

Provided for non-commercial research and education use.
Not for reproduction, distribution or commercial use.



This article appeared in a journal published by Elsevier. The attached copy is furnished to the author for internal non-commercial research and education use, including for instruction at the author's institution and sharing with colleagues.

Other uses, including reproduction and distribution, or selling or licensing copies, or posting to personal, institutional or third party websites are prohibited.

In most cases authors are permitted to post their version of the article (e.g. in Word or Tex form) to their personal website or institutional repository. Authors requiring further information regarding Elsevier's archiving and manuscript policies are encouraged to visit:

<http://www.elsevier.com/authorsrights>

3. Nasir K, Bittencourt MS, Blaha MJ, et al. Implications of coronary artery calcium testing among statin candidates according to American College of Cardiology/American Heart Association cholesterol management guidelines: MESA (Multi-Ethnic Study of Atherosclerosis). *J Am Coll Cardiol* 2015;66:1657-68.
4. Carr JJ, Jacobs DR Jr., Terry JG, et al. Association of coronary artery calcium in adults aged 32 to 46 years with incident coronary heart disease and death. *JAMA Cardiol* 2017;2:391-9.
5. Blankstein R, Greenland P. Screening for coronary artery disease at an earlier age. *JAMA Cardiol* 2017;2:357-8.

Off-Hours and In-Hospital Mortality



Lower Resources or Higher Severity?

We appreciate the study by Ofoma et al. (1). They demonstrated, in their cohort of patients with in-hospital cardiac arrest, a lower survival during off-hours. It is impressive that this study provides further confirmation of previous studies reporting higher mortality in patients admitted on weekends for acute myocardial infarction. It has been postulated that weekend admission may be associated with multitude of factors, for example, reduced availability of expert physicians or lower use of invasive cardiac procedures. Similar evidence is available also for other vascular diseases. Even with the caution needed for findings based on administrative data (2), studies conducted using data from the Italian Ministry of Health showed higher odds of mortality in patients admitted on weekends for both acute aortic dissection or rupture ($n = 17,319$; odds ratio [OR]: 1.34; 95% confidence interval [CI]: 1.24 to 1.44; $p < 0.001$) (3) and pulmonary embolism ($n = 265,035$; OR: 1.15; 95% CI: 1.13 to 1.18; $p < 0.001$) (4). It seems unlikely that off-hours represents a kind of black hole of hospital organization in so many countries with different health care services. However, it is also possible that patients admitted on weekends may be characterized by higher severity due to comorbidity and complications than their weekday counterparts. Patients hospitalized for acute coronary syndrome, for example, showed different clinical pictures (e.g., non-ST-segment elevation [NSTEMI] or ST-segment elevation myocardial infarction [STEMI]), depending on time of day, with the latter significantly more frequent during off-hours (5). Thus, night and weekend admissions deserve the highest caution and appropriate level of alertness.

*Roberto Manfredini, MD
Roberto De Giorgio, MD
Fabio Fabbian, MD

*Department of Medical Sciences

Clinica Medica Unit
University of Ferrara, Italy
Via Ariosto 45
44121 Ferrara
Italy

E-mail: roberto.manfredini@unife.it

<https://doi.org/10.1016/j.jacc.2018.01.081>

© 2018 by the American College of Cardiology Foundation. Published by Elsevier.

Please note: The authors have reported that they have no relationships relevant to the contents of this paper to disclose.

REFERENCES

1. Ofoma UR, Basnet S, Berger A, Kiechner HL, Girotra S, for the American Heart Association Get With the Guidelines-Resuscitation Investigators. Trends in survival after in-hospital cardiac arrest during night and weekends. *J Am Coll Cardiol* 2018;71:402-11.
2. Fedeli U, Gallerani M, Manfredini R. Factor contributing to the weekend effect. *JAMA* 2017;317:1582.
3. Gallerani M, Volpato S, Boari B, et al. Outcomes of weekend versus weekday admission for acute aortic dissection or rupture: a retrospective study on the Italian National Hospital Database. *Int J Cardiol* 2013;168:3117-9.
4. Gallerani M, Fedeli U, Pala M, Giorgi A, Fabbian F, Manfredini R. Weekend versus weekday admission and in-hospital mortality for pulmonary embolism: a 14-year retrospective study on the National Hospital Database of Italy. *Angiology* 2018;69:236-41.
5. LaBounty T, Eagle KA, Manfredini R, Fang J, et al. The impact of time and day on the presentation of acute coronary syndromes. *Clin Cardiol* 2006;29:542-6.

Missed Opportunities in Cardiac Arrest



The Promise of 24/7 Ongoing On-Site Interventional Cardiologist Availability

In-hospital cardiac arrest still causes many unnecessary deaths during nights and weekends (1). We hereby propose a simple and feasible means to improve clinical outcomes in these patients by enforcing continuous on-site availability of an interventional cardiologist.

Although several conditions may lead to in-hospital cardiac arrest, ST-segment elevation acute coronary syndrome (STEACS) still represents a substantial and treatable cause of such ominous event. The typical management approach to dealing with STEACS is to activate emergency procedures for expediting coronary angiography and ad hoc revascularization. However, interventional cardiologists are typically not on the premises during nights and weekends, causing substantial delays.

In order to minimize time to reperfusion, we have adopted, in the last few years at Tor Vergata

University Medical Center, a novel management approach whereby an interventional cardiologist is always available on site for emergency revascularization.

Specifically, our system is active from 8:00 PM to 8:00 AM Monday through Friday and from 8:00 AM to 8:00 AM during weekends. All days of the month are covered, with a total of 8 interventional cardiologists and 14 dedicated nurses. In addition, a noninvasive cardiologist is also always present. The interventional cardiologist covers the coronary care unit (CCU) while not in the catheterization laboratory, and the CCU is temporarily covered by the noninvasive cardiologist when the catheterization laboratory is activated during off-duty hours. The technician is borrowed from the emergency room, where at least 2 technicians are always present. Finally, a neurologist is always present and can provide emergency neurological consultation in case of cardiac arrest.

Indeed, this simple strategy has led to remarkable reductions in time to reperfusion (decreasing from 89 to 45 min; $p < 0.05$) and improvements in 1-month mortality (from 8.9% to 3.9%; $p < 0.05$). Although the lack of a dedicated data collection system precludes per-patient analysis of specific variables and outcomes, generally, we found the proposed system enabled performance of emergency coronary angiography earlier, providing important therapeutic and prognostic details. In particular, if a significant coronary lesion is found, it can be treated immediately, with important benefits for reperfusion and viability. Conversely, if no coronary lesion is found, this emergency design has many important clinical benefits as cardiovascular prognosis improves and antithrombotic therapy can be reduced in intensity, thus minimizing bleeding risk.

Despite the hypothesis-generating scope of this institutional experience, we believe its results call for a dedicated controlled trial. In any case, given the favorable results and the absence of untoward effects, except for the increase in workforce required to meet the personnel requirements, our institution will continue to enforce round-the-clock, daily, on-site availability of an interventional cardiologist.

Francesco Versaci, MD

*Giuseppe Biondi-Zoccai, MD, MStat

Sebastiano Sciarretta, MD, PhD

Giacomo Frati, MD, MSc

Francesco Romeo, MD

*Department of Medico-Surgical Sciences and Biotechnologies
Sapienza University of Rome

Corso della Repubblica 74

04100 Latina

Italy

E-mail: giuseppe.biondizoccai@uniroma1.it

<https://doi.org/10.1016/j.jacc.2018.03.486>

© 2018 by the American College of Cardiology Foundation. Published by Elsevier.

Please note: Prof. Biondi-Zoccai has consulted for Abbott Vascular and Bayer. All other authors have reported that they have no relationships relevant to the contents of this paper to disclose.

REFERENCE

1. Ofoma UR, Basnet S, Berger A, Kirchner HL, Girotra S, for the American Heart Association Get With the Guidelines Resuscitation Investigators. Trends in survival after in-hospital cardiac arrest during nights and weekends. *J Am Coll Cardiol* 2018;71:402-11.

REPLY: Lower Survival for In-Hospital Cardiac Arrests During Nights and Weekends



We agree with Dr. Manfredini and colleagues that lower survival for in-hospital cardiac arrest (IHCA) during nights and weekends (off-hours) compared to daytime on weekdays (on-hours) may be due to higher illness severity during off-hours. Indeed, we found a higher prevalence of unwitnessed arrests and non-shockable rhythm among patients who arrested during off-hours than during on-hours, factors that are associated with worse survival (1). Although, we adjusted for these and 23 other variables in our multivariate models (2), the possibility of unmeasured confounding remains. However, it is important to point out that a higher prevalence of unwitnessed arrest during off-hours is possibly explained by lower hospital staffing, which may lead to missed opportunities for detecting clinical deterioration and timely intervention to prevent IHCA and avoid death (3).

Dr. Versaci and colleagues report on their center's success in achieving round-the-clock availability of interventional cardiologists to minimize reperfusion delays in ST-segment elevation myocardial infarction (STEMI) and posit that such a system could also be effective in improving IHCA survival during off-hours. Although such a strategy could impact quality of STEMI care, we are skeptical that an approach such as this alone would be enough for IHCA care. Unlike out-of-hospital cardiac arrests, a much smaller proportion of IHCA comprised of STEMI patients. In our study, ~15% of patients had an MI at any time during hospitalization, a cohort which consisted of STEMI and non-STEMI patients. Moreover, the role of immediate cardiac catheterization in all cardiac arrest victims remains less well-defined and is currently being evaluated in ongoing clinical trials. We believe that changes to hospital staffing patterns that occur