

# Weekend versus weekday mortality in ST-segment elevation acute myocardial infarction patients between 1985 and 2008

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Appropriate well-timed medical interventions can reduce mortality from ST-segment elevation myocardial infarction (STEMI) [1]. STEMIs occur every day. However staffing tends to be lower on weekends. This may lead to a lower use of invasive cardiac procedures for patients admitted during weekends. Higher mortality rates for patients admitted during the weekends may be the consequence [2,3].

Recent reports that compared mortality rates among acute myocardial infarction patients who were admitted on weekends and those admitted on weekdays were inconsistent [3–7].

The aim of our study is to compare mortality rates among 6,820 STEMI patients admitted on weekends and on weekdays for three time intervals (1985–1990, 1990–2000 and 2000–2008).

All consecutive patients aged > 18 years with a first admission for ST-segment elevation myocardial infarction (STEMI) to the Intensive Coronary Care Unit (ICCU), between June 1985 and December 2008 were included [8].

Trained physicians and nurses accustomed to the use of standardized case report forms collected the data. The primary independent variable was admission on weekends (Saturday or Sunday) versus weekdays (Monday to Friday). The study endpoint was all-cause mortality at 30 days and at 10 years. Survival data was assessed through municipal Civil Registries which is updated regularly and therefore highly accurate in the Netherlands. The author(s) of this manuscript have certified that they comply with the Principles of Ethical Publishing in the International Journal of Cardiology.

Data for the period 1985–2008 were grouped into 3 intervals according to decade of hospitalization (1985–1990, 1990–2000, and 2000–2008). Separate analyses were performed for each interval.

Cumulative survival curves according to admission were constructed using the Kaplan–Meier method, and compared by the log-rank test. We examined the independent association between admission on weekdays or weekends and mortality using logistic regression for 30-day outcome and the Cox proportional hazards model for long-term outcome. Adjustment was performed for age, sex, previous MI, previous PCI, previous CABG, hypertension, diabetes, hyperlipidemia, family history of coronary artery

disease and smoking status. Results are reported as odds ratios (OR) – for 30-day mortality – and hazard ratios (HR) – for long-term mortality – and their respective 95% confidence intervals. All statistical tests were 2-tailed, and p-values were considered significant at < 0.05. Analysis was performed using SPSS software version 20.0 (SPSS, Chicago, Ill).

Between June 1985 and December 2008 a total of 6,820 consecutive patients were admitted to the ICCU with a STEMI, of whom 2053 (30%) were admitted on weekends.

Baseline characteristics are presented in Table 1. With the exception of age between 2000 and 2008 ( $61 \pm 13$  vs  $60 \pm 13$   $p \leq 0.001$ ), previous CABG 1985–1990 (7% vs. 12%  $p = 0.02$ ), current smoking 2000–2008 (37% vs. 42%  $p = 0.001$ ) and anemia 2000–2008 (37% vs. 41%  $p = 0.02$ ) no differences were found between the groups.

During the years studied there was an increase in the prevalence of baseline diabetes, hyperlipidemia, anemia and previous PCI. In contrast, there was a decrease in the prevalence of baseline smoking, previous CABG and renal dysfunction.

During the study period a total of 1929 STEMI patients died of whom 543 patients were admitted during the weekends (28%). Compared to the period 1985–1990 both short-term mortality and long-term mortality of STEMI patients were substantially lower in the period 2000–2008.

Kaplan–Meier cumulate survival curves demonstrated no difference in 30-day and 10 year mortality for weekend versus weekday admission in all 3 intervals (Fig. 1). After adjustment for age and baseline characteristics there was a difference between the weekends and weekdays in favor of STEMI patients who were admitted on weekends between 1990 and 2000 (OR = 0.70 95% CI 0.51–0.97). The adjusted 10-year mortality showed no difference between the groups.

Previous studies demonstrated the “Weekend effect”. Patients admitted on weekends to the acute care hospitals had higher mortality rates than those on weekdays [5]. Staffing levels are lower on weekends, consequently fewer urgent procedures are performed [5,9].

Kostis et al. found a higher mortality among patients with acute myocardial infarction admitted on weekends [3]. They concluded that the worse prognosis for patients admitted on the weekends is mediated in part by the lower rate of invasive procedures. A study in South Korea confirmed that the higher mortality rates in the weekends were due to differences in the rate of performance of medical or invasive procedures [7].

In contrast our results showed that admission either on weekends or on weekdays did not influence both the 30-day mortality and the long-term mortality. This indicates high quality of care. Probably these findings are due to the proper availability of staff and the possibility to perform invasive procedures during the weekends.

Consistent with our results, three studies revealed no difference in mortality rates between weekend and weekday admissions for acute myocardial infarction patients. In a Japanese study Turin et al. found no difference in mortality (HR 1.07 95%CI 0.53–2.16) [4]. In Canada Bell et al. reported no difference in mortality (OR 1.03 95%CI 1.00–1.06) between 160,220 myocardial infarction patients admitted on weekends versus weekdays over a 10-year period. But they reported a lower rate of use of coronary angiography in the weekends [5,10]. Another study from Japan Matsui et al. found no difference in mortality (6.6% vs 6.7%) even though they found a lower rate of stenting during the weekends [6]. These three

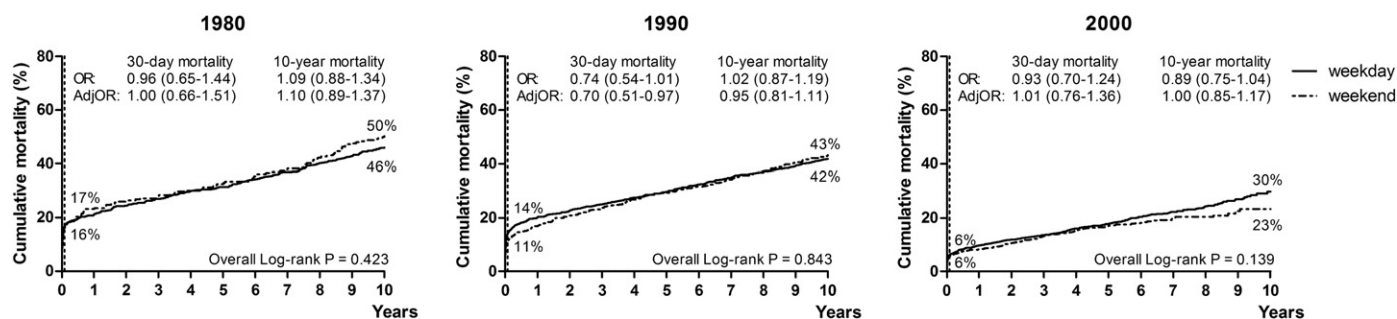
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**Table 1**  
Baseline characteristics.

	1985–1990			1990–2000			2000–2008		
	Weekday	Weekend	P	Weekday	Weekend	P	Weekday	Weekend	P
No. of patients	698	249		1413	515		2656	1289	
<i>Baseline</i>									
Age (years)	60 ± 12	59 ± 12	0.2	60 ± 13	60 ± 13	0.8	61 ± 13	60 ± 13	<0.001
Gender (male)	78%	76%	0.6	74%	76%	0.3	75%	73%	0.2
<i>Cardiac history</i>									
Previous MI <sup>a</sup>	37%	31%	0.1	25%	23%	0.4	28%	26%	0.1
Previous PCI <sup>b</sup>	5%	4%	0.4	7%	6%	0.3	17%	16%	0.4
Previous CABG <sup>c</sup>	7%	12%	0.02	6%	6%	1.0	8%	6%	0.8
<i>Risk factors</i>									
Hypertension	33%	37%	0.2	29%	27%	0.4	34%	31%	0.1
Diabetes	9%	8%	0.8	10%	12%	0.3	15%	13%	0.1
Hyperlipidemia	8%	8%	1.0	15%	15%	1.0	24%	22%	0.1
Family history	22%	20%	0.5	21%	21%	0.9	26%	29%	0.1
Current smoker	41%	47%	0.1	35%	36%	0.5	37%	42%	0.001
Renal dysfunction	12%	10%	0.6	12%	11%	0.5	6%	5%	0.2
Anemia	34%	30%	0.3	41%	44%	0.3	41%	37%	0.02

<sup>a</sup> Myocardial infarction.<sup>b</sup> Percutaneous coronary intervention.<sup>c</sup> Coronary artery bypass grafting.**Fig. 1.** Kaplan Meier curves for 30 day and 10 year cumulative mortality. Unadjusted and adjusted odds ratios (OR and adjOR) for 30-day mortality and the unadjusted and adjusted hazard ratios for 10-year mortality and their respective 95% confidence intervals with weekday used as reference group.

- 1985–1990
- 1990–2000
- 2000–2008.

studies compared respectively 28-day case mortality rates (Turin et al.), in hospital mortality (Bell et al.) and in-hospital, 30-day, and 1-year mortality rates (Matsui et al.). Our study not only compared short term mortality like these studies but long term mortality as well.

Our study has important strengths. We analyzed all patients > 18 year admitted to our ICU between 1985 and 2008 with STEMI, with no further in or exclusion criteria. We were not limited by a small study population, and our analyses cover an inclusion period of 24-years with follow-up data up to 10 years. A potential limitation is that the presented data are derived from a single center.

In conclusion, STEMI patients admitted during the weekends have similar short and long-term survival rates as patients admitted during weekdays.

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