

# Xoc cardiogènic: Diferències regionals en el maneig



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# Introducció

- Elevada mortalitat malgrat els avenços terapèutics dels darrers anys.
- Dificultat per a la inclusió d'aquests pacients en registres i assaigs clínics.
- Informació indirecta i escassa.

# Introducció

- Alta complexitat, requeriment training professionals i consum recursos sanitaris.
- Resultats condicionats per volum de casos anual i entrenament dels equips.

# Volum i pronòstic en el xoc cardiogènic

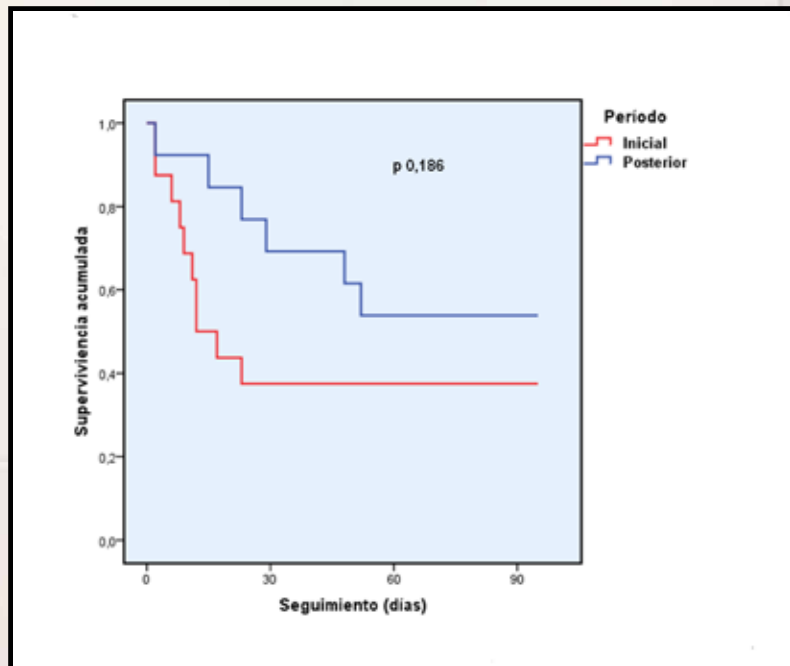
**Table 4.** Association Between Hospital Volume and Risk-Adjusted Mortality

	Annual Hospital Volume of Cardiogenic Shock			
	≤27 Cases	28 to 58 Cases	59 to 106 Cases	≥107 Cases
No. of hospitals, %	2046 (76.49)	366 (13.68)	177 (6.62)	86 (3.21)
Odds ratio, 95% CI				
Unadjusted model	1.58 (1.45 to 1.73)	1.29 (1.17 to 1.41)	1.17 (1.06 to 1.29)	1.00 [Reference]
Multivariate model*	1.27 (1.15 to 1.40)	1.20 (1.08 to 1.32)	1.12 (1.01 to 1.24)	1.00 [Reference]
Mortality incidence, 95% CI				
Unadjusted model	45.32 (44.53 to 46.11)	40.27 (39.25 to 41.29)	37.96 (36.66 to 39.28)	34.40 (32.53 to 36.32)
Multivariate model*	41.97 (40.87 to 43.08)	40.72 (39.52 to 41.93)	39.31 (37.91 to 40.72)	37.01 (35.11 to 38.96)

MI indicates myocardial infarction.

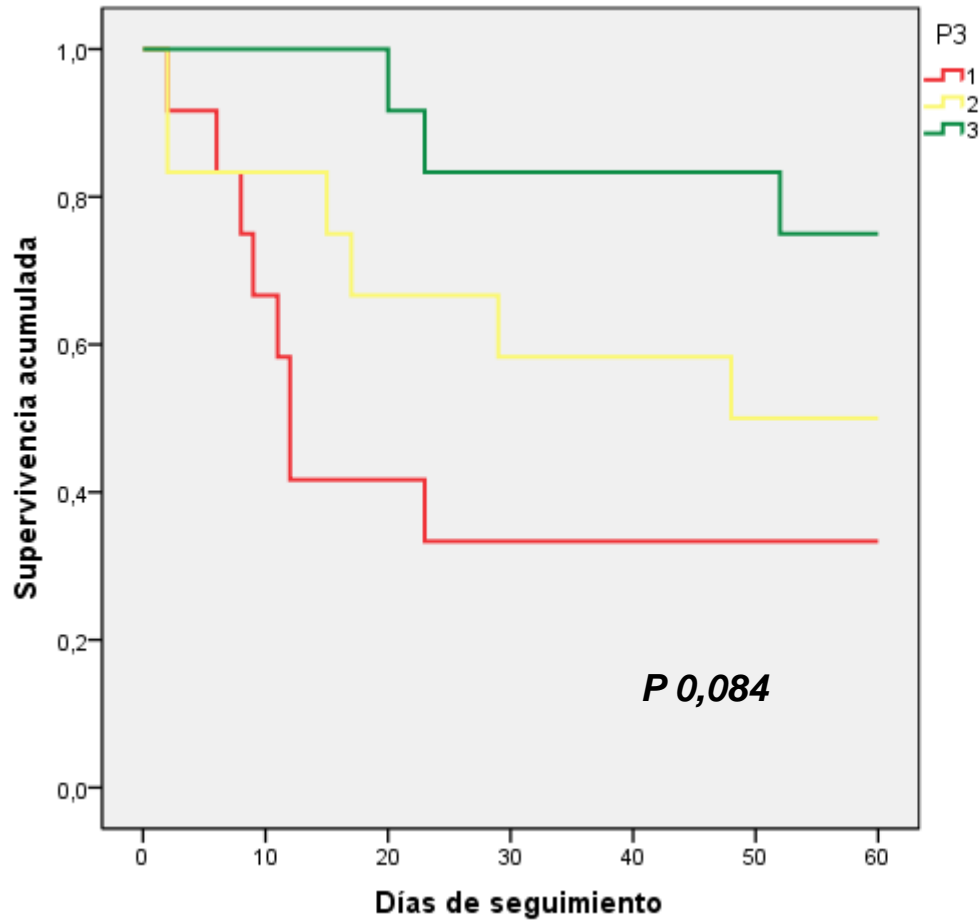
\*Adjusted for age group, sex, race, acute MI, early revascularization, hemodialysis, teaching status of the hospital, hospital region, median household income for the patient's ZIP code, mechanical ventilation, valvular disease, pulmonary circulation disease, peripheral vascular disease, hypertension, paralysis, neurological disorders, chronic pulmonary disease, diabetes with and without chronic complications, hypothyroidism, renal failure, liver disease, peptic ulcer disease, AIDS, lymphoma, metastatic cancer, solid tumor without metastasis, rheumatoid arthritis, coagulopathy, obesity, weight loss, fluid and electrolyte disorders, chronic blood loss anemia, deficiency anemias, alcohol abuse, drug abuse, psychoses, depression.

Shaefi S, O'Gara B, Kociol RD, Joynt K, Mueller A, Nizamuddin J, Mahmood E, Talmor D, Shahul S. Effect of cardiogenic shock hospital volume on mortality in patients with cardiogenic shock. *J Am Heart Assoc.* 2015;4:e001462.



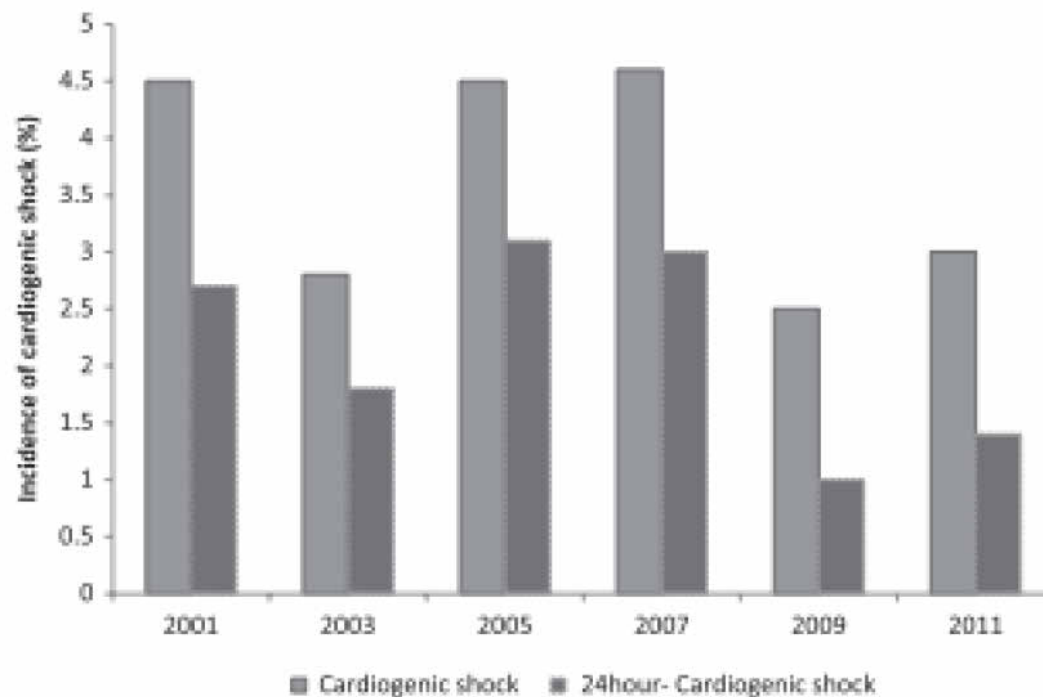
	Período inicial (n=16)	Período posterior (n=13)	p
Edad	56 (50-65)	54 (47-57)	0,442
Sexo masculino	11 (68,8)	10 (76,9)	0,474
Causa del shock			0,091
-Síndrome coronario agudo	7 (43,8)	7 (53,8)	
-miocarditis	3 (18,8)	2 (15,4)	
-miocardiopatía previa	6 (37,5)	1 (7,7)	
INTERMACS 1 al ingreso	14 (87,5)	12 (92,3)	0,669
Creatinina al ingreso	202 (149-240)	126 (87-207)	0,056
PH al ingreso	7,30 (7,19-7,40)	7,19 (7,16-7,30)	0,124
Pico lactato	4,3 (2,8-10,5)	5,7 (2,9-18,5)	0,565
Bicarbonato al ingreso	20 (18-22)	18 (12-21)	0,158
FEV1	22 (14-30)	15 (10-20)	0,050
Planteamiento inicial			0,006
-Puente a recuperación	3 (18,8)	10 (76,9)	
-Puente a trasplante	8 (50)	1 (7,7)	
-Puente a decisión	5 (31,3)	2 (15,4)	
Días ECMO	5 (2-8)	8 (5-11)	0,039
Cambio a asistencia biventricular central	3 (18,8)	4 (30,8)	0,374
Contrapulsación intraaórtica	12 (75)	11 (84,6)	0,435
Catéter de Swan Ganz	11 (68,8)	8 (61,5)	0,685
Depuración extrarrenal	5 (31,3)	7 (53,8)	0,396
Hemorragias	9 (56,3)	9 (69,2)	0,372
Infecciones	9 (56,3)	11 (84,6)	0,216
Congestión pulmonar en ECMO	5 (31,3)	2 (15,4)	0,292
Evolución del soporte ventricular			0,609
-Destete	3 (18,8)	4 (30,8)	
-Trasplante	4 (25)	4 (30,8)	
-Muerte en terapia	9 (56,3)	5 (38,5)	
Mortalidad hospitalaria	10 (62,5)	6 (46,2)	0,186
Días hasta éxitus hospitalario	9,2 (4-12)	27,1 (11-48)	0,071

Ariza-Solé A, Sánchez-Salado JC, Lorente V, González-Costello J, Sbraga F, Cequier Á. Learning curve and prognosis in patients with refractory cardiogenic shock receiving ECMO ventricular support. Med Intensiva. 2015;39:523-5.



# Factors associats al maneig de xoc

- Edat
- Comorbilitats. Expectativa vital
- Disponibilitat de recursos
  - Hemodinàmica 24h
  - Suport ventricular
  - Transplantament cardíac
- Facilitat trasllat. Xarxes de treball. Circuits establerts



**Figure 1.** Trends in the incidence rates of cardiogenic shock in patients hospitalized with acute myocardial infarction.

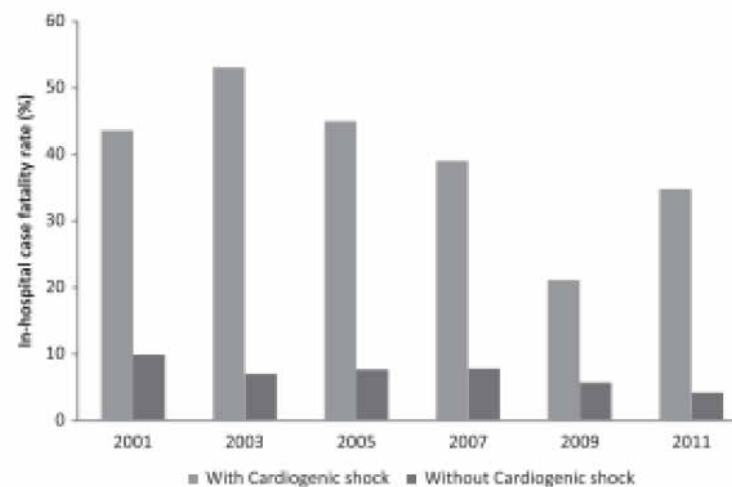
Goldberg RJ, Makam RC, Yarzebski J, et al. Decade-Long Trends (2001-2011) in the Incidence and Hospital Death Rates Associated with the In-Hospital Development of Cardiogenic Shock after Acute Myocardial Infarction. *Circ Cardiovasc Qual Outcomes*. 2016;9:117-25.



**Table 3. Hospital Management Practices in Patients Hospitalized with Acute Myocardial Infarction**

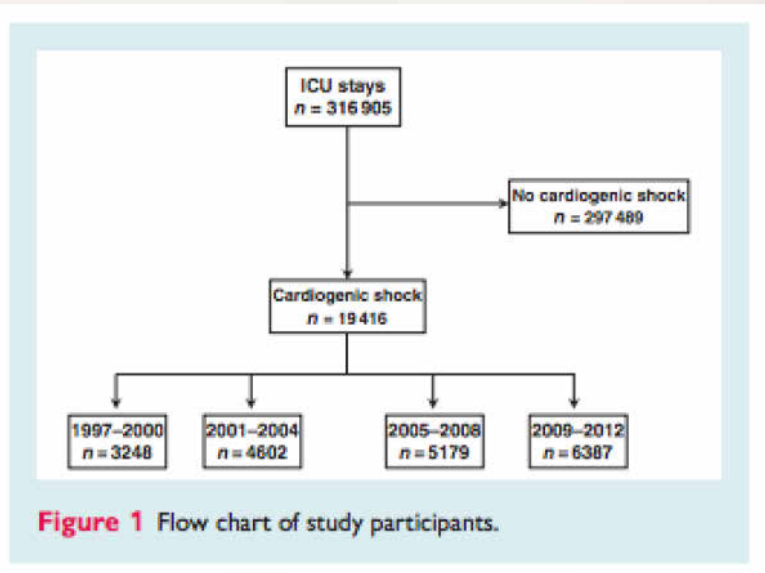
	Total	2001/2003	2005/2007	2009/2011	P Value for Trend
<b>Hospital medications (%)</b>					
ACE inhibitors/ARBs	69.5	66.5	73.8	69.2	<0.001
Aspirin	93.3	90.2	95.3	95.6	<0.001
Beta-blockers	91.6	87.9	95.1	93.3	<0.001
Calcium channel blockers	23.2	26.2	21.7	20.3	<0.001
Lipid lowering medications	76.7	66.1	78.8	90.6	<0.001
Thrombolytics	3.3	7.1	0.9	0.4	<0.001
<b>Hospital procedures (%)</b>					
Cardiac catheterization	61.7	53.1	66.7	69.0	<0.001
Coronary artery bypass graft surgery	6.4	7.0	5.7	6.4	0.22
Intra-aortic balloon counterpulsation	5.3	5.0	6.7	4.2	<0.005
PCI	43.5	35.0	49.3	49.7	<0.001

ACE indicates angiotensin-converting enzyme; ARB, angiotensin II receptor blocker; and PCI, percutaneous coronary intervention.

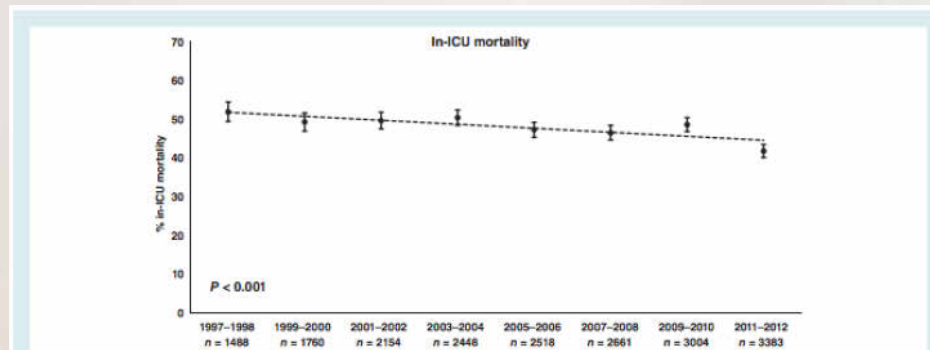


**Figure 2. Trends in hospital case-fatality rates among patients hospitalized with acute myocardial infarction according to the presence of cardiogenic shock.**

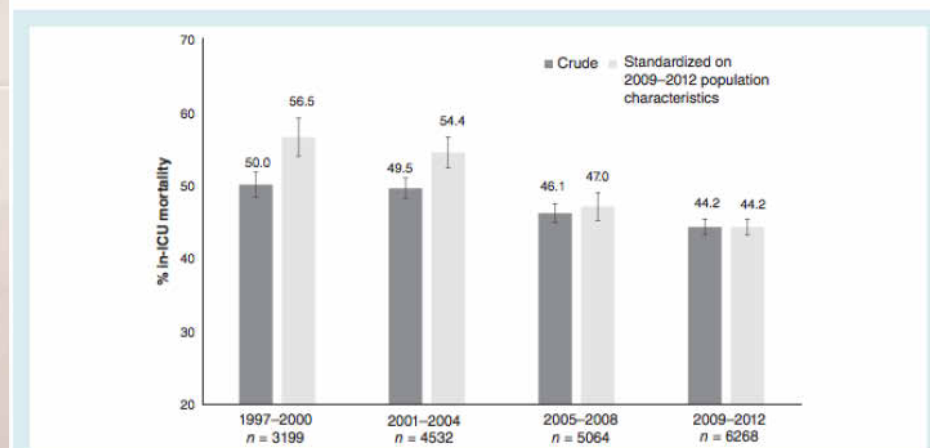
Goldberg RJ, Makam RC, Yarzebski J, et al. Decade-Long Trends (2001-2011) in the Incidence and Hospital Death Rates Associated with the In-Hospital Development of Cardiogenic Shock after Acute Myocardial Infarction. *Circ Cardiovasc Qual Outcomes*. 2016;9:117-25.



**Figure 1** Flow chart of study participants.

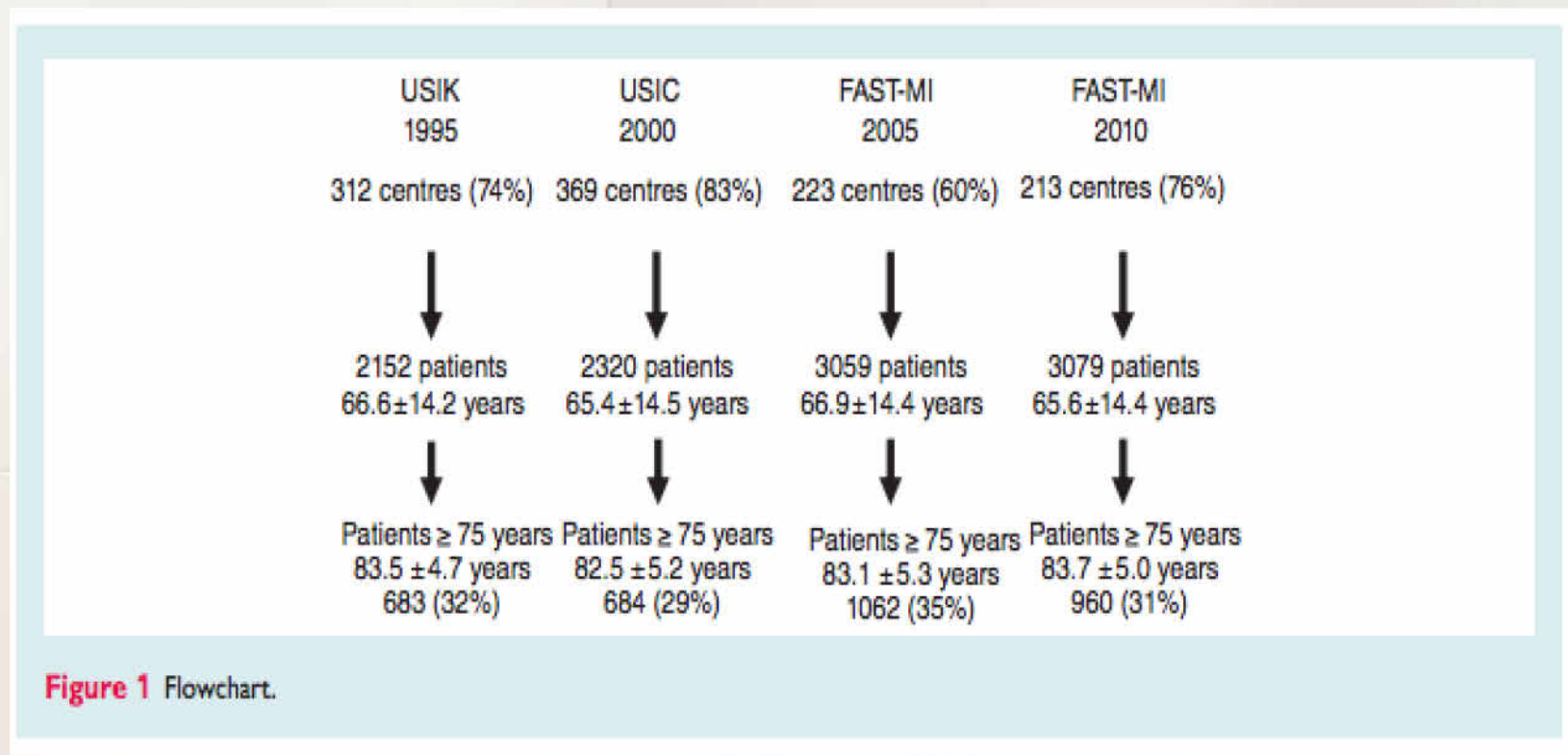


**Figure 2** In-intensive care unit (ICU) mortality ( $P < 0.001$ ).



**Figure 3** Crude and Simplified Acute Physiology Score (SAPS)-standardized intensive care unit (ICU) mortality rates ( $P < 0.001$ ). n, number of patients for whom SAPS-II was available.

Puymirat E, Fagon JY, Aegerter P, et al. Cardiogenic shock in intensive care units: evolution of prevalence, patient profile, management and outcomes, 1997-2012. *Eur J Heart Fail.* 2016 Oct 6. doi: 10.1002/ejhf.646.

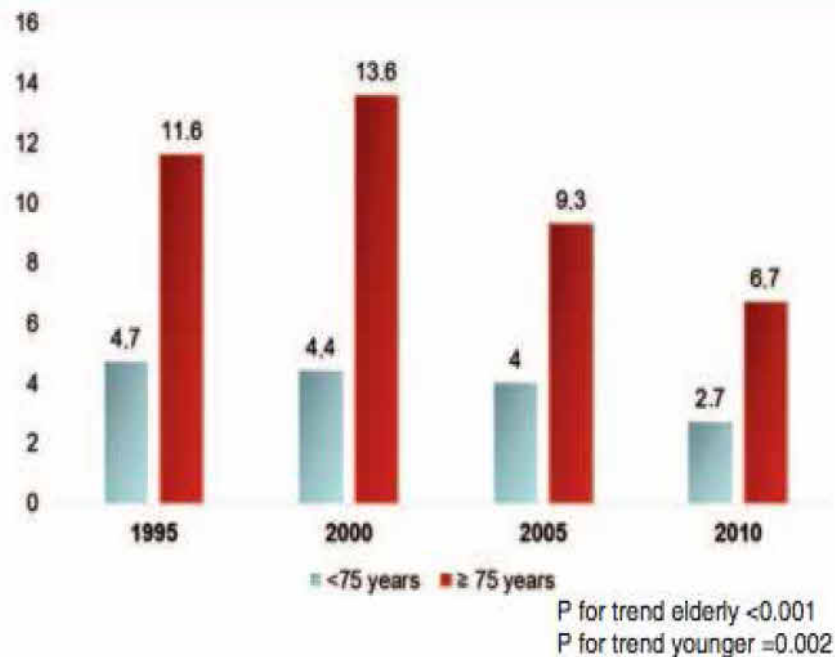


Aissaoui N, Puymirat E, Juilliere Y, et al. Fifteen-year trends in the management of cardiogenic shock and associated 1-year mortality in elderly patients with acute myocardial infarction: the FAST-MI programme. *Eur J Heart Fail.* 2016;18:1144-52.

**Table 1** Trend characteristics and management of elderly patients with acute myocardial infarction according to the presence or absence of cardiogenic shock

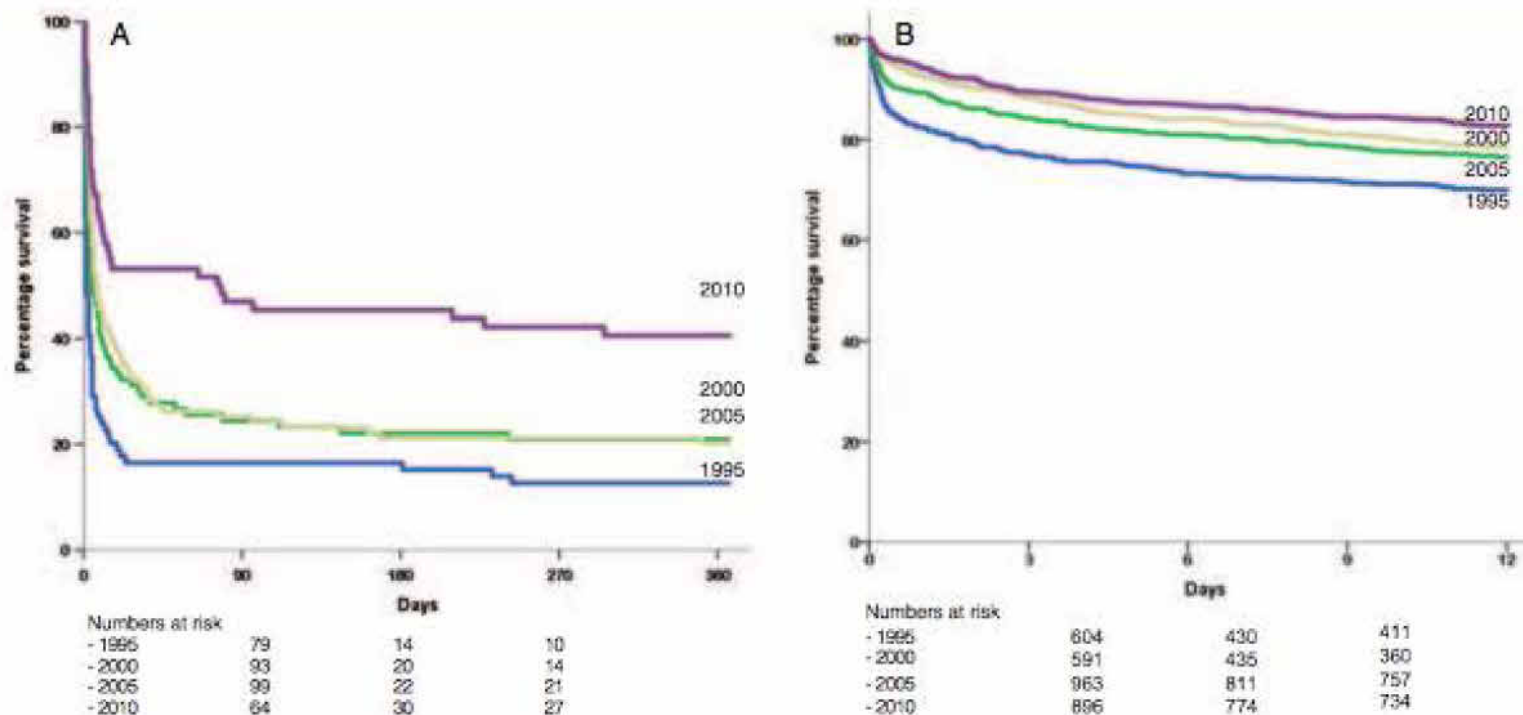
Characteristics	1995		2000		2005		2010		P-value <sup>a</sup>	P for trend no CS
	CS (n = 79)	No CS (n = 604)	CS (n = 93)	No CS (n = 591)	CS (n = 99)	No CS (n = 963)	CS (n = 64)	No CS (n = 896)		
Age, mean, years	83 ± 5	82 ± 5	83 ± 5	82 ± 5	83 ± 5	82 ± 5	84 ± 5	82 ± 5	0.46	0.195
Age class (years)										
75–79	18 (23)	217 (36)	38 (41)	283 (48)	34 (34)	395 (41)	16 (25)	339 (38)	0.81	0.88
80–84	25 (32)	211 (35)	22 (24)	140 (24)	29 (29)	314 (33)	20 (31)	308 (34)		
≥85	36 (46)	176 (29)	33 (35.5)	168 (28)	36 (36)	254 (26)	28 (44)	249 (28)		
Female, n (%)	44 (56)	307 (51)	39 (42)	284 (48)	51 (51.5)	483 (50)	41 (64)	391 (44)	0.22	0.01
STEMI, n (%)	59 (75)	400 (66)	75 (81)	(439 (74)	50 (50.5)	395 (41)	38 (59)	399 (44.5)	0.001	<0.001
Medical history and risk factors, n (%)										
Body mass kg/m <sup>2</sup>	24 ± 3	25 ± 4	24 ± 4	25 ± 4	25 ± 6	26 ± 4	26 ± 5	26 ± 4	0.03	<0.001
Diabetes mellitus, n (%)	16 (21)	122 (20.5)	24 (26)	138 (23)	26 (26)	269 (28)	26 (41)	260 (29)	0.02	<0.001
Hypertension, n (%)	47 (60)	345 (58)	49 (53)	373 (63)	74 (75)	719 (75)	54 (84)	669 (75)	<0.001	<0.001
Hypercholesterolaemia, n (%)	12 (15)	171 (29)	24 (26)	202 (35)	45 (45.5)	426 (44)	29 (39)	389 (43)	<0.001	<0.001
Current smoking, n (%)	4 (5)	52 (9)	5 (6)	38 (6.5)	8 (8)	79 (8)	0	56 (6)	0.37	0.17
Prior myocardial infarction, n (%)	22 (28)	123 (20)	22 (24)	137 (23)	19 (19)	208 (22)	15 (23)	203 (23)	0.36	0.46
Prior PCI (%)	–	–	6 (6.5)	42 (7)	10 (10)	137 (14)	10 (16)	180 (20)	0.06	<0.001
Prior CABG (%)	–	–	4 (4)	27 (5)	5 (5)	71 (7)	3 (5)	69 (8)	0.89	0.03
Prior heart failure, n (%)	20 (25.5)	110 (18)	23 (25)	72 (12)	13 (13)	107 (11)	11 (17)	81 (9)	<0.001	0.054
Presentation, n (%)										
Shock on admission	–	–	35 (38)	–	30 (30)	–	31 (51)	–	–	–
Admission SBP <90 mmHg	–	–	22 (24)	25 (4)	17 (17.5)	25 (3)	14 (23)	23 (3)	0.71	0.10
LVEF										
Missing	50 (63)	272 (45)	57 (61)	179 (30)	28 (28)	235 (24)	10 (16)	139 (15.5)	<0.001	<0.001
>40%	12 (15)	230 (38)	14 (15)	39 (52)	27 (27)	533 (55)	29 (45)	557 (62)		
≤40%	17 (21.5)	102 (17)	22 (24)	103 (17)	44 (44)	195 (20)	25 (39)	200 (22)		
Extent of CAD (patients with angiography)										
None/missing	–	–	2 (5)	33 (10)	1 (2)	84 (13)	3 (7)	90 (12)	0.70	0.03
1-vessel disease	–	–	8 (20.5)	133 (39.5)	11 (26)	223 (35)	9 (20)	226 (31)		
2-vessel disease	–	–	13 (33)	100 (30)	15 (36)	188 (29)	20 (44)	223 (30)		
3-vessel disease	–	–	16 (41)	71 (21)	15 (36)	148 (23)	13 (29)	197 (27)		
Management, n (%)										
Antiplatelet agents	52 (66)	536 (89)	81 (87)	547 (93)	88 (89)	902 (89)	60 (94)	872 (97)	<0.001	<0.001
Thienopyridine	–	–	–	–	61 (62)	751 (78)	54 (84)	831 (93)	0.002	<0.001
Unfractionated heparin	71 (90)	581 (96)	81 (87)	425 (72)	67 (68)	569 (59)	38 (59)	141 (46)	<0.001	<0.001
Low molecular weight heparin	0	0	18 (19)	174 (29)	38 (38)	553 (57)	25 (39)	468 (52)	<0.001	<0.001
Glycoprotein IIb/IIIa inhibitors	0	0	12 (13)	48 (8)	18 (18)	221 (23)	12 (19)	186 (21)	<0.001	<0.001
Vitamin K antagonists	–	–	0	11 (2)	0	11 (1)	2 (3)	48 (5)	0.042	<0.001
Amiodarone	–	–	21 (23)	97 (16)	38 (38)	138 (14)	13 (20)	111 (12)	0.98	0.028
Lipid-lowering agents	1 (1)	24 (4)	9 (10)	195 (33)	49 (50)	633 (66)	45 (70)	733 (82)	<0.001	<0.001
Diuretics	60 (76)	331 (55)	55 (59)	238 (40)	75 (76)	479 (50)	40 (63)	422 (47)	0.46	0.15
Beta-blockers	13 (17)	259 (43)	25 (27)	332 (56)	38 (38)	583 (61)	26 (41)	659 (74)	<0.001	<0.001
ACE inhibitors	15 (19)	299 (50)	20 (22)	247 (42)	37 (37)	420 (44)	22(34)	431 (48)	0.005	0.975
Inotropes	–	–	49 (53)	27 (5)	46 (47)	53 (6)	16 (25)	32 (4)	<0.001	0.26
Procedures, n (%)										
Reperfusion therapy in STEMI	12 (20)	93 (23)	28 (37)	153 (35)	22 (44)	172 (44)	20 (57)	250 (66.5)	<0.001	<0.001
Fibrinolysis in STEMI patients	8 (14)	72 (18)	14 (19)	86 (20)	11 (22)	65 (16.5)	2 (6)	29 (8)	–	–
Primary PCI	4 (7)	21 (5)	14 (19)	67 (15)	11 (22)	107 (27)	18 (51)	221 (59)	–	–
Pre-hospital fibrinolysis	0	0	3 (4)	22 (5)	3 (6)	43 (11)	2 (6)	20 (5)	–	–
PCI in the first 3 days	9 (11)	32 (5)	26 (28)	140 (24)	26 (26)	354 (37)	31 (48)	896 (100)	<0.001	<0.001
CABG	0	2 (0)	1 (1)	14 (2)	0	32 (3)	2 (3)	29 (3)	<0.001	<0.001

Aissaoui N, Puymirat E, Juilliere Y, et al. Fifteen-year trends in the management of cardiogenic shock and associated 1-year mortality in elderly patients with acute myocardial infarction: the FAST-MI programme. Eur J Heart Fail. 2016;18:1144-52.



**Figure 2** Trends in prevalence of cardiogenic shock according to age.

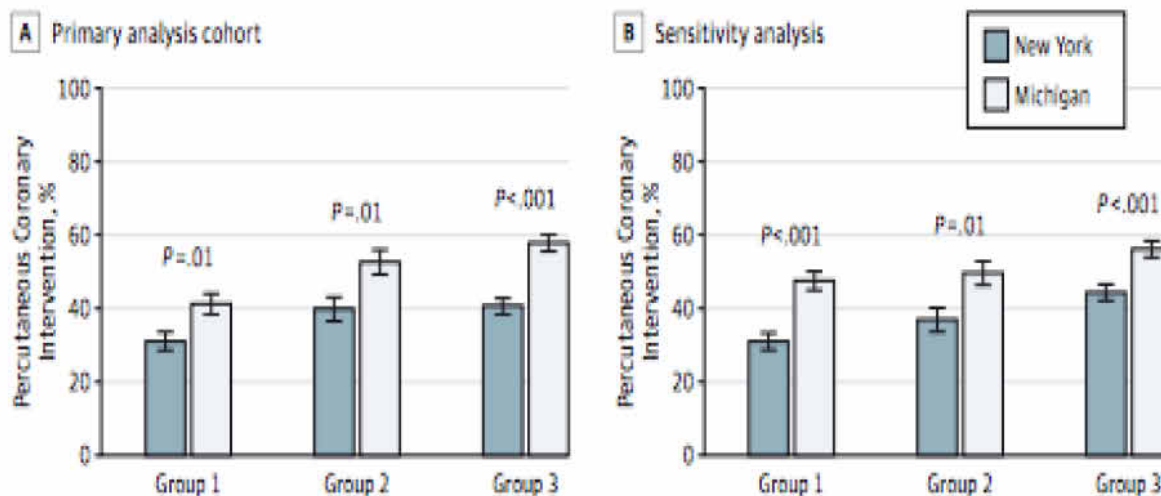
Aissaoui N, Puymirat E, Juilliere Y, et al. Fifteen-year trends in the management of cardiogenic shock and associated 1-year mortality in elderly patients with acute myocardial infarction: the FAST-MI programme. Eur J Heart Fail. 2016;18:1144-52.



**Figure 3** Evolution of 1-year survival in elderly patients with (A) or without (B) cardiogenic shock at the acute stage.

Aissaoui N, Puymirat E, Juilliere Y, et al. Fifteen-year trends in the management of cardiogenic shock and associated 1-year mortality in elderly patients with acute myocardial infarction: the FAST-MI programme. *Eur J Heart Fail.* 2016;18:1144-52.

Figure 1. Use of Percutaneous Coronary Intervention for Cardiogenic Shock: New York vs Michigan



Bangalore S, Guo Y, Xu J, et al. Rates of Invasive Management of Cardiogenic Shock in New York Before and After Exclusion From Public Reporting. JAMA Cardiol. 2016;1:640-7.

**TABLE 1** Demographic and Clinical Characteristics in Cardiogenic Shock in the Setting of Acute Myocardial Infarction Patients Undergoing Percutaneous Coronary Intervention

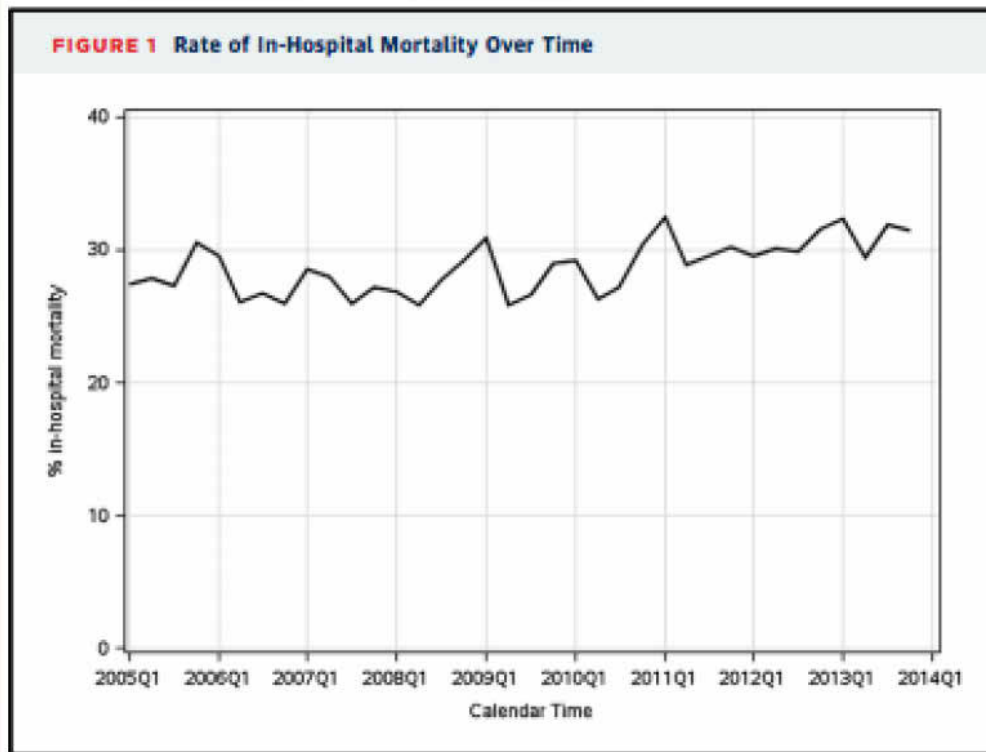
	2005-2006 (n = 5,658)	2006-2008 (n = 10,337)	2009-2010 (n = 13,562)	2011-2013 (n = 26,940)	p Value
Age (yrs)	64.7 ± 13	64.9 ± 13	64.9 ± 13	65.0 ± 13	0.70
Male	65	65.9	67.4	68.2	<0.001
Ethnicity					
Caucasians	83.6	79.4	85.2	85.7	<0.001
African Americans	5.9	7.1	8.0	8.7	<0.001
Asians	2.2	2.5	3.0	4.0	<0.001
Hispanic	3.4	4.8	6.1	7.1	<0.001
BMI (kg/m <sup>2</sup> )	28.1 ± 6.2	28.2 ± 6.1	28.4 ± 6.3	28.6 ± 6.4	<0.001
Uninsured	10.2	11.1	13.1	14.5	<0.001
Length of stay					<0.001
1-2 d	9.8	9.5	10.8	12.7	
2-4 d	15.7	17.4	18.1	20.0	
>4 d	74.5	73.1	71.1	67.3	
Smoker (current/recent)	39.4	37.4	38.1	37.0	0.003
Hypertension	61.5	63.6	67.3	68.7	<0.001
Dyslipidemia	51.8	55.3	58.6	57.2	<0.001
PAD	11.7	10	10.4	10.0	0.003
Diabetes mellitus	27.2	27.3	29.0	30.5	<0.001
Dialysis	2.2	2.6	2.7	2.9	<0.001
Previous MI	23.2	21.2	22.8	23.1	0.001
Previous CHF	12.2	11.0	11.4	12.0	0.03
Cerebrovascular disease	11.4	10.3	10.7	11.0	0.15
Chronic lung disease	18.5	17.4	14.8	15.0	<0.001
Family history of CAD	18.5	16.3	16.0	15.6	<0.001
Previous PCI	19.6	21.3	22.5	23.0	<0.001
Previous CABG	9.1	9.1	8.8	8.4	0.11
Chronic kidney disease	7.9	8.8	4.1	2.9	<0.001
Location type					<0.001
Rural	13.5	12.2	11.5	13.4	
Suburban	30.7	30.3	34.4	35.6	
Urban	55.9	57.5	54.2	51.1	
Hospital type					<0.001
Private/community	91.6	90.2	90.4	89.6	
Government/university	8.4	9.8	9.6	10.4	
Residency/fellowship	49.4	46.0	44.2	42.3	<0.001
Geographical region					<0.001
West	24.1	24.1	22.2	21.3	
Northeast	10.6	11.8	13.2	13.7	
Midwest	33.8	28.3	27.7	26.5	
South	31.2	35.6	36.9	38.4	
Average annual PCI volume					<0.001
<500	30.7	34.6	43.7	48.1	
500-1,000	40.4	37.3	35.9	33.5	
1,000-1,500	16.9	16.2	13.9	12.6	
1,500-2,000	7.3	7.3	3.8	3.4	
>2,000	4.7	4.6	2.6	2.3	

**TABLE 2** Catheterization Laboratory Characteristics in Cardiogenic Shock in the Setting of Acute Myocardial Infarction Patients Undergoing Percutaneous Coronary Intervention

Variable	2005-2006 (n = 5,658)	2006-2008 (n = 10,337)	2009-2010 (n = 13,562)	2011-2013 (n = 26,940)	p Value
STEMI	80.6	81.1	82.1	82.1	0.01
Symptom to presentation (STEMI only)					<0.001
<6 h	88.1	89.6	79.5	77.2	
6-12 h	7.7	6.6	9.2	9.3	
>12 h	4.2	3.8	11.3	13.5	
Thrombolysis	1.0	2.0	1.7	1.3	<0.001
Radial access	0.4	0.6	1.1	4.2	<0.001
>70% stenosis					
Left main	7.1	7.7	8.4	8.9	<0.001
LAD	88	87	90	89.4	<0.001
LCX	44	45	45.5	45.5	0.004
RCA	66.7	63.6	64.3	63.7	0.02
RI	4.2	4.5	4.1	4.2	<0.001
Grafts	11.1	10.9	10.6	10	<0.001
Median fluoroscopy time (min)	14.0	13.0	13.0	12.8	<0.001
Median contrast volume (ml)	200	200	190	180	<0.001
High-risk lesion (type C)	69.6	66.2	71.2	72.4	<0.001
>1 lesion treated	31.5	30.7	29.0	25.8	<0.001
IABP	49.5	49.7	49.5	44.9	<0.001
Other LV support devices	NA	NA	5.5	7.2	0.60
Medications					
LMWH	11.8	10.1	7.5	5.2	
UFH	82.3	78.9	74.5	68.0	
Bivalirudin	12.6	18.7	28.5	45.6	
GPI	75.8	71.6	66.1	52.8	
Pre-PCI aspirin	83.6	84.1	81.1	82.0	
Second anti-platelet	55	59.0	61.3	60.5	<0.001
Previously treated lesion	7.6	9.1	9.7	9.4	<0.001
Timeframe					<0.001
<1 month	31.2	23.5	18.7	18.7	
1-6 months	14.4	12.4	11.8	9.7	
6 months-1 yr	12.3	8.2	5.5	7.1	
1-2 yr	12.1	10.4	10.1	9.3	
>2 yr	16.1	29.1	42.5	43.7	
Discharge medications					<0.001
Aspirin	93.2	94.5	88.4	86.1	
Statin	80.6	84.3	80.7	83.1	
Second antiplatelet	90.4	92.2	86.3	78.5	
Beta blocker	87.8	89.9	84.4	83.3	

Wayangankar SA, Bangalore S, McCoy LA, et al. Temporal Trends and Outcomes of Patients Undergoing Percutaneous Coronary Interventions for Cardiogenic Shock in the Setting of Acute Myocardial Infarction: A Report From the CathPCI Registry. JACC Cardiovasc Interv. 2016;9:341-51.





Wayangankar SA, Bangalore S, McCoy LA, et al. Temporal Trends and Outcomes of Patients Undergoing Percutaneous Coronary Interventions for Cardiogenic Shock in the Setting of Acute Myocardial Infarction: A Report From the CathPCI Registry. *JACC Cardiovasc Interv.* 2016;9:341-51.

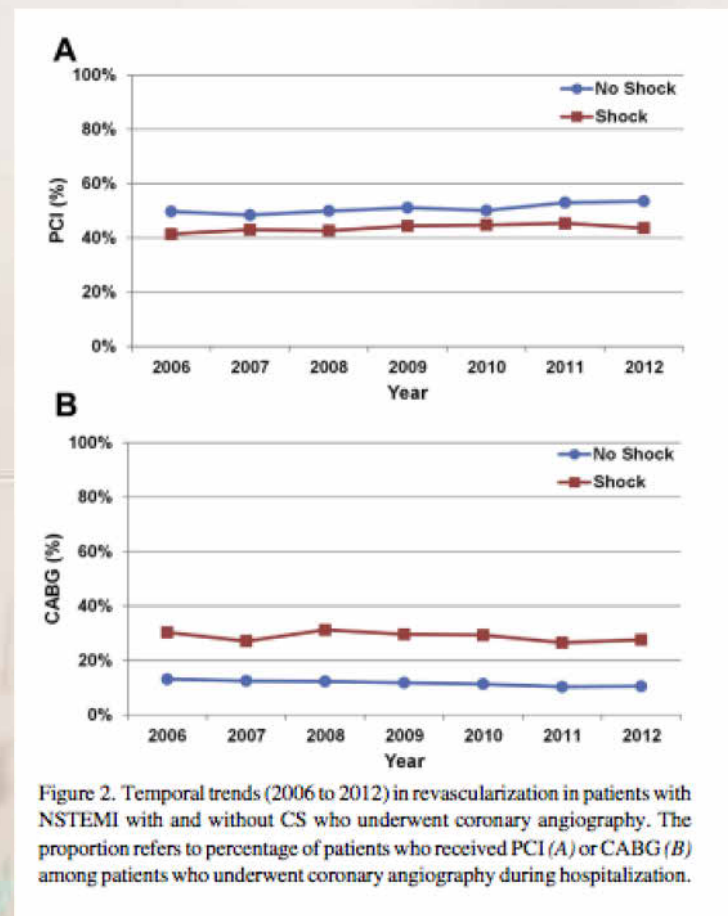
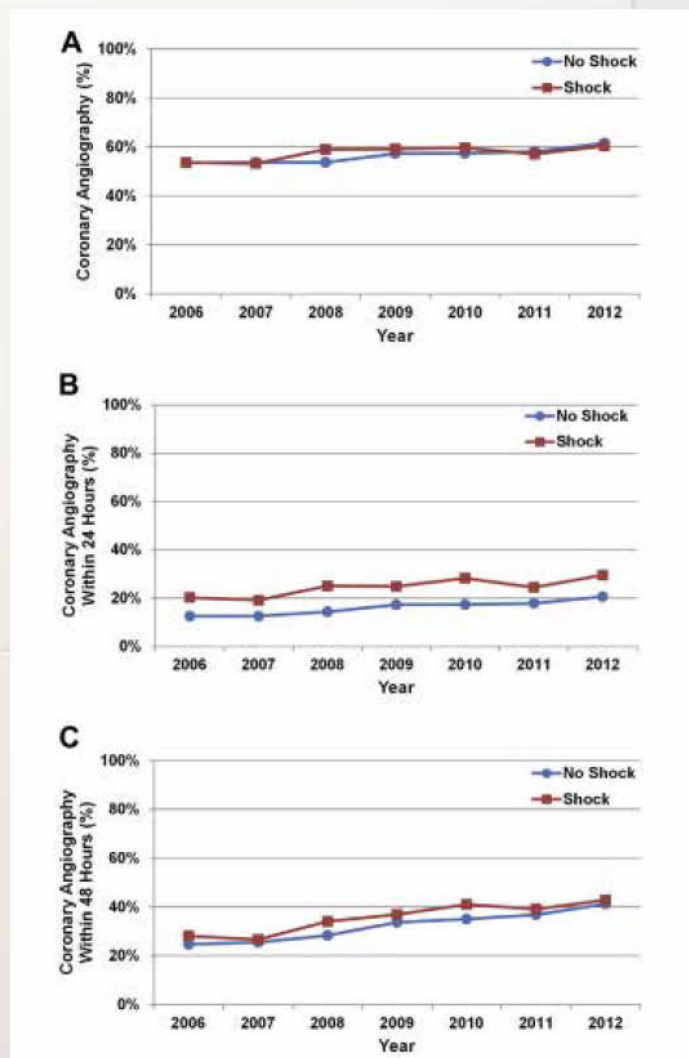


Figure 2. Temporal trends (2006 to 2012) in revascularization in patients with NSTEMI with and without CS who underwent coronary angiography. The proportion refers to percentage of patients who received PCI (A) or CABG (B) among patients who underwent coronary angiography during hospitalization.

Kolte D, Khera S, Dabhadkar KC, et al. Trends in Coronary Angiography, Revascularization, and Outcomes of Cardiogenic Shock Complicating Non-ST-Elevation Myocardial Infarction. *Am J Cardiol.* 2016;117:1-9.

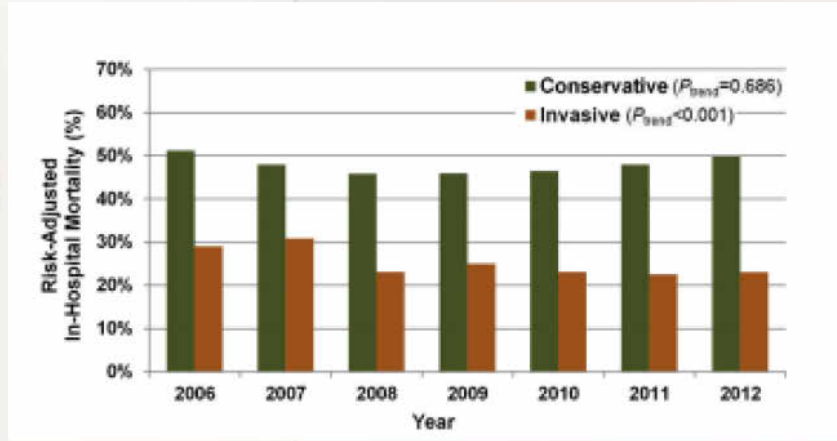


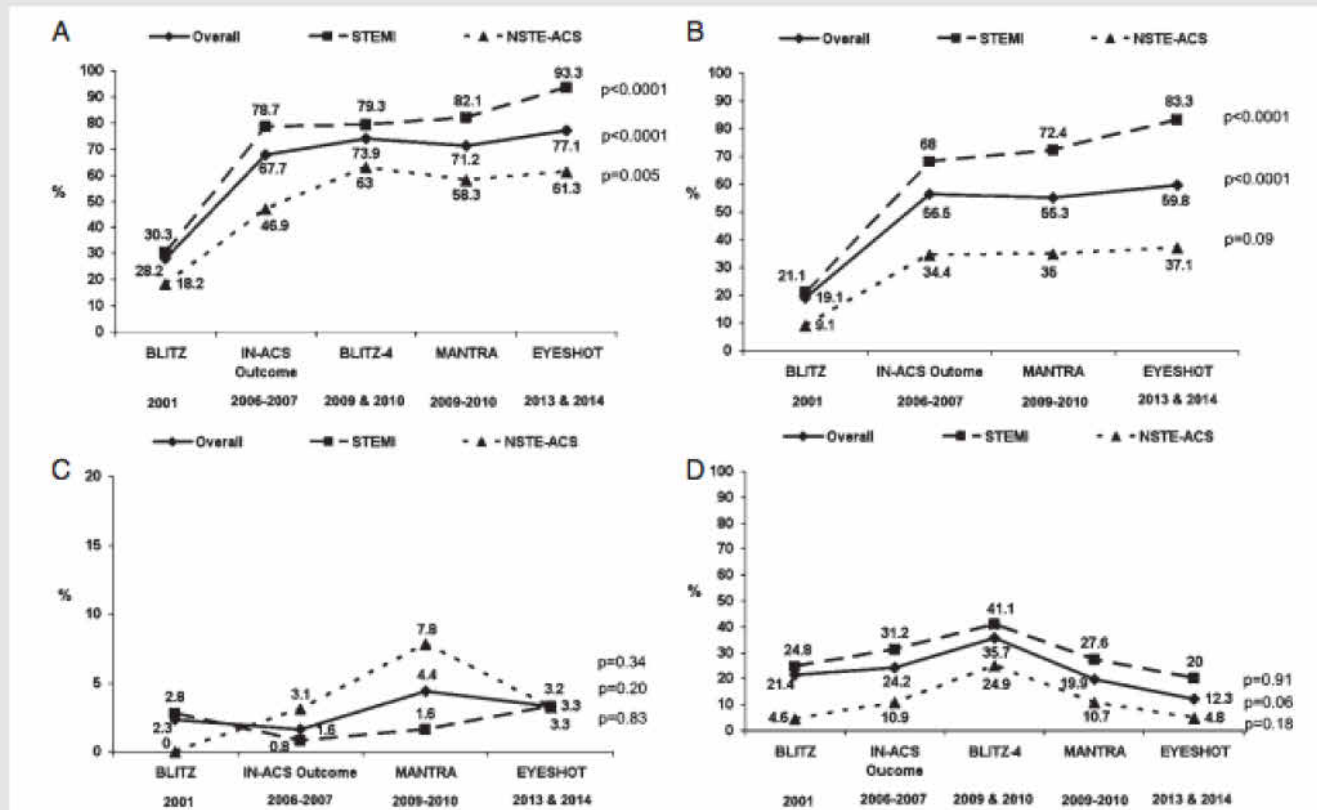
Table 2

Temporal trends in in-hospital mortality in patients with non-ST-elevation myocardial infarction with or without cardiogenic shock managed using conservative or invasive strategy

Cardiogenic Shock	Overall	2006	2007	2008	2009	2010	2011	2012	Unadjusted OR Per Year (95% CI)	Adjusted OR Per Year (95% CI)
No	3.6%	4.1%	3.9%	4.0%	3.5%	3.4%	3.2%	3.2%	0.954 (0.950-0.957)	0.993 (0.989-0.997)
Conservative	6.6%	7.2%	6.6%	6.9%	6.4%	6.3%	6.0%	6.5%	0.977 (0.973-0.981)	1.002 (0.998-1.007)
Invasive	1.3%	1.4%	1.5%	1.5%	1.3%	1.2%	1.1%	1.2%	0.955 (0.948-0.962)	0.982 (0.974-0.991)
Yes	34.6%	40.8%	40.3%	33.2%	33.6%	32.3%	32.7%	32.7%	0.944 (0.935-0.952)	0.966 (0.956-0.975)
Conservative	48.0%	53.1%	48.6%	46.6%	46.3%	46.2%	46.8%	49.1%	0.981 (0.968-0.994)	0.997 (0.983-1.012)
Invasive	24.8%	30.1%	33.0%	23.9%	24.8%	22.8%	22.1%	21.9%	0.921 (0.909-0.933)	0.924 (0.911-0.938)

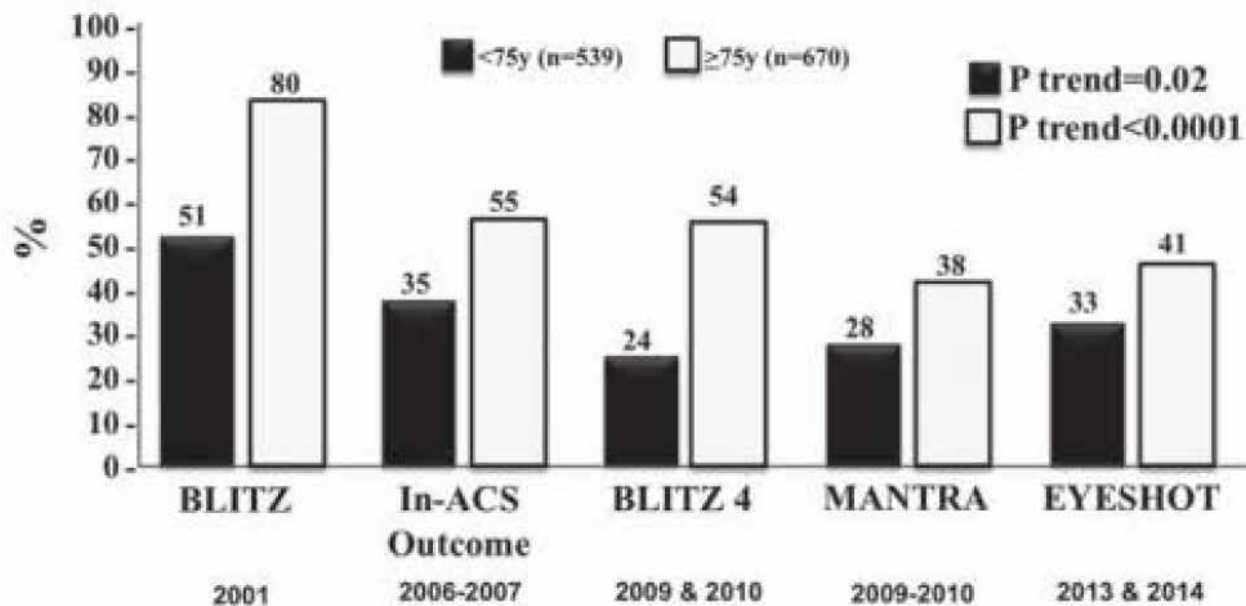
CI = confidence interval; OR = odds ratio.

Kolte D, Khera S, Dabhadkar KC, et al. Trends in Coronary Angiography, Revascularization, and Outcomes of Cardiogenic Shock Complicating Non-ST-Elevation Myocardial Infarction. Am J Cardiol. 2016;117:1-9.



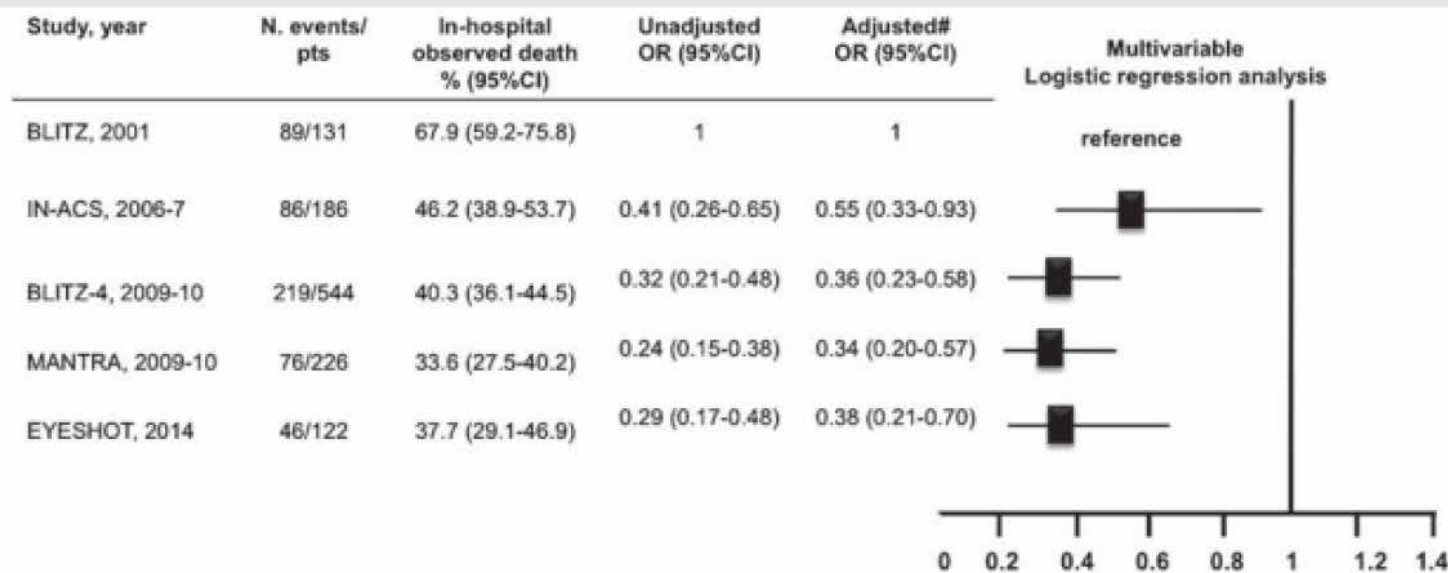
**Figure 2** In-hospital use of coronary angiography (A), percutaneous coronary intervention (PCI) (B), coronary artery bypass grafting (CABG) (C) and intra-aortic balloon pump (IABP) (D) from 2001 to 2014 among patients with cardiogenic shock and initial diagnosis of ST-elevation myocardial infarction (STEMI) and non-ST elevation acute coronary syndrome (NSTEMI-ACS). Note: in BLITZ- 4, the rate of PCI for patients transferred from enrolling hospitals without interventional facilities to interventional centres is unknown, while the collected rate of CABG referred to the indication rather than to the execution of the procedure; therefore, they have not been reported in the figure.

De Luca L, Olivari Z, Farina A, et al. Temporal trends in the epidemiology, management, and outcome of patients with cardiogenic shock complicating acute coronary syndromes. *Eur J Heart Fail.* 2015;17:1124-32.



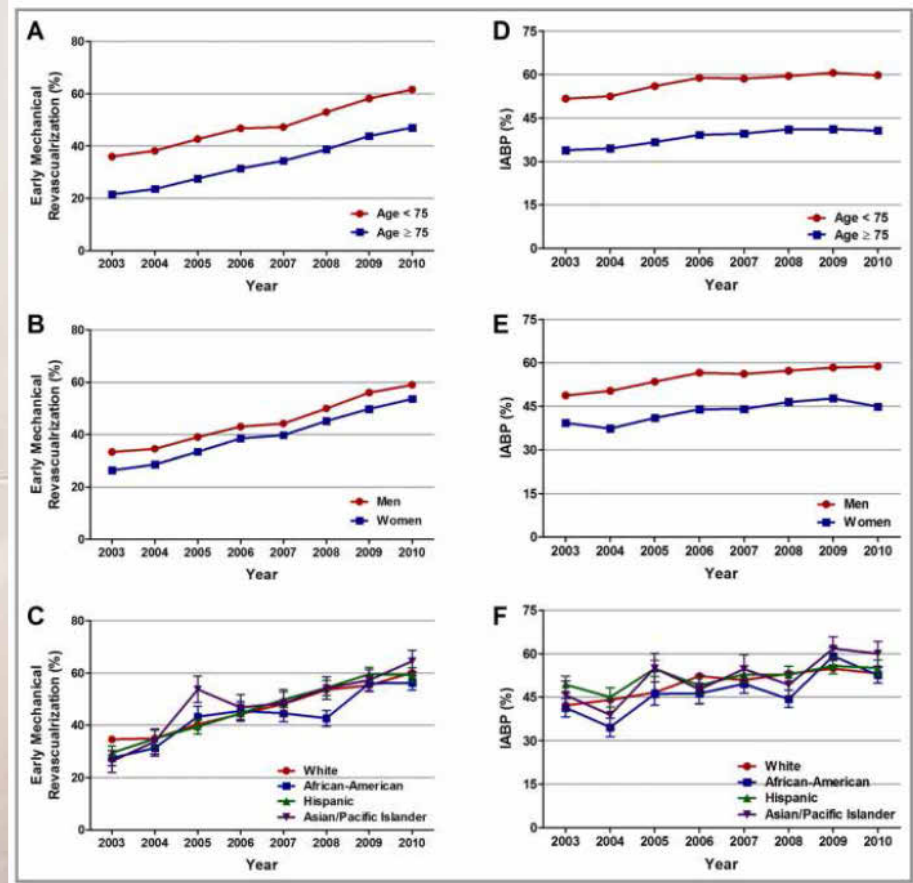
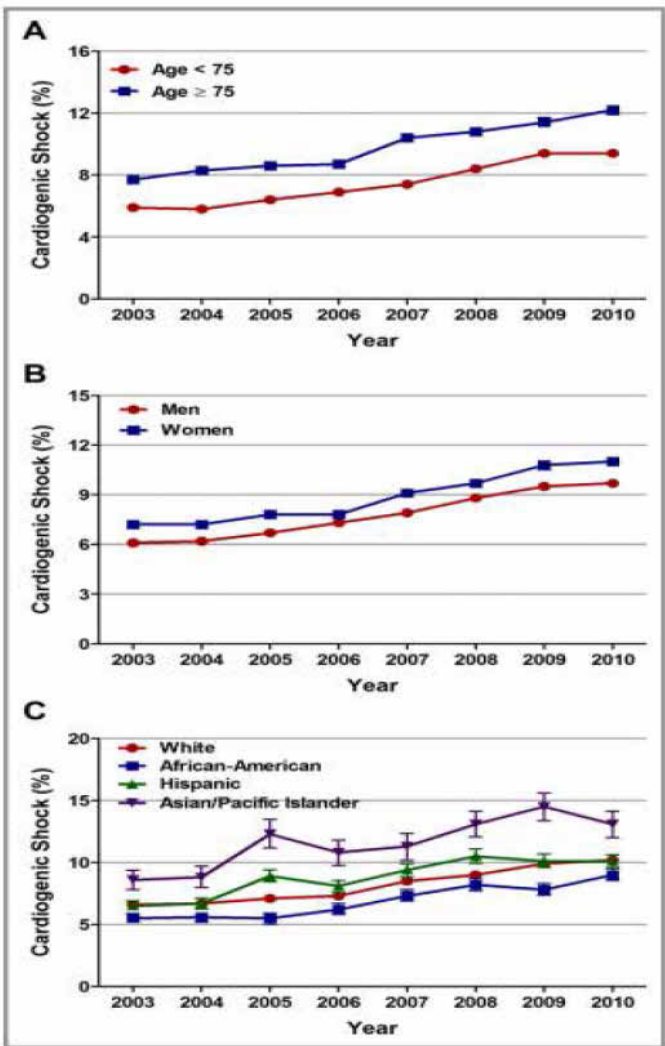
**Figure 4** In-hospital case-fatality rate from 2001 to 2014 among patients with cardiogenic shock aged < or ≥75 years.

De Luca L, Olivari Z, Farina A, et al. Temporal trends in the epidemiology, management, and outcome of patients with cardiogenic shock complicating acute coronary syndromes. *Eur J Heart Fail.* 2015;17:1124-32.

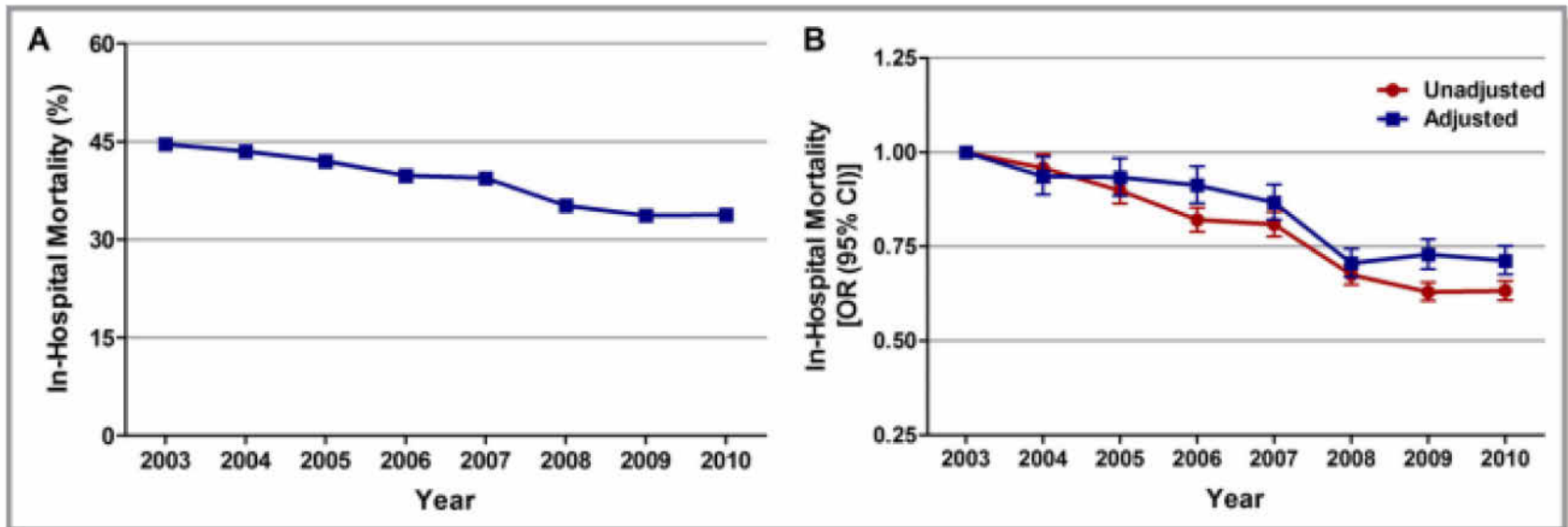


**Figure 5** Temporal trends in the crude and multivariable-adjusted odds ratio of in-hospital all-cause case-fatality rate in patients with cardiogenic shock. #Multivariable logistic regression analysis adjusted for diagnosis at entry (ST-elevation myocardial infarction vs. non-ST elevation acute coronary syndromes), gender, age, systolic blood pressure, active smoker, history of heart failure, prior stroke/transient ischaemic attack, history of peripheral artery disease, history of renal dysfunction, cardiogenic shock (i.e. Killip class IV) at entry, AF at first ECG, hospital with a cath lab, geographic area of the hospital (North, Centre, South), and type of study. OR, odds ratio; CI, confidence interval.

De Luca L, Olivari Z, Farina A, et al. Temporal trends in the epidemiology, management, and outcome of patients with cardiogenic shock complicating acute coronary syndromes. *Eur J Heart Fail.* 2015;17:1124-32.



Kolte D, Khera S, Aronow WS, et al. Trends in incidence, management, and outcomes of cardiogenic shock complicating ST-elevation myocardial infarction in the United States. *J Am Heart Assoc.* 2014;3(1)



Kolte D, Khera S, Aronow WS, et al. Trends in incidence, management, and outcomes of cardiogenic shock complicating ST-elevation myocardial infarction in the United States. *J Am Heart Assoc.* 2014;3(1)



# Registres xoc Catalunya

- Sèrie H Sant Pau. Desembre 2005- Maig 2009
- Edat mitja 68 a. Mortalitat 30 d: 64%

Variable	All patients (n = 129)
ACS	64 (50)
STEMI	60 (47)
NSTEMI	4 (3)
Non-ACS causes	65 (50)
Cardiomyopathy	28 (22)
Valvular disease	11 (9)
Pericardial disease	8 (6)
Endocarditis	6 (5)
Arrhythmia	5 (4)
Other causes <sup>a</sup>	7 (5)

**Table 4.** Inhospital management and procedures according to the use of PAC

Variable	All patients (n = 129)
Intra-aortic balloon pump	41 (32)
Left-ventricular assist device	2 (2)
Noninvasive ventilation	15 (12)
Orotracheal intubation	84 (65)
Continuous hemodiafiltration	27 (21)
Pericardiocentesis	8 (6)
Cardiopulmonary resuscitation previous to shock	21 (16)
Transvenous cardiac pacing	23 (18)
Use of inotropes	120 (93)

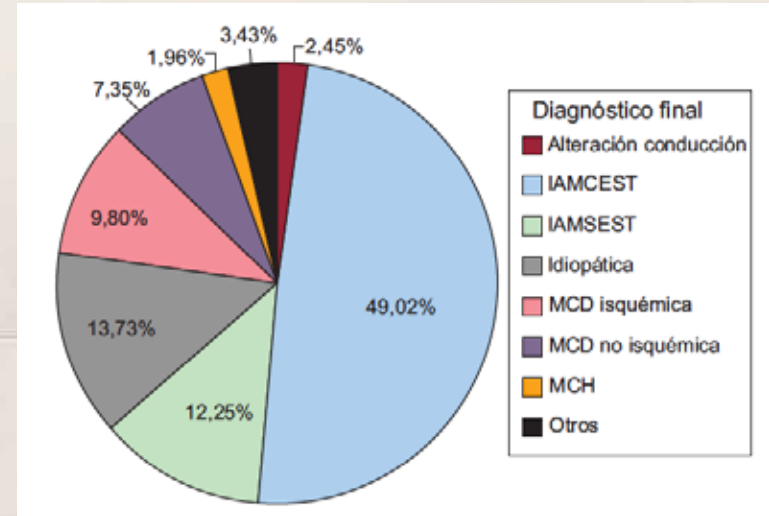
Rossello X, Vila M, Rivas-Lasarte M, et al. Impact of Pulmonary Artery Catheter Use on Short- and Long-Term Mortality in Patients with Cardiogenic Shock. *Cardiology*. 2017;136:61-69.

# Registre post-PCR a Catalunya

- La incidència de XC en malats atesos per PCR és alta i confereix un mal pronòstic

Predictores pronòstics. Anàlisi univariable

	Buen pronóstico	Mal pronóstico	p
Pacientes	104 (51)	100 (49)	
<b>Shock al ingreso</b>	<b>23 (34,8)</b>	<b>43 (65,2)</b>	<b>0,01</b>
IAMCEST	62 (58,3)	45 (41,7)	0,045
Hipotermia	53 (62,1)	33 (37,9)	0,01
pH < 7,1	11 (24,4)	34 (75,6)	< 0,001

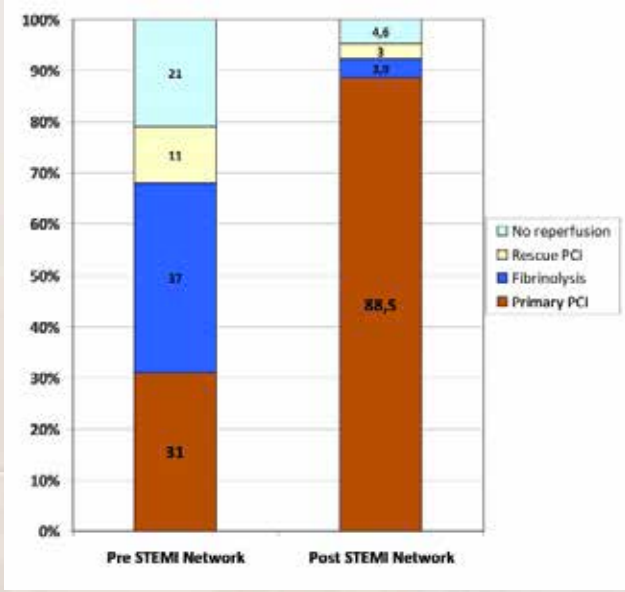
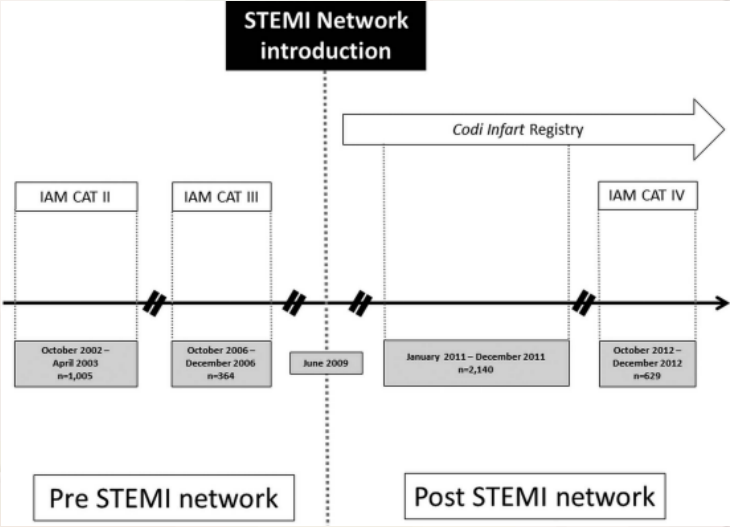


Predictores pronòstics. Anàlisi multivariable (n = 126)

	p	Exp(B)	OR (IC95%)
<b>Shock</b>	<b>0,0027</b>	<b>3,5739</b>	<b>1,98 (1,29-3,03)</b>
Hipotermia	0,0278	0,4083	0,66 (0,47-0,92)
PCR-ROSC < 30 min	0,0159	0,3565	0,56 (0,43-0,72)
Ritmo desfibrilable	0,0034	0,2956	0,57 (0,45-0,72)
pH > 7,1	0,0071	0,2689	0,67 (0,53-0,85)

Loma-Orsorio P, Aboal J, Sanz M et al. Clinical characteristics and vital and functional prognosis of out-of-hospital cardiac arrest survivors admitted to five cardiac intensive care units. Rev Esp Cardiol. 2013;66:623-8.

# Prevalença xoc . Registres a Catalunya



	Pre-STEMI network (n=367)	Post-STEMI network (n=2140)	p Value
Anterior MI	158 (43%)	882 (41%)	0.22
Cardiogenic shock at admission	22 (6.0%)	141 (6.6%)	0.67

*Figueras J et al. RSCC 2005*  
*Figueras J et al. Med Clin (Bar) 2009*  
*Regueiro A et al. BMJ 2015.*

# Estudis d'ECMO. Catalunya

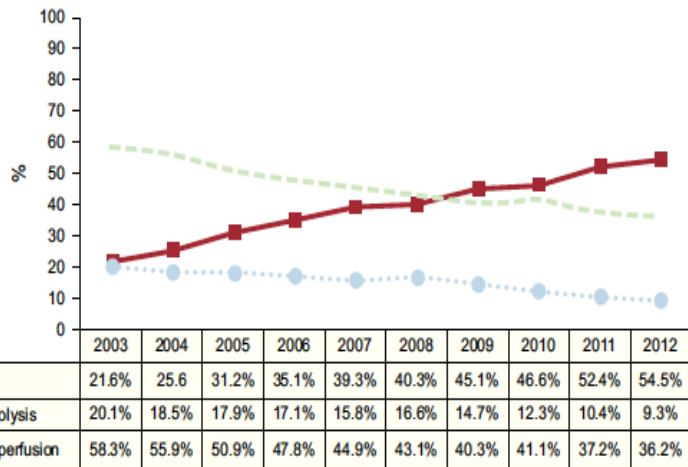


	Bellvitge <sup>1</sup>	Clinic <sup>2</sup>
N	16 2009-2012	10 (70% post-IAM) >2012
Sexe (homes)	68,7%	60%
Edat	54,6 anys	51 anys
INTERMACS I	87,5%	90%
BCPIAO	75%	90%
Transfer Hospital	50%	20%
Pont-Tx	50%	60%
Pont-recuperació	18,7%	20%
Pont-decisió	31,3%	20%
Hemorràgies	56,2%	--
Infeccions	56,2%	--
Recuperació	25%	30%
Trasplantament	25%	20%
Mort intrahosp ECMO o post-Tx	62,5%	50%
Supervivència	37,5%	50%

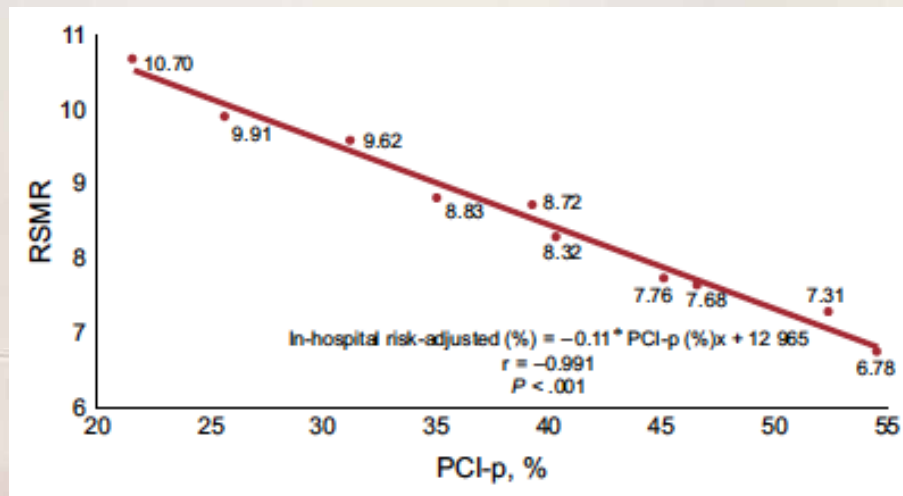
# Maneig de l'IAMEST i incidència de xoc



(2003-2012 ) 302.471 IAMEST



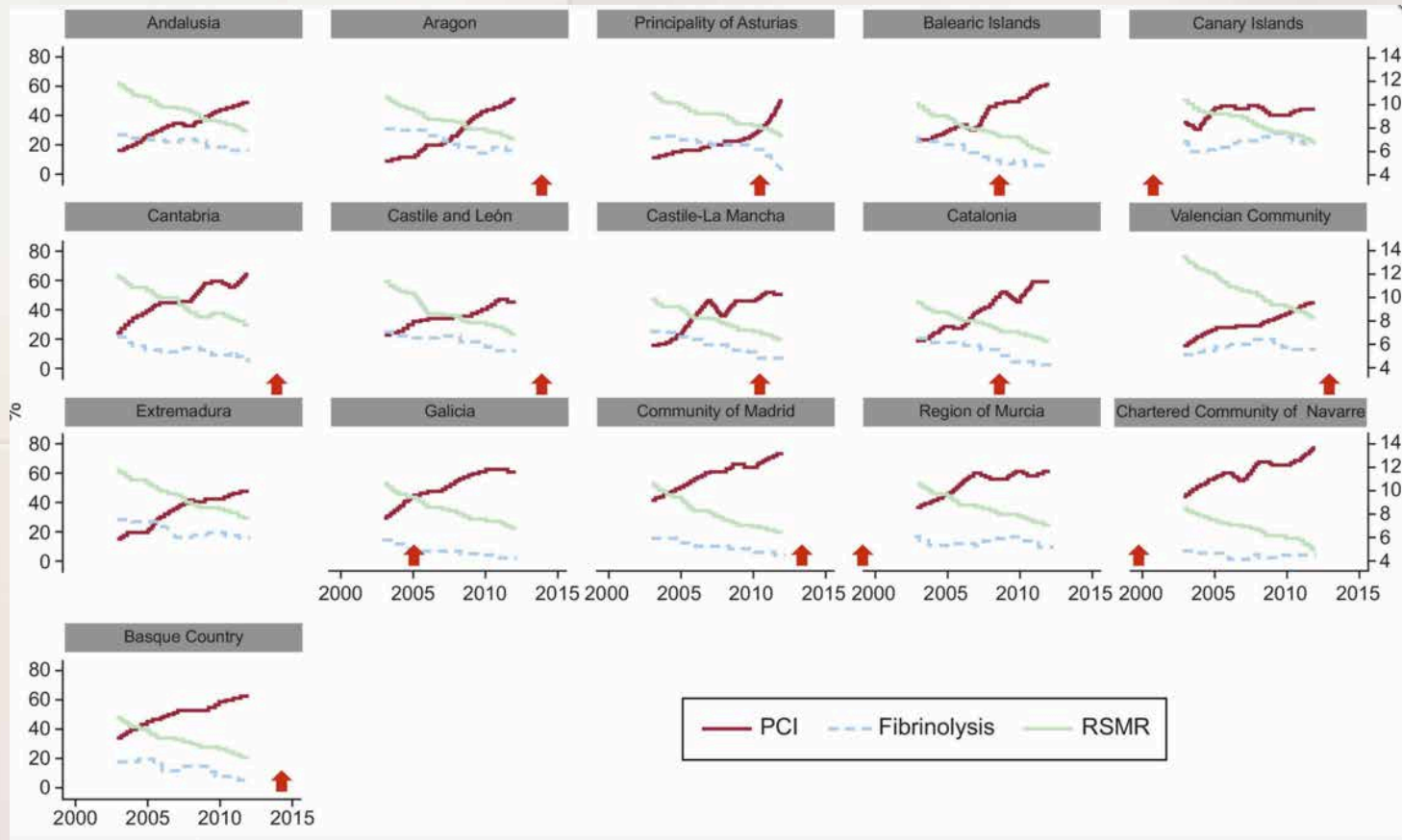
P < .001 for % (increase/decrease) for all treatment groups



	Total (n = 302 471)	Reperfusion strategies			P
		PCI (n = 116 621)	Thrombolysis (n = 46 720)	No reperfusion (n = 139 130)	
	n (%)	n (%)	n (%)	n (%)	
Shock	18 735 (6.2)	5780 (5.0)	2757 (5.9)	10 198 (7.3)	<.001
In-hospital mortality	33 651 (11.1)	5559 (4.8)	4021 (8.6)	24071 (17.3)	<.001

Cequier À, Ariza-Solé A, Elola FJ, et al. Impact on Mortality of Different Network Systems in the Treatment of ST-segment Elevation Acute Myocardial Infarction. The Spanish Experience. Rev Esp Cardiol 2016. Ahead of print

# Maneig de l'IAMEST

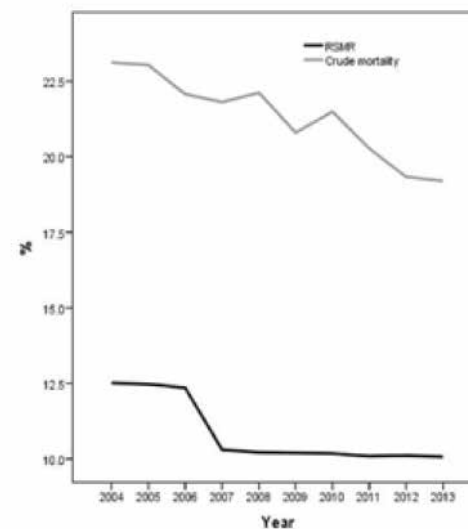
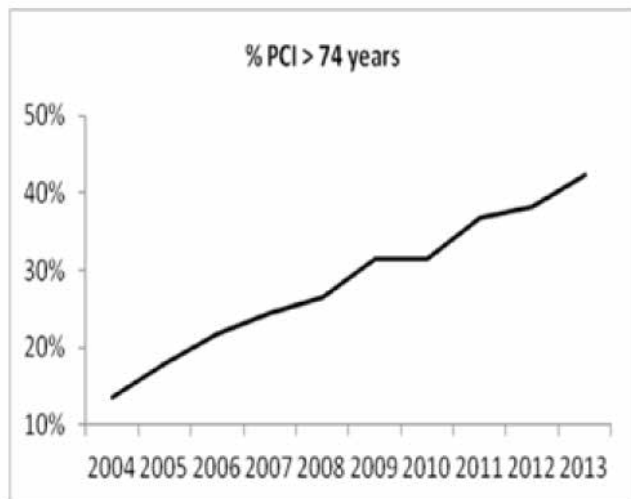


Cequier À, Ariza-Solé A, Elola FJ, et al. Impact on Mortality of Different Network Systems in the Treatment of ST-segment Elevation Acute Myocardial Infarction. The Spanish Experience. Rev Esp Cardiol 2016. Ahead of print

Table 1. Patients with ST segment elevation myocardial infarction aged  $\geq 75$  years in Spanish National Health System 2004-2013

Year	Age groups					Total	$\geq 74$ / Total
	35-74	75-79	80-84	85-89	>89		
2004	21,069	4,994	3,889	2,137	1,059	33,148	36.4%
2005	20,248	4,682	3,885	2,030	1,102	31,947	36.6%
2006	19,886	4,390	3,765	2,104	1,019	31,164	36.2%
2007	19,445	4,287	3,617	2,155	1,052	30,556	36.4%
2008	18,550	4,182	3,622	2,118	1,018	29,490	37.1%
2009	18,471	3,946	3,456	2,240	930	29,043	36.4%
2010	18,715	3,761	3,320	2,196	1,052	29,044	35.6%
2011	18,326	3,561	3,234	2,201	1,043	28,365	35.4%
2012	18,400	3,450	3,272	2,165	1,059	28,346	35.1%
2013	18,929	3,346	3,305	2,138	1,108	28,826	34.3%
Total	192,039	40,599	35,365	21,484	10,442	299,929	36.0%

Management of myocardial infarction in the elderly. Insights from Spanish Minimum Basic Data Set. Ariza Solé A, Alegre O, Elola FJ et al. Submitted.



Management of myocardial infarction in the elderly. Insights from Spanish Minimum Basic Data Set.  
 Ariza Solé A, Alegre O, Elola FJ et al. Submitted.



**Table 1. Hospital typologies**

Typology	Characteristics
1	Hospitals with no structured cardiac unit: <1500 "cardiac disease" discharges a year, no specific coding for cardiac unit discharges or <500 cases coded for cardiology each year
2	Hospitals with structured cardiac unit without cathlab facility: > 1500 cardiac disease cases a year and that encodes > 500 discharges to cardiology, or that even encoding > 1500 cases do not perform > 200 PCI a year; group
3	Hospitals with structured cardiac unit with cathlab facility, but without cardiac surgery department: > 1500 discharges of cardiac diseases per year, encoding > 500 cases to cardiology, performing > 200 PCI and <50 coronary artery bypass grafting procedures (CABG).
4	Hospitals with structured cardiac unit with cathlab and cardiac surgery department: > 1500 discharges of cardiac disease per year, encoding > 500 cases to cardiology, performing > 200 PCI and > 50 CABG a year.
5	Hospitals with cathlab facility and / or cardiac surgery, performing > 200 PCI and/or > 50 CABG a year, but without a structured cardiac unit (encoding < 500 cases to cardiology).

Management of myocardial infarction in the elderly. Insights from Spanish Minimum Basic Data Set.  
Ariza Solé A, Alegre O, Elola FJ et al. Submitted.

Table 5. Ratio of Standardized Mortality Rate according to age groups, management performed, clinical unit, type of hospital and STEMI Regional Network.

		RSMR (%)				p
		75-79	80-84	85-89	>89	
		B	C	D	E	
		Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	
Treatment	PCI	10.1 (2.8) CDE	9.9 (2.5) BD	9.7 (2.3) BC	9.7 (2.1) B	< .0001*
	Thrombolysis	11.4 (2.6)	11.3 (2.5)	11.2 (2.3)	11.3 (2.1)	
	No reperfusion	11.4 (2.9)	11.3 (2.7)	11.1 (2.4)	11.0 (2.2)	
Cardiology Unit		10.4 (2.9) CDE	10.4 (2.8) BDE	10.4 (2.5) BC	10.7 (2.5) BCD	< .0001*
Other clinical unit		11.6 (2.7) CDE	11.4 (2.5) BDE	11.2 (2.3) BCE	11.1 (2.1) BCD	
Hospital & Cardiac Unit Typology	1	11.0 (2.2) CDE	11.1 (2.2) BE	11.2 (2.0) BE	11.3 (1.9) BCD	< .0001*
	2	11.3 (2.5)	11.4 (2.3)	11.3 (2.1)	11.3 (1.8)	
	3	10.1 (2.3)	10.1 (2.3)	10.1 (2.1)	10.2 (1.9)	
	4	9.4 (2.0) CDE	9.5 (2.0) B	9.5 (1.8) B	9.6 (1.6) B	
	5	10.6 (1.9)	10.6 (1.8)	10.7 (1.7)	10.8 (1.5)	
Regional healthcare network systems for STEMI	Yes	8.6 (2.1) CDE	8.9 (2.1) BDE	9.3 (2.1) BCE	10.8 (1.9) BCD	0.001*
	No	10.5 (1.6) CDE	10.6 (1.6) BDE	10.8 (1.6) BC	9.6 (1.5) BC	

\* Capital letters show statistical significant differences between age groups

Management of myocardial infarction in the elderly. Insights from Spanish Minimum Basic Data Set. Ariza Solé A, Alegre O, Elola FJ et al. Submitted.

# Maneig del xoc cardiogènic



Año	Diagnóstico principal	Diagnóstico secundario	Nº Casos
2004	0	2.943	2.943
2005	59	3.095	3.154
2006	94	3.038	3.132
2007	116	3.241	3.357
2008	132	3.448	3.580
2009	109	3.426	3.535
2010	128	3.393	3.521
2011	133	3.471	3.604
2012	136	3.603	3.739
2013	139	3.764	3.903
2014	130	3.369	3.499
<b>Total</b>	<b>1.176</b>	<b>36.791</b>	<b>37.967</b>

61,1% homes  
edat mitjana 72 $\pm$ 13a.  
61% IAM.  
Mortalitat: 56,3%.

Sánchez Salado JC, Ariza-Solé A, Elola FJ et al. Unpublished data.

# Manejo



Procedimientos	%
Contrapulsacion	14,6
Angioplastia	24,3
Dispositivo Soporte Ventricular	,4
Ventilación Mecánica Invasiva	1,0
ECMO	,7
Ventilación No Invasiva	9,2
Depuracion extrarrenal	7,2
Catéter de Swan Ganz	5,1

Sánchez Salado JC, Ariza-Solé A, Elola FJ et al. Unpublished data.

# Mortalidad bruta



Año	Odds ratio	P
2004	1	
2005	0,9304799	0,194
2006	0,7699459	<0,001
2007	0,8023579	<0,001
2008	0,6577831	<0,001
2009	0,682703	<0,001
2010	0,6038992	<0,001
2011	0,5623607	<0,001
2012	0,4709343	<0,001
2013	0,4818461	<0,001
2014	0,453278	<0,001

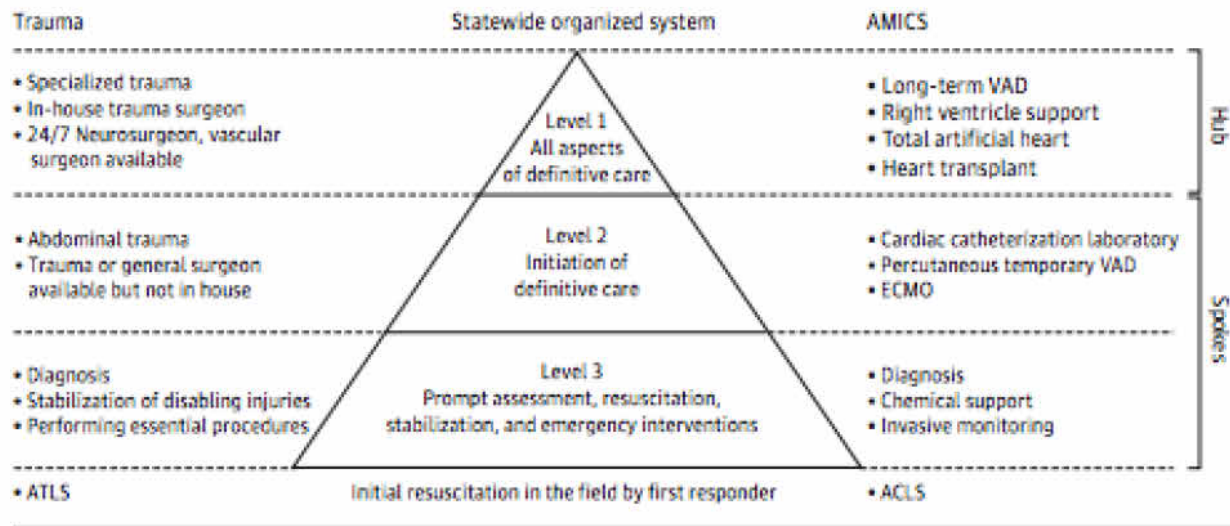
Sánchez Salado JC, Ariza-Solé A, Elola FJ et al. Unpublished data.

## Recommendations regarding management of patients with cardiogenic shock

Recommendations	Class <sup>a</sup>	Level <sup>b</sup>	Ref <sup>c</sup>
In all patients with suspected cardiogenic shock, immediate ECG and echocardiography are recommended.	I	C	
All patients with cardiogenic shock should be rapidly transferred to a tertiary care center which has a 24/7 service of cardiac catheterization, and a dedicated ICU/CCU with availability of short-term mechanical circulatory support.	I	C	
In patients with cardiogenic shock complicating ACS an immediate coronary angiography is recommended (within 2 hours from hospital admission) with an intent to perform coronary revascularization.	I	C	
Continuous ECG and blood pressure monitoring are recommended.	I	C	
Invasive monitoring with an arterial line is recommended.	I	C	
Fluid challenge (saline or Ringer's lactate, >200 ml/15–30 min) is recommended as the first-line treatment if there is no sign of overt fluid overload.	I	C	
Intravenous inotropic agents (dobutamine) may be considered to increase cardiac output.	IIb	C	
Vasopressors (norepinephrine preferable over dopamine) may be considered if there is a need to maintain SBP in the presence of persistent hypoperfusion.	IIb	B	558
IABP is not routinely recommended in cardiogenic shock.	III	A	585, 586
Short-term mechanical circulatory support may be considered in refractory cardiogenic shock depending on patient age, comorbidities and neurological function.	IIb	C	

Ponikowski P, Voors AA, Anker SD, et al; Authors/Task Force Members.. 2016 ESC Guidelines for the diagnosis and treatment of acute and chronic heart failure: The Task Force for the diagnosis and treatment of acute and chronic heart failure of the European Society of Cardiology (ESC) Developed with the special contribution of the Heart Failure Association (HFA) of the ESC. Eur Heart J. 2016 ;37:2129-200.

**Figure. Proposed Statewide Organization of Acute Myocardial Infarction With Cardiogenic Shock (AMICS) Management Similar to Trauma Center Paradigm**

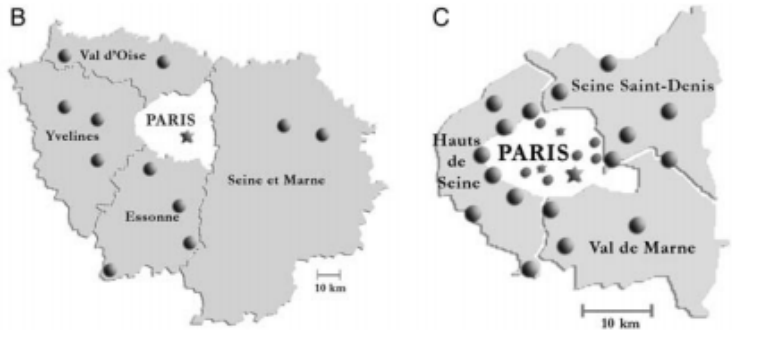


Tchantchaleishvili V, Hallinan W, Massey HT. Call for Organized Statewide Networks for Management of Acute Myocardial Infarction-Related Cardiogenic Shock. *JAMA Surg.* 2015;150:1025-6.

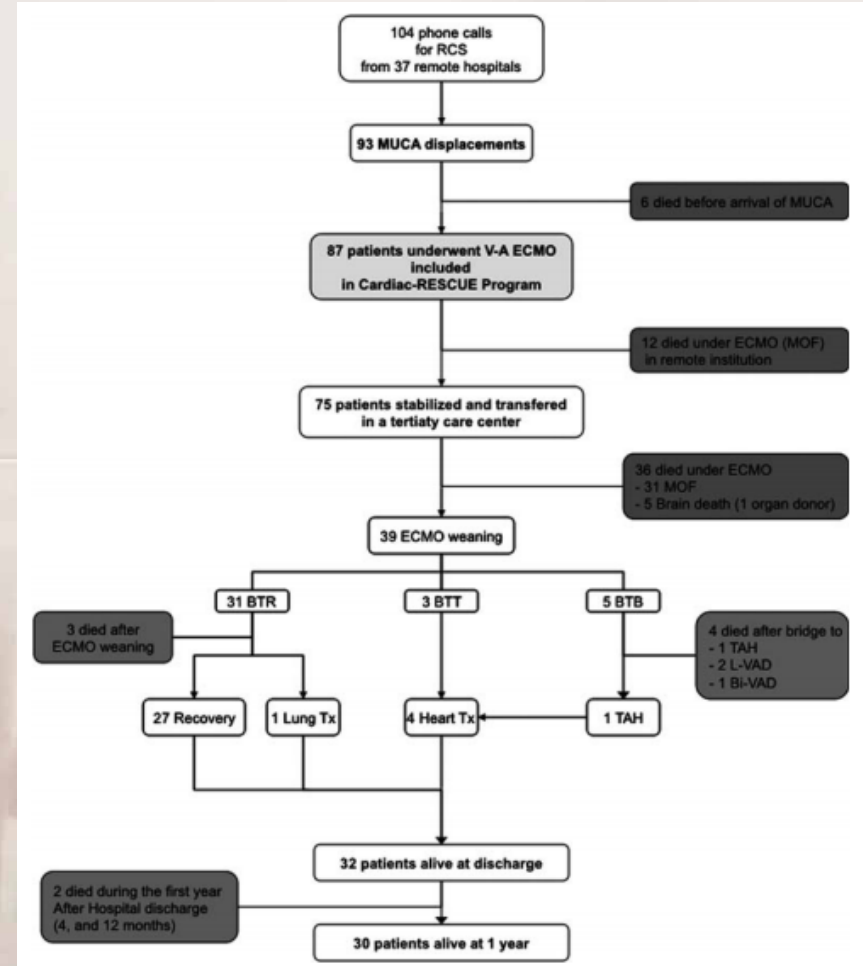
# Treball en xarxes

## Emergency circulatory support in refractory cardiogenic shock patients in remote institutions: a pilot study (the cardiac-RESCUE program)

Sylvain Beurtheret<sup>1\*†</sup>, Pierre Mordant<sup>1†</sup>, Xavier Paoletti<sup>2</sup>, Eloi Marijon<sup>3,4,5</sup>, David S. Celmaj<sup>6</sup>, Philippe Léger<sup>1</sup>, Alain Pavie<sup>1</sup>, Alain Combes<sup>7</sup>, and Pascal Leprince<sup>1</sup>



- 32/75 supervivents al alta. 36,8%
- Sense diferències amb les ECMO implantades localment





# Xarxes de treball en xoc



## Treball en xarxa. H. Puerta de Hierro Madrid. "Shock-team"

71 pacients. Sept 2014-Sept 2016  
2,8 pacients/mes

"codigo shock". Guardia Tx 24/7

- Nivel 1. H. Referència
- Nivel 2. H. CCV
- Nivel 3. H. con UCI

30 pts locals

41 pts  
evaluats  
19 hospitals

12  
descartats

DA

13 pt  
(68%)

ECMO periférico	20
ECMO central	10
IMPELLA CP	7
CENTRIMAG izqda	5
CENTRIMAG dcha	2
CENTRIMAG biV	2
EXCOR	2

29 traslladats  
66% nivell 2  
34% nivell 3

# Recursos tècnics disponibles als hospitals



	Llits crítics Nº	% ingresos XC	% XC per SCA	PCI primària	Horari PCI primària
Bellvitge	8	3-4%	50%	✓	7d / 24 hs
Sant Pau	9	3.5%	80%	✓	7d / 24 hs
Clínic	8	5-6 %	70%	✓	7d / 24 hs
Vall Hebron	10	7 %	70%	✓	7d / 24 hs
H Germans Trias	8	2%	>90%	✓	7d / 24 hs
Josep Trueta	8	7.5%	72%	✓	7d / 24 hs
Arnau Lleida	6-8	5%	75%	✓	7d / 24 hs
Moises Broggi/HGH	22 polivalents	1-2%	50-80%	-	-
Joan XXIII	6+9 polivalents	5%	50%	✓	7d/24 hs
H. Del Mar	4	2%	40%	✓	5d/12 hs

# Recursos tècnics disponibles als hospitals



	BCPIA	ECMO	DAVp Impella	DAV curta Levitronix/ Maquet	DAV llarga Heart Mate	Tx	DAV inicial
Bellvitge	✓	✓	✓	✓	✓	✓	ECMO/Levit**
Sant Pau	✓	✓	-	✓	✓	✓	BCPIA
Clínic	✓	✓	-	✓	✓	✓	BCPIA
Vall Hebron	✓	✓	-	-	-	-	BCPIA
H Germans Trias	✓	-	✓	-	-	-	BCPIA
Josep Trueta	✓	-	✓	-	-	-	BCPIA
Arnau Lleida	✓	-	-	-	-	-	BCPIA
M Broggi/HGH	-	-	-	-	-	-	-
Joan XXIII	✓	-	✓	-	-	-	BCPIA
H. Del Mar	✓	✓ **	-	-	-	-	BCPIA

# Conclusions

- Poques dades, la majoria basades en series unicèntriques de n limitada
- Grans registres mostren un increment progressiu de l'estratègia invasiva i la revascularització , amb tendència a reduir mortalitat
- Malgrat tot, mortalitat persistentment elevada
- Dades discordants sobre l'evolució en la incidència de xoc en el SCA

# Conclusions

- Major utilització de procediments invasius, amb millors resultats en funció del volum de pacients i experiència dels centres
- Dades indirectes mostren millors resultats en centres amb major grau de tecnificació (pacients seleccionats)
- La selecció dels pacients i la centralització de l'assistència, probablement claus en optimitzar resultats

## IC avançada i trasplantament

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## Cures Intensives Cardiològiques

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