Rev Esp Cardiol. 2024;77(6):448–449

Editorial comment

Risk of hospital admission on nonworking days: *se non è vero, è ben trovato*

Riesgos de hospitalización en días no laborables: *se non è vero, è ben trovato*

Carlos Fernández-Palomeque,[a,b,*] Xavier Rosselló,[a,b,c] and Alfonso Leiva Rus[b,d,e]

[a] *Servicio de Cardiología, Hospital Universitario Son Espases, Palma de Mallorca, Balearic Islands, Spain*
[b] *Institut d'Investigació Sanitària Illes Balears (IdISBa), Palma de Mallorca, Balearic Islands, Spain*
[c] *Departamento de Medicina, Facultad de Medicina, Universitat de les Illes Balears (UIB), Palma de Mallorca, Balearic Islands, Spain*
[d] *Unidad de Investigación de Atención Primaria de Mallorca, Palma de Mallorca, Balearic Islands, Spain*
[e] *Red de Investigación en Cronicidad Atención Primaria y Promoción de la Salud (RICAPPS), Spain*

Article history:
Available online 19 February 2024

The term *weekend effect*, which refers to excess mortality associated with nonelective hospitalization on weekends compared with weekdays, became popular after Bell and Redelmeier[1] published an article in *The New England Journal of Medicine* in 2001 describing an increased risk of death among patients seeking emergency care during the weekend. The article sparked an ongoing debate within the scientific community regarding the existence and magnitude of this effect. In more recent years, the debate has spread into political discussions. In 2015, the UK Secretary of State for Health largely attributed 6000 annual avoidable deaths within the country's national health system to reduced staffing levels on weekends and public holidays (nonworking days, NWDs).[2,3] While there is little doubt that the weekend effect exists (it has been confirmed by several meta-analyses and systematic reviews),[4–6] its ubiquity has been questioned.[7] It is also unclear whether the effect varies geographically and whether it is limited to certain diagnostic groups or admission subtypes. In addition, there is a need to clarify the exact extent to which it is influenced by its various potential causes.

Strictly speaking, the term *weekend effect* would be accurately described as *weekend association*, as the studies describing this phenomenon are not randomized trials and are hence unable to prove causality.[8] In a recent article published in *Revista Española de Cardiología*, Elola et al.[9] explored the weekend effect applied to heart failure using data for 2018 and 2019 from the minimum data set, which contains mandatory records of all public hospital admissions and discharges in Spain. The authors' approach was innovative in that it involved examining the potential effects of limited resources over varying lengths of NWDs, which included weekends, public holidays, and days falling between 2 NWDs.

Elola et al.[9] observed that patients with heart failure admitted on a NWD had a higher risk of in-hospital mortality or readmission for circulatory disease within 30 days compared with those admitted on a working day. They also found that the risk of in-hospital mortality increased with NWD duration. Although a dose-response curve is one of the classic Bradford Hill criteria for causation,[10] its observation does not necessarily imply a causal link, especially when residual confounding from known or unknown factors cannot be ruled out. Elola et al. observed a slightly more severe clinical profile in the NWD admission group, but suggested that the higher mortality and readmission rates in this group could be due to reduced medical and nursing staffing levels on NWDs. Nonetheless, very few, if any, studies have conclusively shown that higher staffing levels and improved access to procedures on weekends lead to better hospital outcomes.

Studies analyzing the weekend effect face similar design and interpretation challenges, primarily due to the type of data used and the presence of multiple clinical, health care, and logistic confounders. Relevant factors that are difficult to control for include intrinsic reasons for seeking emergency medical care on weekends vs weekdays and differences in hospitalization practices among hospitals and emergency departments. Furthermore, it is important to carefully interpret existing results and conclusions within the context of their methodological framework, as most studies investigating the weekend effect to date have been retrospective, observational studies.

In principle, any effect of NWD admission on mortality should only be considered significant if the patients admitted on these days are comparable to those admitted on working days, or if the likelihood of admission during either period is the same. Nevertheless, patients admitted on weekends appear to differ from those admitted on weekdays.[11]

Considering the potential significance of the weekend effect, future research should use methodologies able to establish causation, as this would facilitate the implementation of effective countermeasures.

Administrative databases like the MDS are often criticized for their lack of clinical detail. They are, however, suitable for health outcomes research as they compile data on large populations of individuals over time and are relatively easy to access. Their usefulness, however, is closely depends on the accuracy of the data collected, which, in turn, is linked to the quality of the diagnostic and procedure coding process.

Elola et al.[12] highlighted the validity of the MDS as a tool for investigating outcomes in acute general hospitals. The clinical data contained in this database are also clearly amenable to classification into hospitalization-related categories. Results based on

SEE RELATED CONTENT:
https://doi.org/10.1016/j.rec.2023.10.003

* Corresponding author.
E-mail address: cferpalomeque@gmail.com (C. Fernández-Palomeque).

https://doi.org/10.1016/j.rec.2023.11.019

administrative data, however, are often difficult to analyze as they are prone to bias from a number of sources, including coding errors or inaccuracies and a lack of adjustment for case mix and severity.[13] To improve their control over these variables, Elola et al.[9] categorized cases using secondary MDS diagnosis codes that are included in the diseases and clinical categories listed by the Agency for Healthcare Research and Quality. They then controlled for potential bias by propensity score matching. There is a need to determine, however, whether such analyses can reliably distinguish between different levels of disease severity, particularly in the context of acute heart failure.

One of the most common explanations given for the weekend effect is that hospitals reduce staff levels and access to services on weekends and holidays. It is plausible that patient outcomes could be negatively affected by staff reductions and limited or delayed access to services, such as diagnostic tests, interdisciplinary consultations, interventions, and surgery. Nonetheless, the evidence on the association between lower staffing levels and increased mortality points in different directions.[3,5,11,14] Variations in results can be explained by a number of factors, including staffing differences among hospitals, challenges associated with measuring the intensity and quality of care on NWDs, and variable clinical contexts (both in terms of diagnostic groups and disease severity). These factors can also complicate the interpretation of results. The authors of an Australian study conducted in 501 hospitals from 2001 to 2007 detected variations in temporal mortality patterns following weekend admission among diagnostic groups, with differences noted at 7, 30, and 90 days.[11] Their findings suggest that the effects of weekend admission differ, depending on the disease involved.

There are a number of potential solutions for dealing with the above limitations, including adjustment for case mix and severity, incorporation of disease-specific quality-of-care indicators,[15] and analysis of other temporal factors that could potentially affect health care provision, such as day to night variations and the cumulative number of NWDs. Inclusion of these factors in future studies examining the weekend effect[16] should help identify the causes of temporal patterns in health outcomes and provide insights to guide organizational decision-making.

In conclusion, excess in-hospital mortality on NWDs has implications for everybody, but especially for patients. Although Elola et al.[9] showed an association between NWD admission and mortality, a causal link remains to be demonstrated. It is also unclear whether higher staffing levels and services would mitigate the so-called "weekend effect". Future research in this field should prioritize prospective designs and use clinically confirmed cases or, at least, ensure that coded data are validated against a clinical standard. The use of quality-of-care indicators would also help identify with more precision potential causes of time-related variations in health outcomes.

FUNDING

None.

CONFLICTS OF INTEREST

None.

REFERENCES

1. Bell CM, Redelmeier DA. Mortality among patients admitted to hospitals on weekends as compared with weekdays. *N Engl J Med.* 2001;345:663–668.
2. McKee M. Is the UK government right that seven day working in hospitals would save 6000 lives a year?.: The claim turned out to come from a single study that shows nothing so simple. *BMJ.* 2015;351:1–2.
3. McKee M. The weekend effect: Now you see it, now you don't. *BMJ.* 2016;353:11–12.
4. Zhou Y, Li W, Herath C, et al. Off-hour admission and mortality risk for 28 specific diseases: A systematic review and meta-analysis of 251 cohorts. *J Am Heart Assoc.* 2015;5:1–11.
5. Pauls LA, Johnson-Paben R, McGready J, Murphy JD, Pronovost PJ, Wu CL. The weekend effect in hospitalized patients: A meta-analysis. *J Hosp Med.* 2017;12:760–766.
6. Hoshijima H, Takeuchi R, Mihara T, et al. Weekend versus weekday admission and short-term mortality: A meta-analysis of 88 cohort studies including 56,934,649 participants. *Medicine (Baltimore).* 2017;96:e6685.
7. Baldwin HJ, Marashi-Pour S, Chen HY, Kaldor J, Sutherland K, Levesque JF. Is the weekend effect really ubiquitous?. A retrospective clinical cohort analysis of 30-day mortality by day of week and time of day using linked population data from New South Wales, Australia. *BMJ Open.* 2018;8:e016943.
8. Rossello X, González-Del-Hoyo M. Survival analyses in cardiovascular research, part I: the essentials. *Rev Esp Cardiol.* 2022;75:67–76.
9. Elola J, Fernández-Pérez C, del Pradoo N, et al. Weekend and holiday admissions for decompensated heart failure and inhospital mortality. A cumulative effect of "nonworking" days? *Rev Esp Cardiol.* 2023. http://dx.doi.org/10.1016/j.rec.2023.10.003.
10. Hill AB. The enviroment and disease: association or causation? *Proc R Soc Med.* 1965;58:295–300.
11. Concha OP, Gallego B, Hillman K, Delaney GP, Coiera E. Do variations in hospital mortality Patterns after weekend admission Reflect reduced quality of care or Different patient cohorts' A population-based study. *BMJ Qual Saf.* 2014;23:215–222.
12. Bernal JL, Bonilla-Palomas JL, Rosillo N, Bonanad C, Elola J, Anguita M. Validity of the minimum data set for outcomes research in patients hospitalized for heart failure in Spain. *Rev Esp Cardiol.* 2023;76:938–939.
13. Li L, Rothwell PM. Biases in detection of apparent "weekend effect" on outcome with administrative coding data: Population based study of stroke. *BMJ.* 2016;353:i2648.
14. Aldridge C, Bion J, Boyal A, et al. Weekend specialist intensity and admission mortality in acute hospital trusts in England: a cross-sectional study. *Lancet.* 2016;388:178–186.
15. Rossello X, Massó-Van Roessel A, Perelló-Bordoy A, et al. Assessment of the ESC quality indicators in patients with acute myocardial infarction: A systematic review. *Eur Hear J Acute Cardiovasc Care.* 2021;10:878–889.
16. Bray BD, Cloud GC, James MA, et al. Weekly variation in health-care quality by day and time of admission: a nationwide, registry-based, prospective cohort study of acute stroke care. *Lancet.* 2016;388:170–177.