From being a long-standing topic of interest only to health services researchers and policy-makers, ~~this issue~~ assumed high media coverage when the Secretary of State for Health, Jeremy Hunt, employed it as the prime reason for increasing service provision at weekends and, in turn, why the junior doctors in the NHS should accept new terms and conditions of service. In support of his claims, the Department of Health for England assembled an overview of the topic and concluded that there was 'significant evidence demonstrating this 'weekend effect'.' (1) Attributing the 'weekend effect' to the junior doctors' working practices was felt by them to be unjustified and only served to redouble their opposition to the new contract they were being offered. This resulted in a series of strikes including, for the first time in England, ~~physiciansdoctors~~ withdrawing emergency care. ~~(2) — perhaps add ref, Goddard in JAMA, Aug 22, 2016~~ ~~In light of these events~~ ~~While the dispute has rumbled on,~~ researchers have re-examined the evidence of higher mortality for weekend admissions.

The first reports that ~~hospital~~ mortality was higher ~~during at~~ ~~weekend~~s appeared in the 1970s. Studies in the USA, the UK and Australia found that deaths ~~involving in~~ neonates ~~were~~as higher among those born at the weekend. Such a 'weekend effect' was confirmed by Bell and Redelmeier ~~(32) in a study of examining~~ adult admissions to Canadian hospitals in the 1990s ~~who reported that although~~ ~~However, while they found~~ mortality was higher for a quarter of the 100 conditions that were the most frequent causes of death, for the majority of conditions, no such effect was apparent. This mixed picture was confirmed by subsequent studies of specific conditions.

The situation changed around 2010 when some ambitious attempts were made in England to compare the mortality for ~~the entire all~~ patient ~~populations~~ admitted at weekends to ~~the mortality for all that for~~ weekday admissions, ~~rather than focusing~~ ~~on specific diseases as previous studies had.~~ ~~(Nick — not sure I understand the difference — please clarify).~~ (1) These studies reported mortality as being 10-15% higher ~~among for~~ weekend admissions ~~and formed the basis of politicians'~~

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~~subsequent claims.~~ However, these analyses were based on administrative databases ~~that~~which have little information ~~about~~on the clinical state of patients ~~at the time of~~ admission. These were the same data, subjected to the same analytical techniques, that had been used over the preceding decade to derive hospital-wide standardized mortality ratios. Just as those metrics and comparisons have ~~never~~ been ~~adequately~~ validated (43), comparisons of mortality by day of admission ~~have~~suffer from the same methodological limitations. (43) The authors were inevitably restricted in their ability to ~~consider~~take into account differences in case-mix between weekend and weekday admissions as the databases include incomplete information ~~about patients' on their~~ comorbid conditions and no indication ~~about~~of the severity or acuity of the patient's primary and secondary ~~diagnoses~~ ~~[AU:correct?]~~conditions. In addition, inconsistency in diagnostic coding between weekends and weekdays could not be ruled out. Thus, higher mortality observed ~~during~~ at-weekends could have been due to ~~sicker~~ patients ~~with more severe illness or greater co-morbidities~~ being admitted on those days. What was needed were more rigorous analyses using databases with more clinical information ~~that~~which had been collected in a more consistent way (such as using agreed diagnostic definitions).

Commented [NB2]: Fine

Recent studies using high quality clinical databases have ~~indeed~~ justified these concerns about the existence of a 'weekend effect' on mortality. Each of the three potential limitations of administrative databases have been shown to have contributed to ~~potentially~~ misleading findings. First, the problem of inconsistent coding was demonstrated in ~~a study of~~ admissions for stroke. (54) The authors found that non-emergency admissions after a previous stroke were more likely to be coded as a new stroke on weekdays than at weekends (41% v 27%). As 30 day mortality for ~~admissions for non-emergency stroke~~ies (4%) was ~~much~~ lower than ~~admissions~~ for new strokes (22%), the survival of weekday admissions appeared to be better than ~~at~~ weekend ~~admissions~~. When this coding error was corrected, there was no evidence of a 'weekend effect'. The authors concluded that "similar biases are likely to occur in studies of the 'weekend effect' in acute admissions for other conditions for which administrative diagnostic coding is prone to inaccuracy." (5)

Commented [NB3]: I'd prefer to state the findings were misleading rather than just 'potentially'!

The second concern, insufficient consideration of comorbidity, was addressed in another study of stroke admissions. (65) The authors used a national clinical

database of stroke care in England and Wales in which clinicians collect and validate detailed data ~~about~~ the clinical characteristics of new acute cases. ~~After~~ Having adjusted for case-mix differences, there was no evidence of a weekend effect on 30 day mortality.

Failure to ~~consider~~ take the severity or acuity of patients ~~into account~~, the third concern, was addressed indirectly in a study that compared the two routes of emergency admissions: direct referrals (from primary care physicians) and via the emergency ~~department room~~ (EDR). (76) Whereas the daily number of admissions via the EDR ~~during~~ at weekends was similar to that on weekdays, the number of direct admissions was 61% lower. ~~Compared to mortality for admissions during weekdays, m~~ While mortality for admissions via the EDR was only 5% higher at weekends, ~~whereas~~ for direct admissions ~~mortality~~ it was 21% higher. Given that, apart from initial treatment in the EDR, both sets of patients received the same inpatient care, this finding provides ~~suggestive circumstantial~~ evidence that the mortality difference between weekend and weekday is more likely to be attributable to how ~~sick patients'~~ severity of illness and co-morbid conditions at the time of ~~are on~~ admission, rather than the quality of hospital care.

Since then stronger evidence has emerged. Researchers have overcome the lack of severity measures in administrative data by using a recently introduced standard measure of risk of dying based on seven physiological variables, ~~known as~~. Using the National Early Warning Score (NEWS). ~~In a, they conducted a~~ study in three general hospitals, ~~the authors~~ and found that ~~patients admitted on admissions at weekends had greater severity of illness were sicker than than~~ those admitted on weekdays and had a 10% higher risk of dying. (7) ~~although when~~ ~~When th~~ NEWS ~~[AU:correct] is~~ was ~~considered in the analysis [AU:correct?] taken into account~~, the difference in mortality between weekend and weekday admissions disappeared.

Commented [NB4]: Correct!

~~All~~ these recent studies suggest that patients admitted ~~during at~~ weekends are at no greater risk of dying than those admitted during the week. ~~Although the majority of the recent studies were conducted in England, research focused on this question in any country would have to deal with these same major limitations of using administrative data noted above, particularly case-mix adjustment and illness acuity of the patients at the time of admission.~~

The results of the various recent studies ~~is do not~~ ~~not~~ mean there is no 'weekend effect', only that if care provided at weekends is poorer than weekdays it ~~does not~~ result in patients' deaths. This should come as no surprise given that death is not a particularly sensitive measure of the overall quality of a hospital ~~care because~~ only about 4% of hospital deaths are thought to be avoidable. (98) Instead, to ~~determine find out~~ if the widely held concerns about a 'weekend effect' are justified, investigations need to focus on other dimensions of quality such as health outcomes (morbidity, health-related quality of life), safety (falls, hospital-acquired infections), patients' experience (delays in diagnosis, not receiving sufficient information) and educational quality (training of junior doctors at weekends). In addition, concerns about poorer operational efficiency (extended lengths of stay, delayed discharges) ~~during~~ weekends also need to be addressed. ~~Fortunately,~~ the development of various databases and surveys in these areas means investigation of these factors can be ~~conducted~~ readily and ~~relatively inexpensively.~~ ~~cheaply conducted.~~

In the meantime, policy-makers need to avoid unjustified claims about an ~~increased heightened~~ risk of ~~death among patients ying if admitted during~~ weekends as ~~doing so~~ this only serves to undermine ~~the public's~~ confidence and trust in ~~their~~ hospitals and ~~to damage negatively affect to damage~~ the morale of staff. Neither of these are in the interests of ~~patients or~~ the public.

**Commented [NB5]:** Personal view but not keen on 'negatively affect'. Prefer plain English of 'damage'!

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