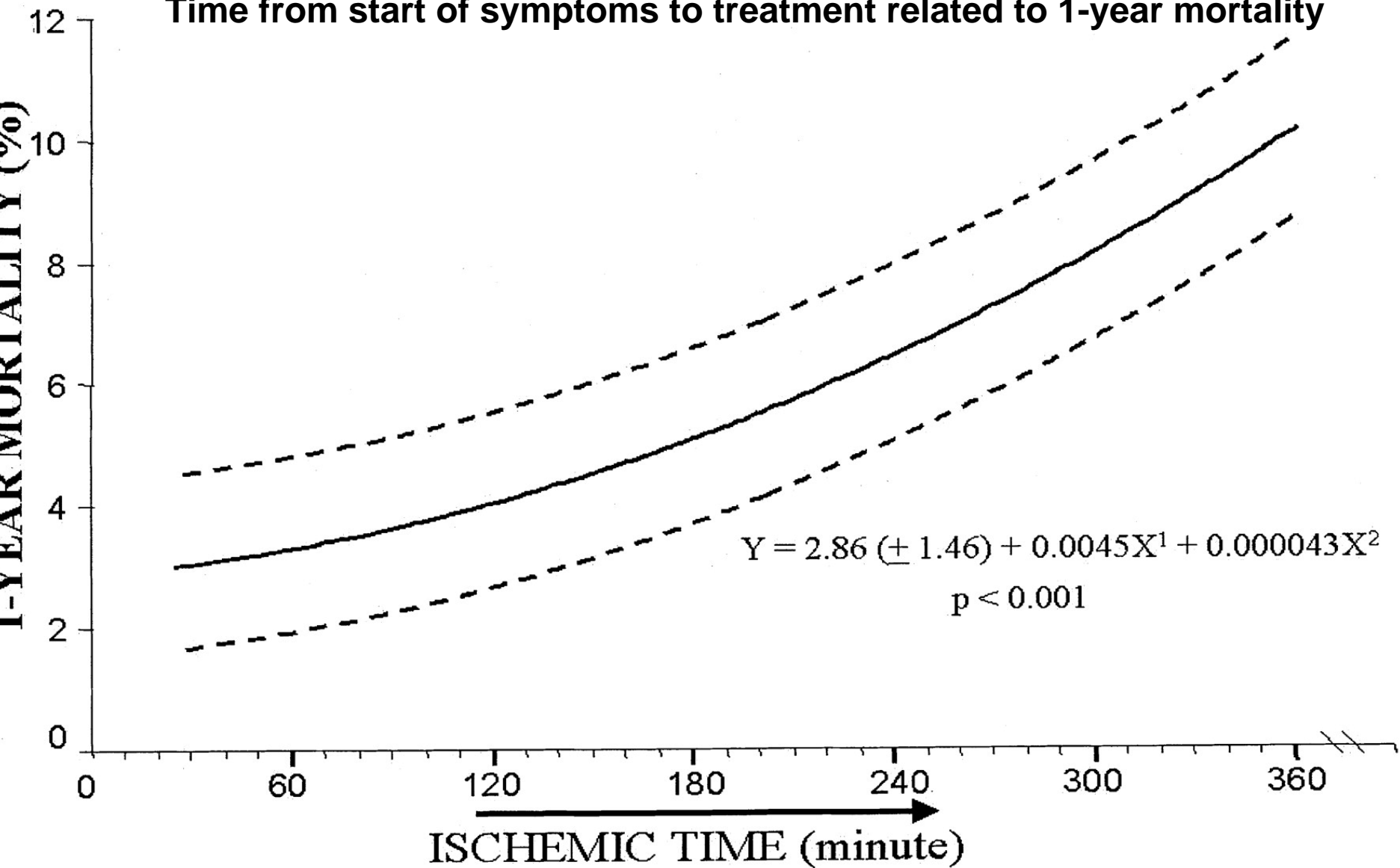


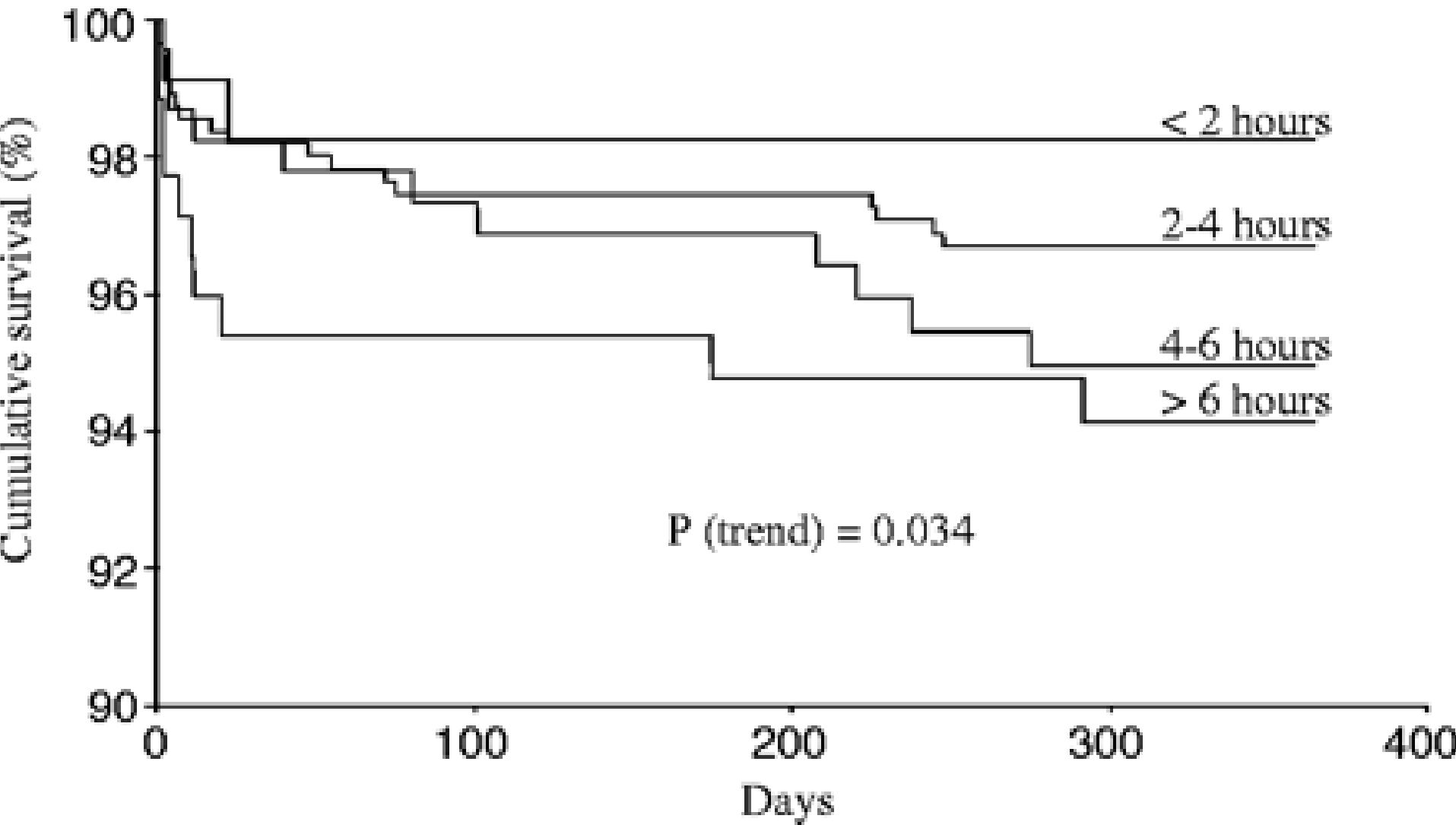
Best management of STEMI in rural areas

Jan Erik Nordrehaug
Department of Heart Disease
Haukeland University Hospital
Bergen, Norway

Time from start of symptoms to treatment related to 1-year mortality



Primary PCI: Kaplan-Meier survival curves according to time to treatment

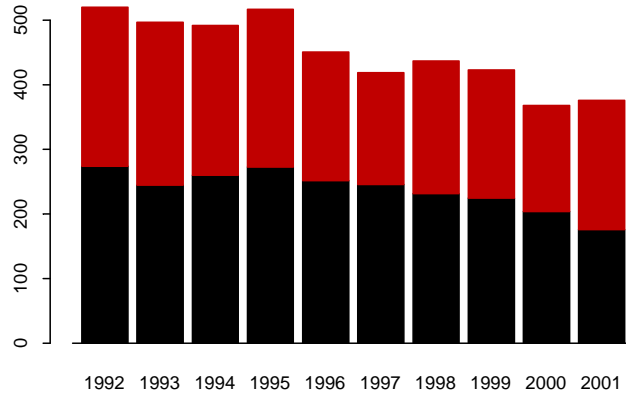


30 minutes saved at different delay times	Number of extra survivors pr 1000 patients
240 → 210 minutes	4 31 _{±7} → 35 _{±10}
105 → 75 minutes	10 55 _{±20} → 65 _{±23}
75 → 45 minutes	20 65 _{±23} → 85 _{±27}
45 → 15 minutes	83 85 _{±27} → 168 _{±32}

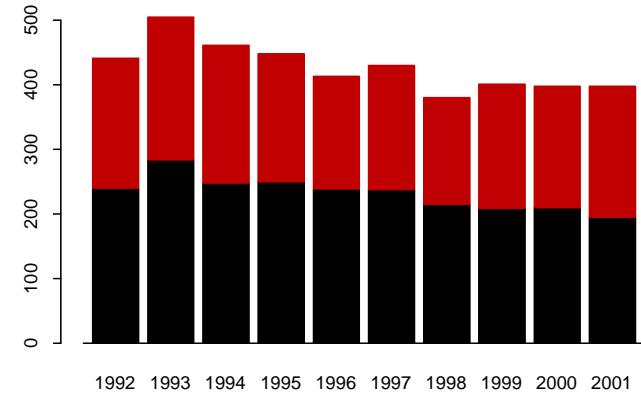
Each minute of delay first 3 hours confers 10 lost days of survival

AMI mortality in / outside hospital Western Norway 1992 - 2001

70+ yrs

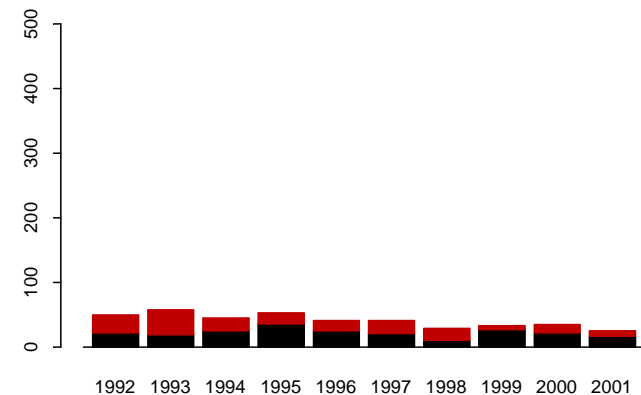
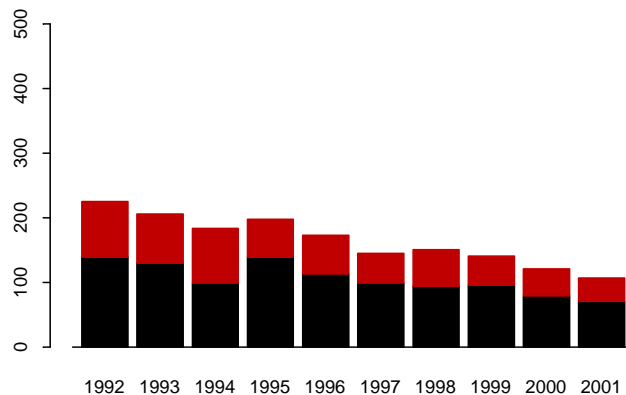


Men



Women

40-69 yrs



Data from HKS registry West Norway

Table 1. Baseline Characteristics of the Patients and Use of Concomitant Medications.*

Characteristic	Folic Acid, B ₁₂ , and B ₆ (N=937)	Folic Acid and B ₁₂ (N=935)	B ₆ (N=934)	Placebo (N=943)	P Value
Age — yr	63.6±11.9	63.2±11.6	62.5±11.7	62.6±11.4	0.11
Male sex — no. (%)	684 (73)	696 (74)	686 (73)	705 (75)	0.80
Total cholesterol — mmol/liter	5.8±1.2	5.8±1.2	5.8±1.3	5.7±1.3	0.49
Creatinine — μmol/liter	91±27	91±26	90±25	91±24	0.57
Systolic blood pressure — mm Hg	126±21	126±20	125±20	125±20	0.27
Diastolic blood pressure — mm Hg	73±13	73±13	72±13	72±13	0.25
Body-mass index†	26.5±4.0	26.2±3.5	26.3±3.8	26.3±3.8	0.66
Medical history — no. (%)					
Myocardial infarction	171 (18)	155 (17)	149 (16)	153 (16)	0.54
Angina pectoris	262 (28)	225 (24)	243 (26)	240 (26)	0.28
Stroke	50 (5)	36 (4)	38 (4)	33 (3)	0.21
Diabetes mellitus	103 (11)	83 (9)	86 (9)	96 (10)	0.40
Coronary-artery bypass surgery	55 (6)	40 (4)	38 (4)	44 (5)	0.26
Percutaneous coronary inter- vention	44 (5)	45 (5)	43 (5)	49 (5)	0.94
Receiving treatment for hypertension — no. (%)	281 (30)	250 (27)	268 (29)	275 (29)	0.46
Current smoker — no. (%)	429 (46)	405 (43)	460 (49)	453 (48)	0.05
Use of vitamin supplements — no./total no. (%)	271/931 (29)	275/930 (30)	257/928 (28)	263/935 (28)	0.78
Qualifying myocardial infarction					
Received primary or rescue PCI — no. (%)	59 (6)	61 (7)	54 (6)	54 (6)	0.86
Received thrombolysis — no./total no. (%)	383/932 (41)	403/931 (43)	405/929 (44)	381/942 (40)	0.42
Q-wave — no./total no. (%)	403/906 (44)	420/906 (46)	411/894 (46)	417/904 (46)	0.85
Peak creatine kinase — U/liter‡					
Median	969	1043	1004	929	0.62
Interquartile range	425–2156	461–2136	489–2084	457–2095	
Concomitant medication — no./total no. (%)					
Acetylsalicylic acid	757/874 (87)	789/880 (90)	764/853 (90)	778/880 (88)	0.16

NEJM 2006;
April 13

What is a rural area?

- No distinct definition, will depend on
 - population (volume of service)
 - road systems (at speed 30 km/h driving 1.5 km cancels time saved by sending EKG, at 90 km/h this equals 4.5 km)
 - telecommunication feasibility
 - may be defined by access time for first medical contact (25 minutes in West Norway)





Organising STEMI logistics in rural areas

- Political decision with financial support
- Treatment for STEMI should be validated (consensus document) via national cardiology working groups or use of guidelines
- Regional working groups should include cardiologists, intensive care anesthetists, ambulance paramedics, GP-on call service
- New PCI centers?

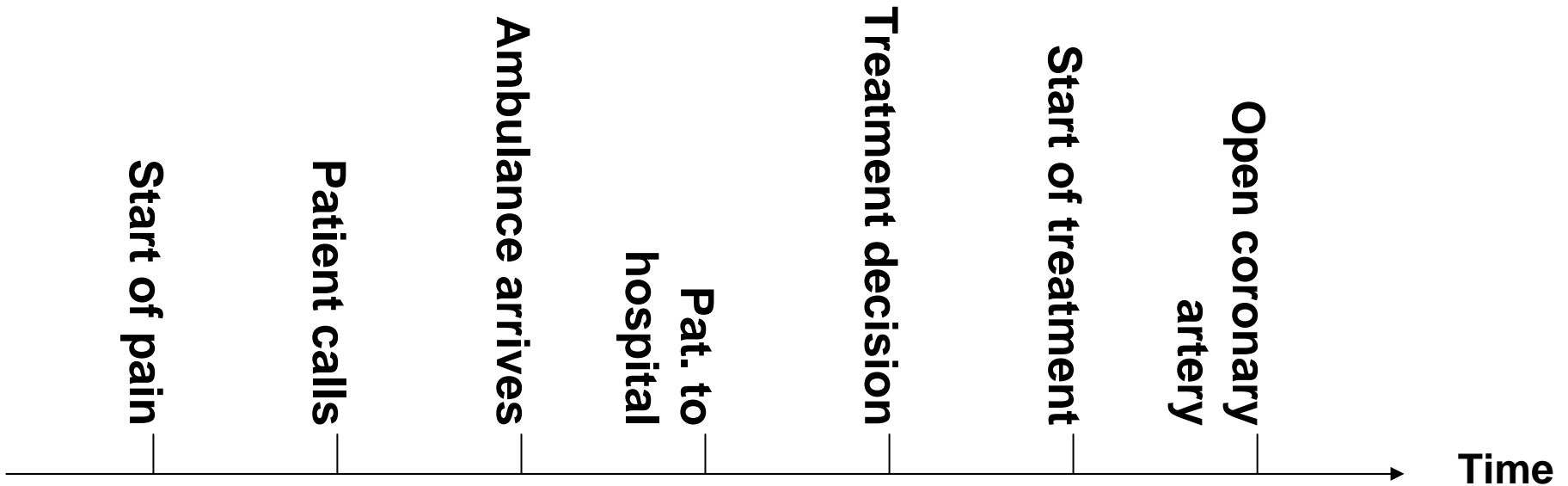
Important steps to consider

- Emergency switch (113) and GP-on call same response and decision times?
- Qualified personell must guide the patients, emergency switch board should use a preset brief questionnaire and classify response (red, yellow, green)
- All ambulances/helicopters should be a part of the emergency system

Important steps

- Implementation of telemedicine with EKG transmission from ambulances and helicopters to the PCI hospitals
- Decision on who reads the EKGs and response times
- Decide if difference between rural and central areas in response times for ambulances/helicopters, and use of EKG transmission (may be time-consuming if very short transport)
- Implementation of guideline response times
- Training of paramedics in administering thrombolysis

Chest pain: The time cascade



Factors related to delay times in patients with acute chest pain

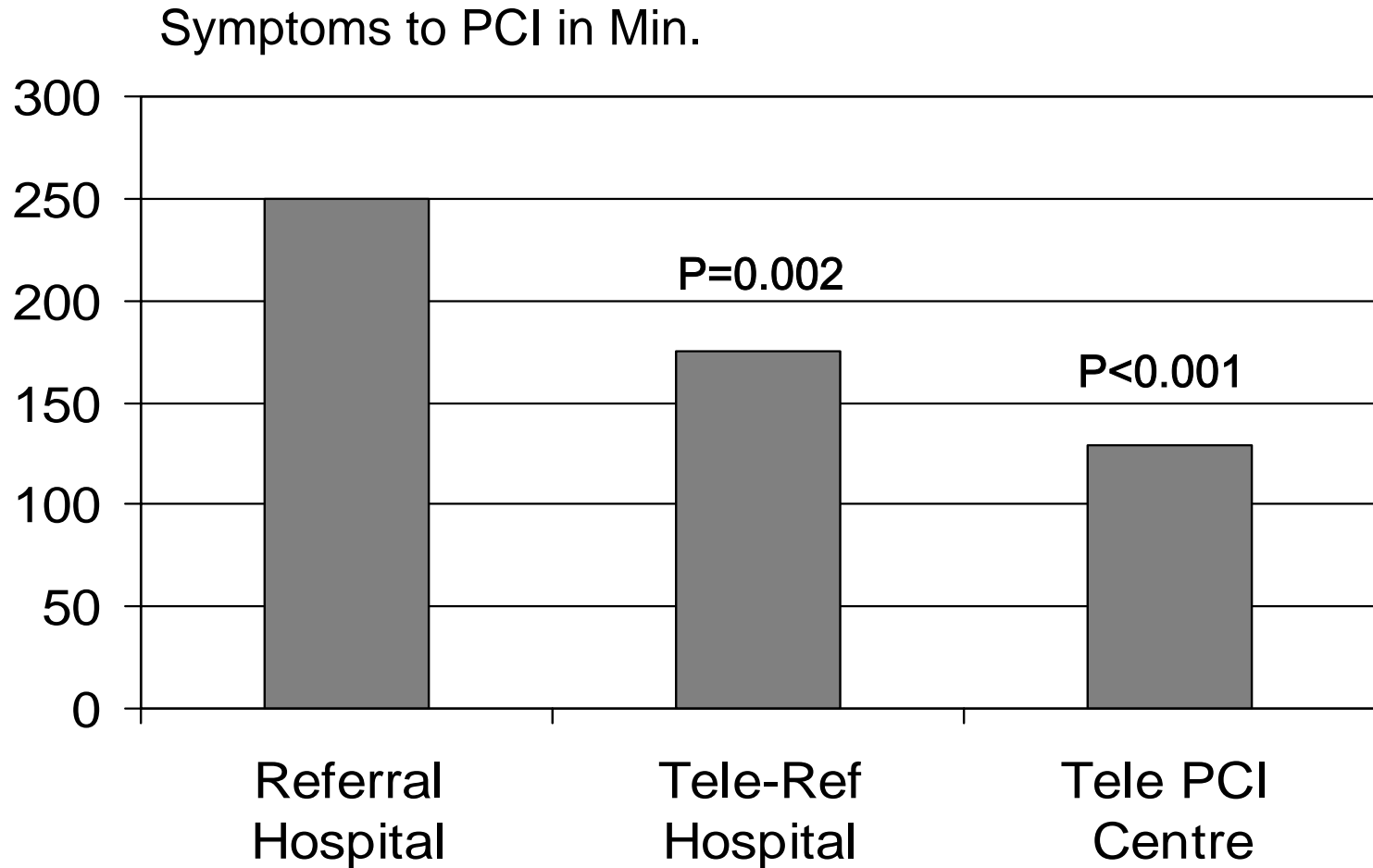
Predictors in multiple regression analysis:

	OR	p
Dull pain	2.12 (1.11-4.04)	0.023
Contacted GP	2.81 (1.53-5.15)	0.001
Contacted ES	0.45 (0.26-0.80)	0.007

ES=emergency service

Johansson Heart and Lung 2004

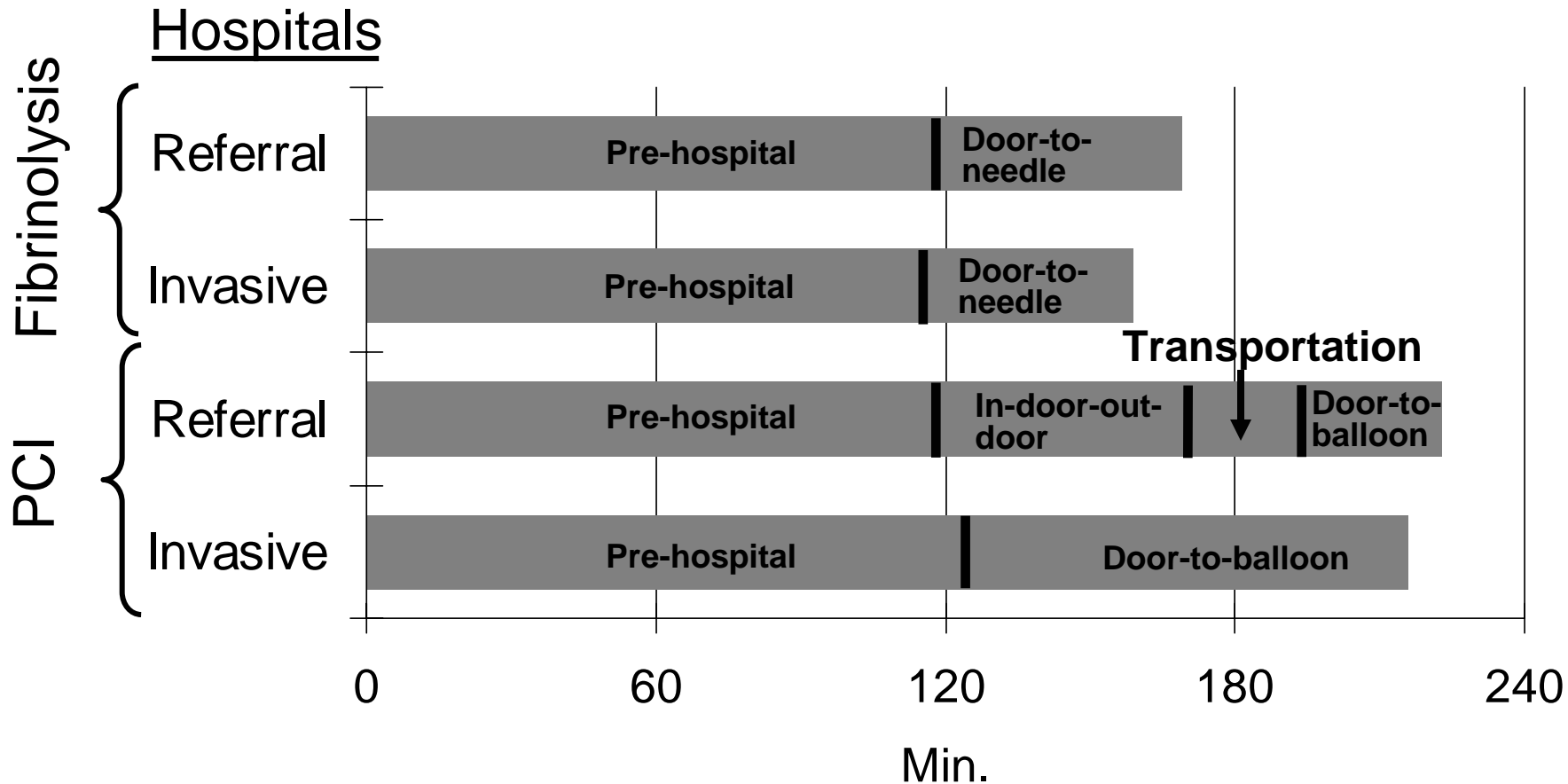
Importance of Pre-Hospital STEMI-Diagnosis

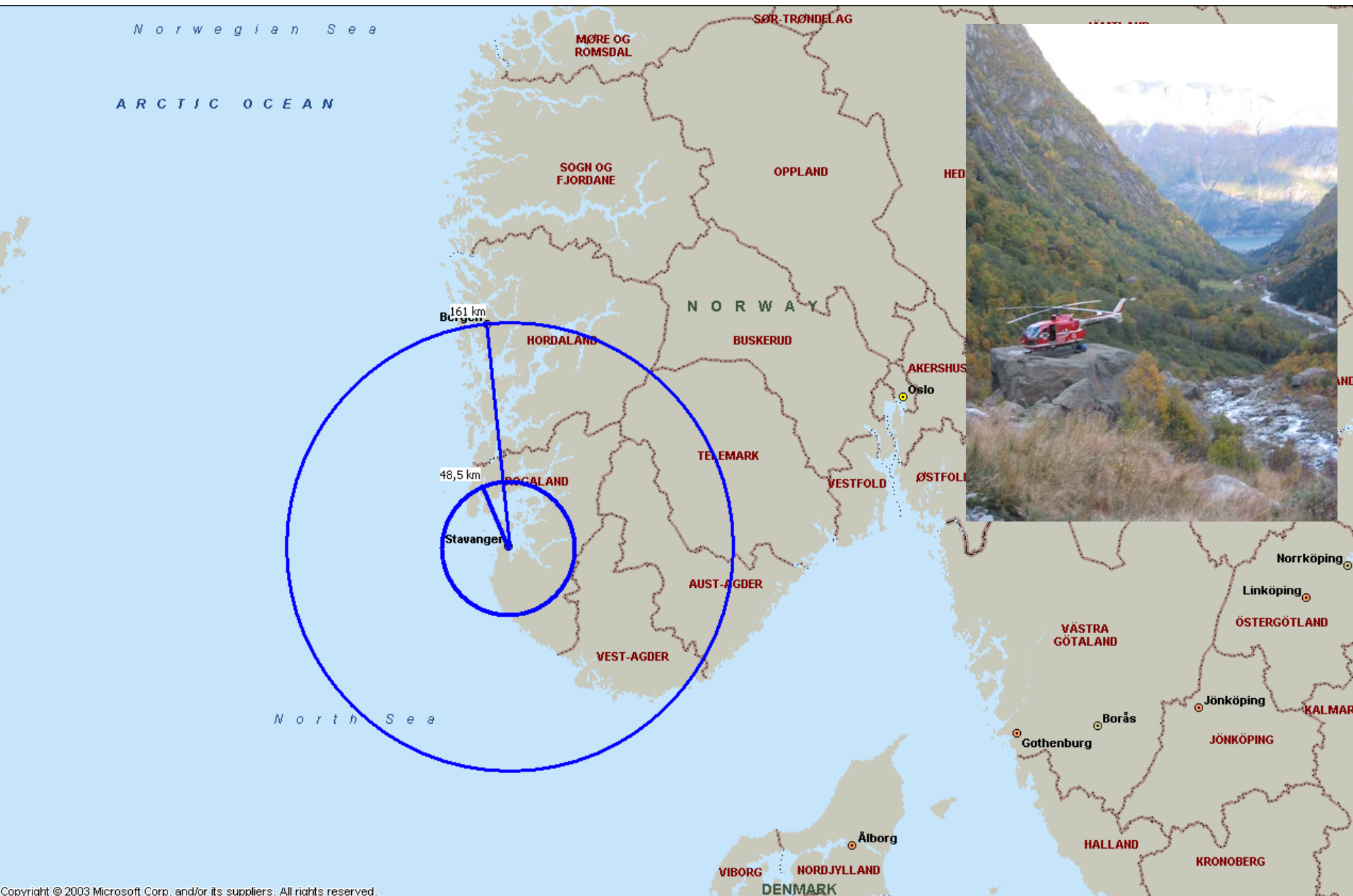


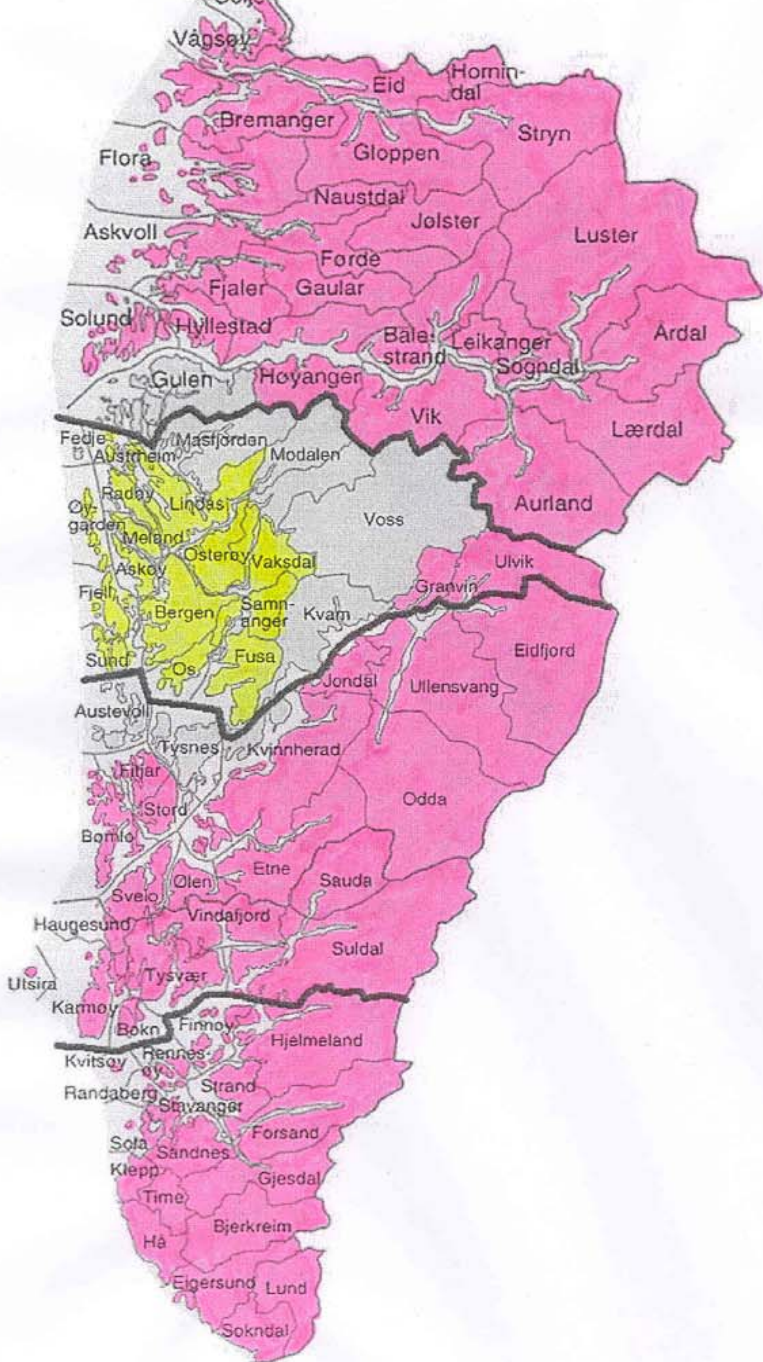
Terkelsen CJ et al. Eur Heart J 2005

DANAMI - 2

Time from onset of symptoms to treatment
(1,572 patients)







**Regional PCI center only
Not helicopter weather**

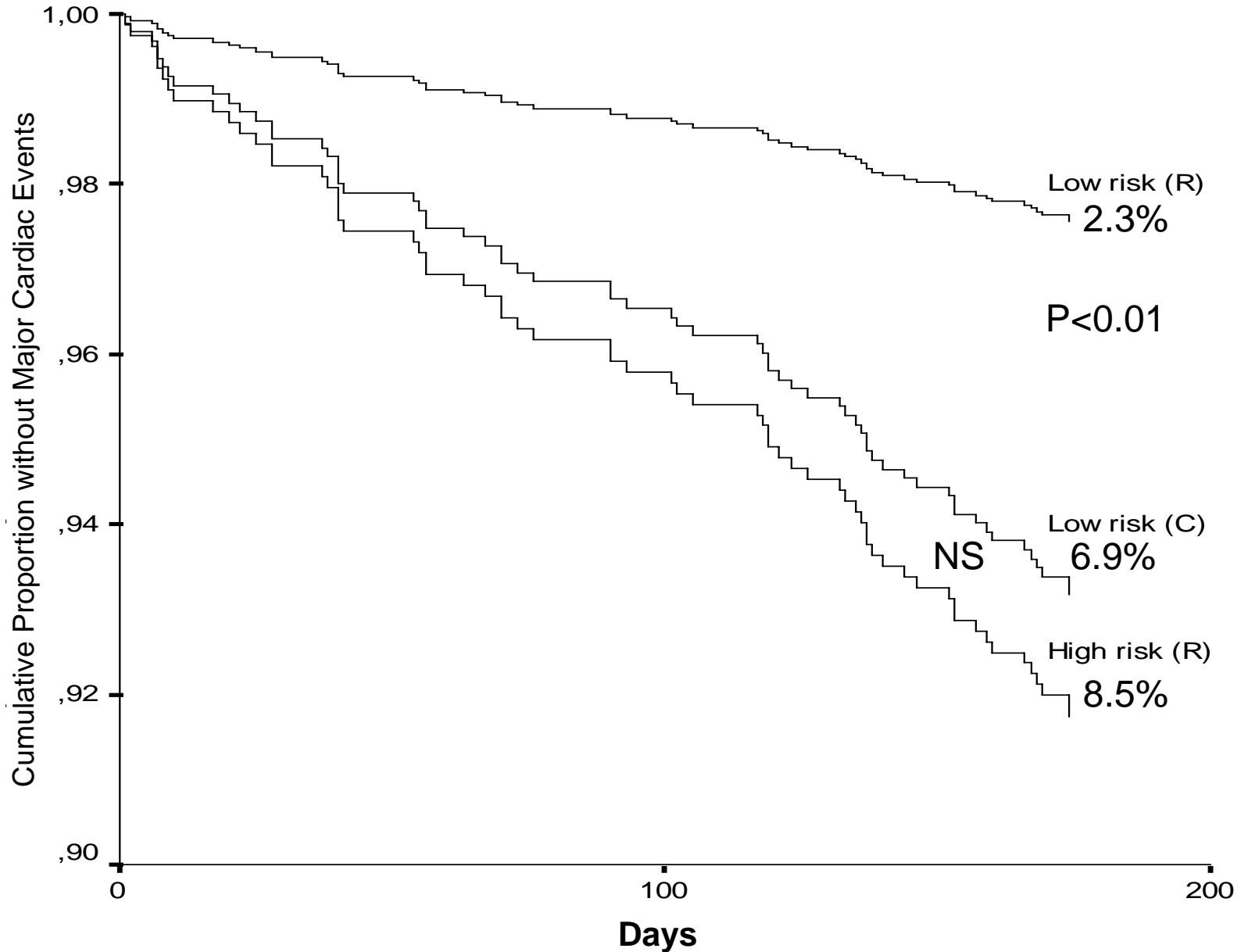
Time between PCI or T	Therapy decision
Green: <90 min	Primary PCI
Red: >120 min	Thrombolysis
Grey: 90-120 min	Circumstantial

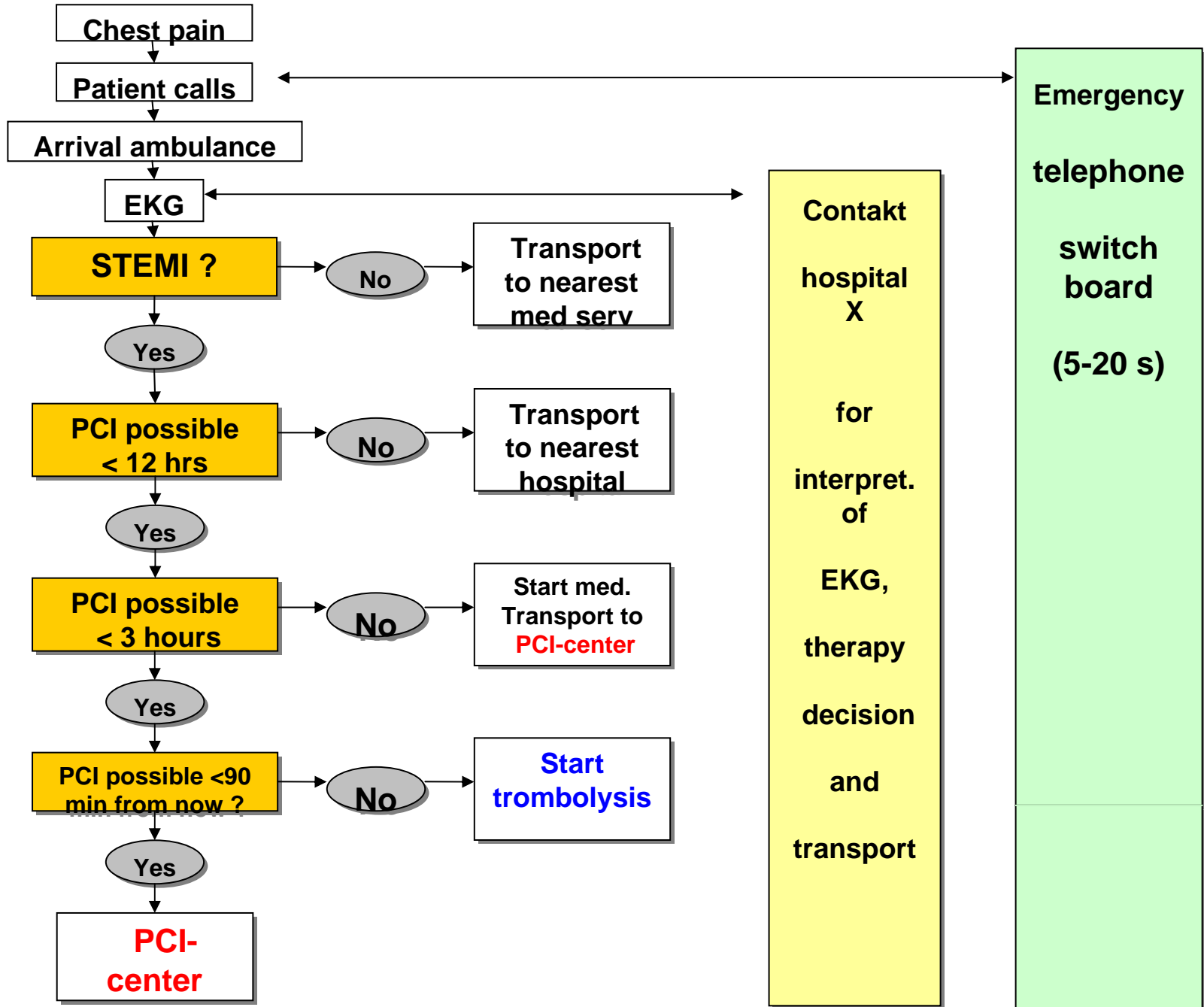
Clinical outcome measures at 6 months follow-up

	Regional hospital (n = 299)		Community hospital (n = 304)		P value	All low risk patients (n = 603)		High-risk patients (n = 459)		P value
	n	%	n	%		n	%	n	%	
Death	0	0	1(1 *)	0.3	0.32	1(1*)	0.2	5(3*)	1.1	0.047
Myocardial infarction	3	1.0	3	1.0	0.99	6	1.0	7	1.5	0.44
Readmission with unstable angina	7	2.3	12	3.9	0.26	19	3.2	19	4.1	0.39
Repeat angiography without PCI	8	2.7	15	4.9	0.15	23	3.8	18	3.9	0.93
Repeat PCI	5	1.7	17	5.6	0.01	21	3.8	21	4.6	0.54
CABG after PCI	1	0.3	2	0.7	0.57	3	0.5	6	1.3	0.15

Am Heart J 2006. In press.

Cumulative event rate





Chest pain

Patient calls

Arrival ambulance

EKG

STEMI ?

No

Transport to nearest med serv

Yes

PCI possible < 12 hrs

No

Transport to nearest hospital

Yes

PCI possible < 3 hours

No

Start med. Transport to PCI-center

Yes

PCI possible < 90 min from now ?

No

Start trombolysis

Yes

PCI-center

Emergency telephone switch board

(5-20 s)

Contact hospital X

for interpret. of

EKG, therapy decision

and transport

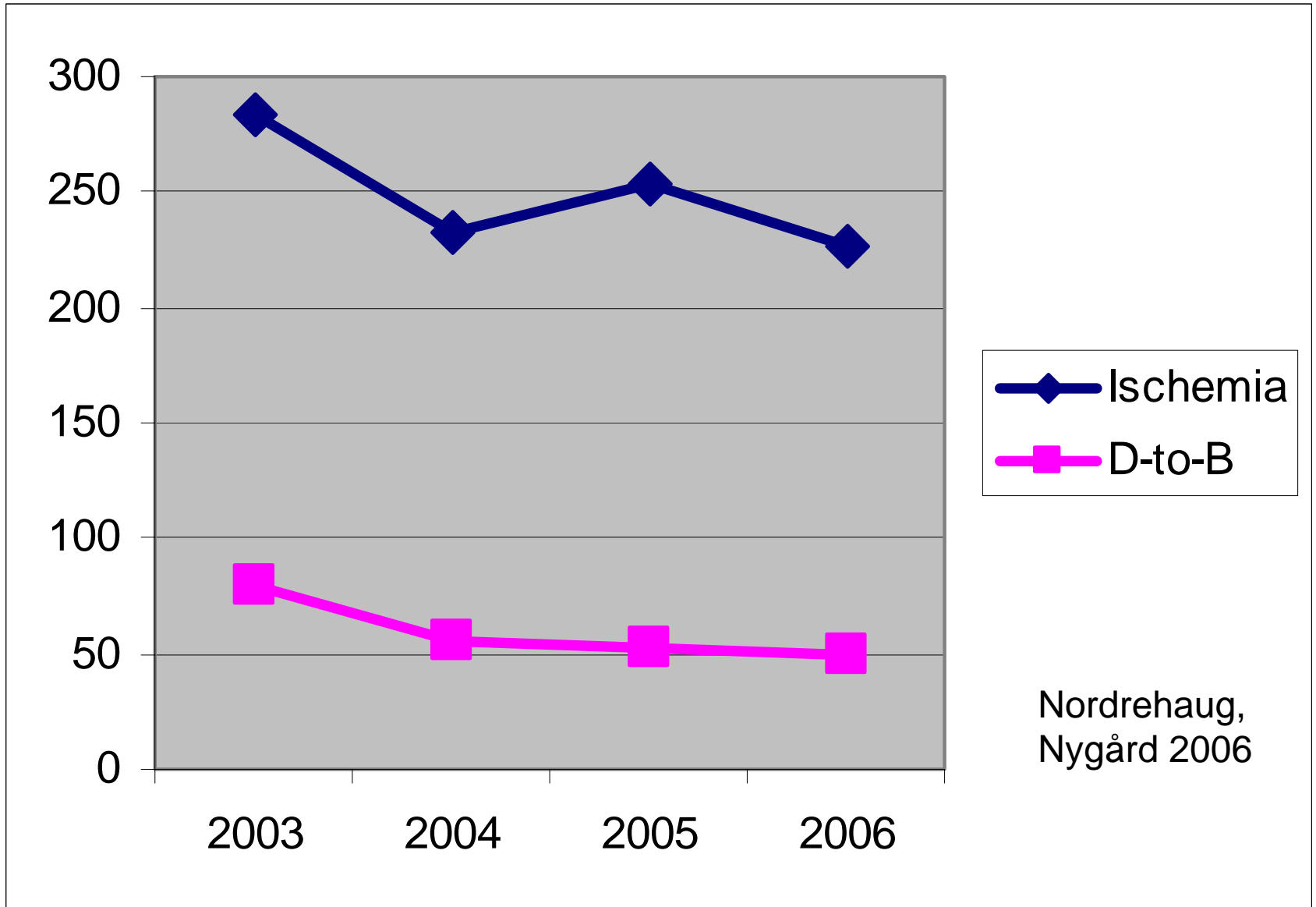


Western Norway – use of 113 for acute chest pain

- Patient/relative/GP on call calls 113: 60%
- Admitted via own GP (113): 15%
- Other 25%

- No media- or public chest pain education campaigns in the region, however GPs and patients are aware that the ambulance or helicopter may provide a diagnosis and treatment

Total ischemia time and door to balloon



Time Delays in Central Copenhagen and Western Norway

	Copenhagen	West Norway (helicopter)
Symptom to 112/113	50 (1-115)	70
112 to MD-Ambulance Arrival	7 (3-12)	30
Ambulance Arrival to ECG	9 (1-18)	17
ECG to Departure	9 (2-22)	
Departure to Arrival Rigshospitalet	10 (2-15)	38
Total: Symptom to Arrival at Rigshospitalet	85	155

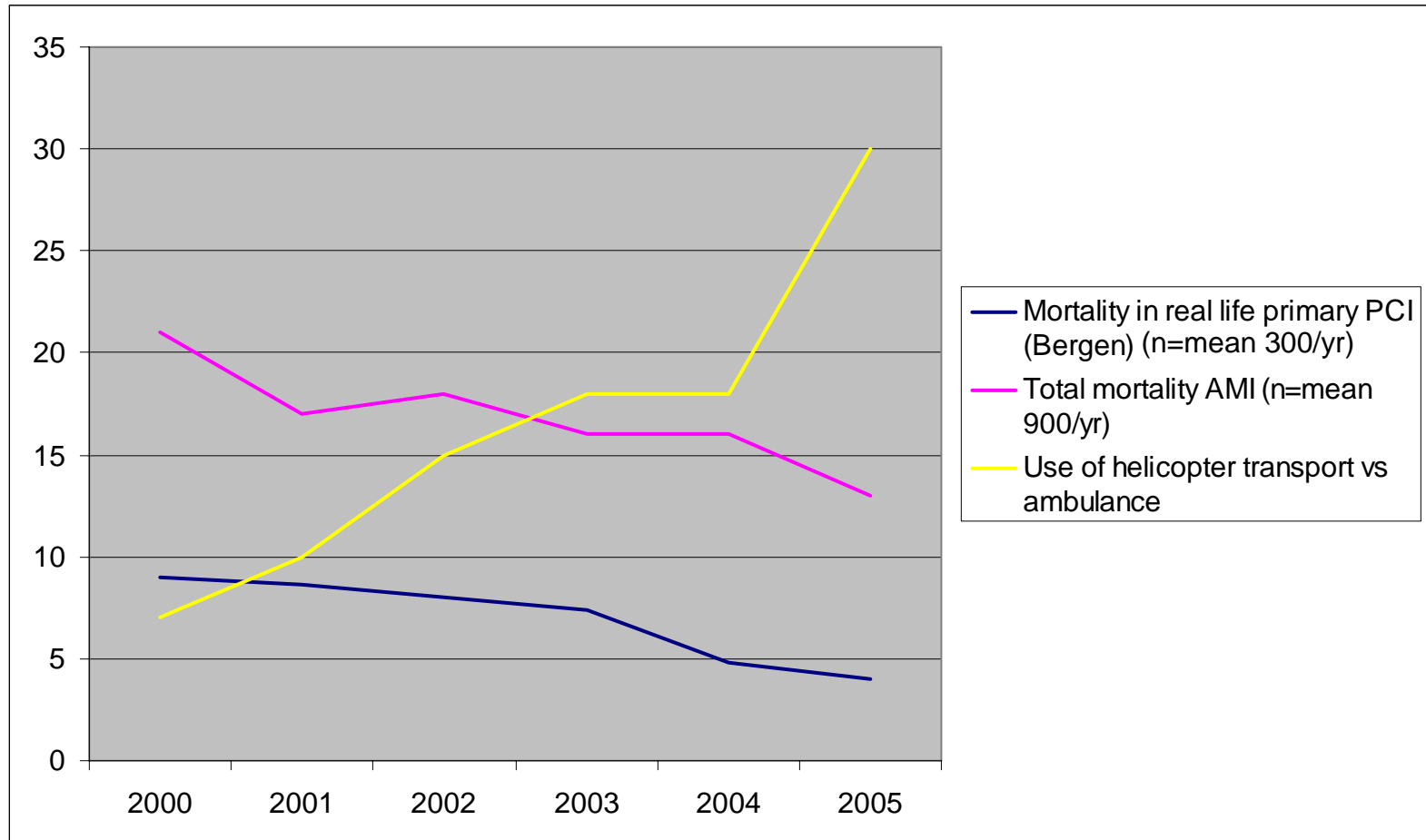
N=136/24; Figures are minutes (range)

Sillesen et al.

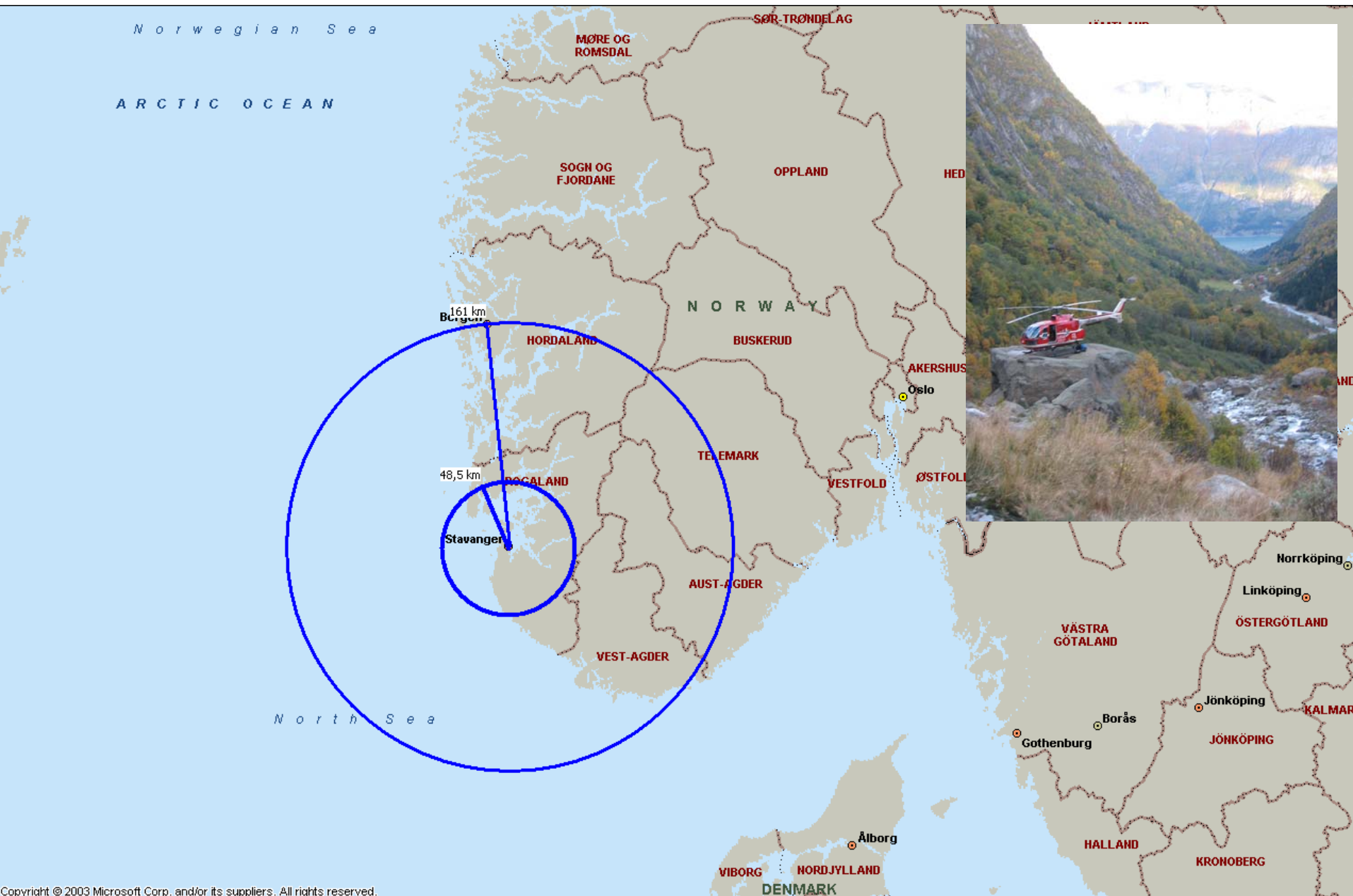
www.escardio.org

Mortality at 30 days

% total AMI mortality, primary PCI mortality, and % helicopter transport

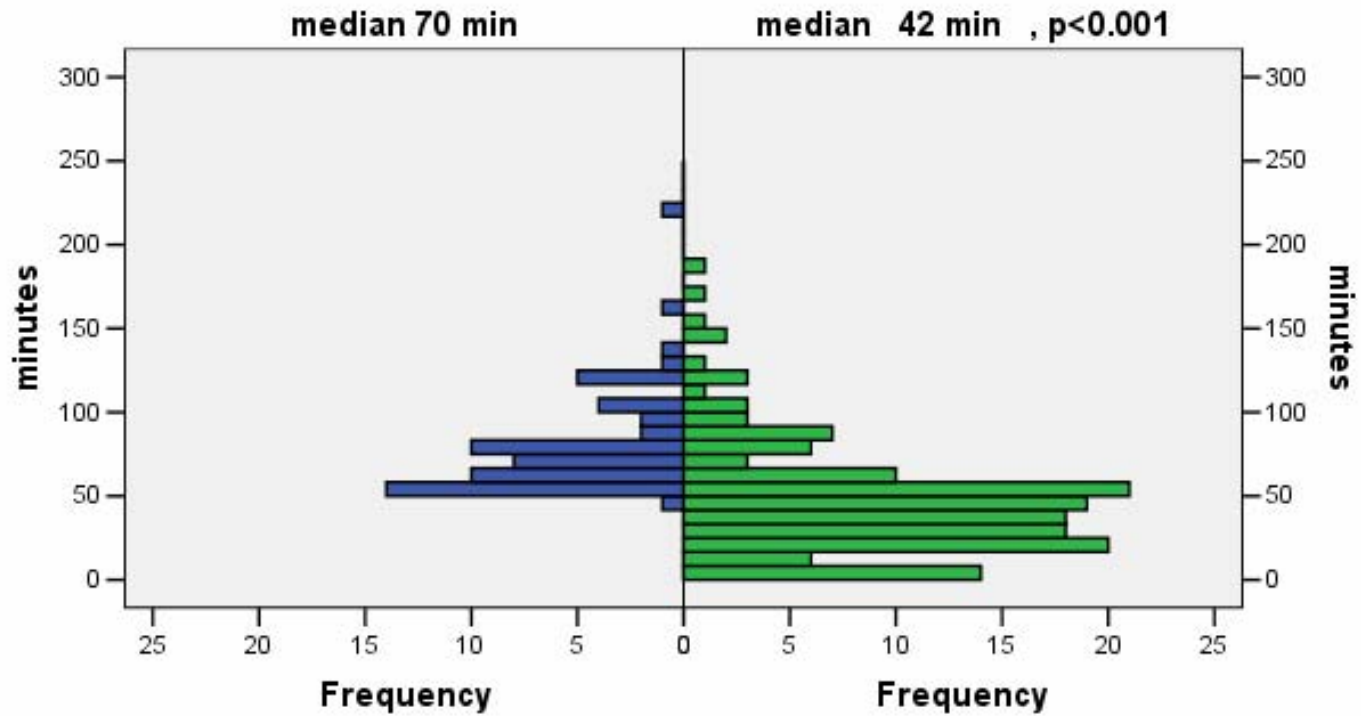


Nygård O, Nordrehaug JE



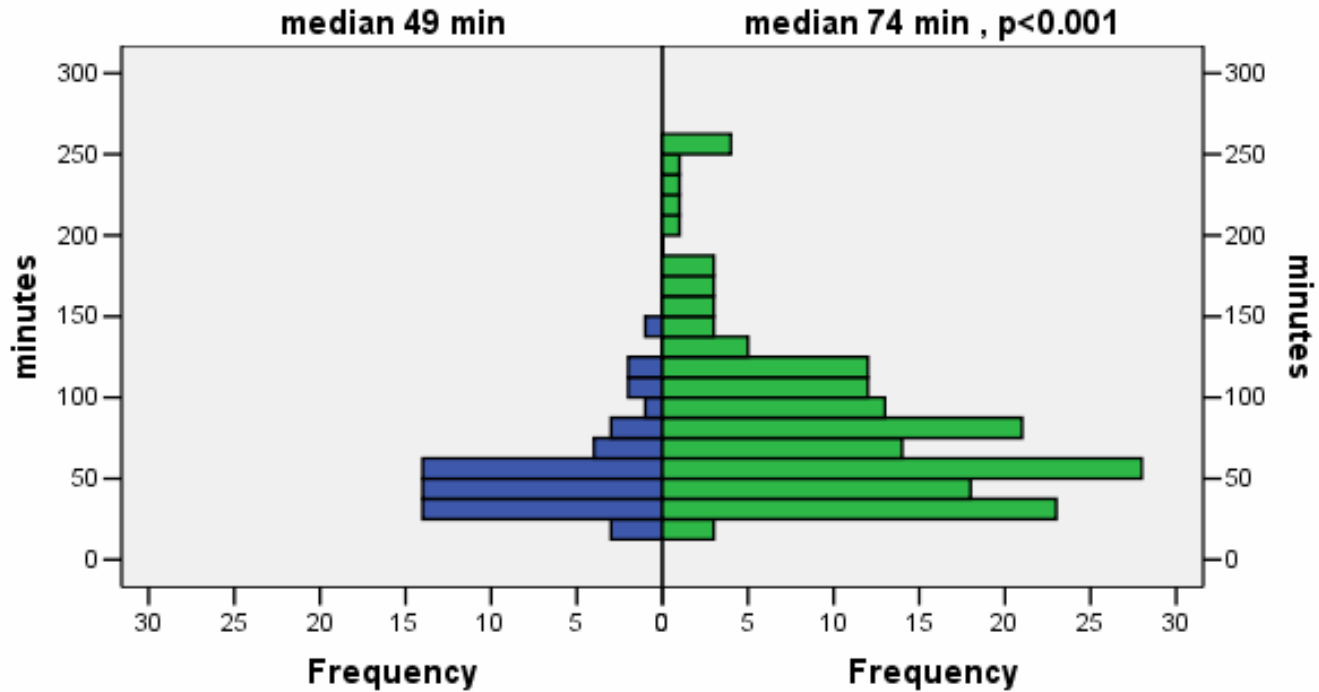
First contact to arrival

transferred vs non-transferred

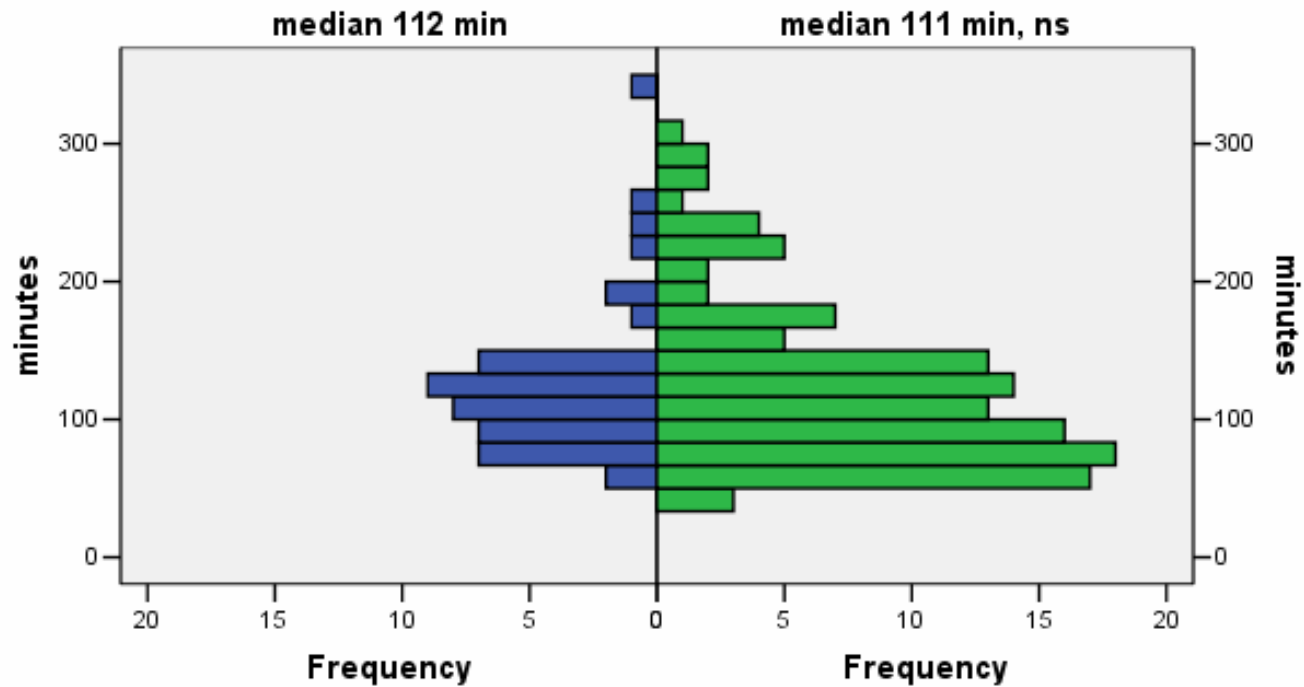


DOOR TO BALLOON

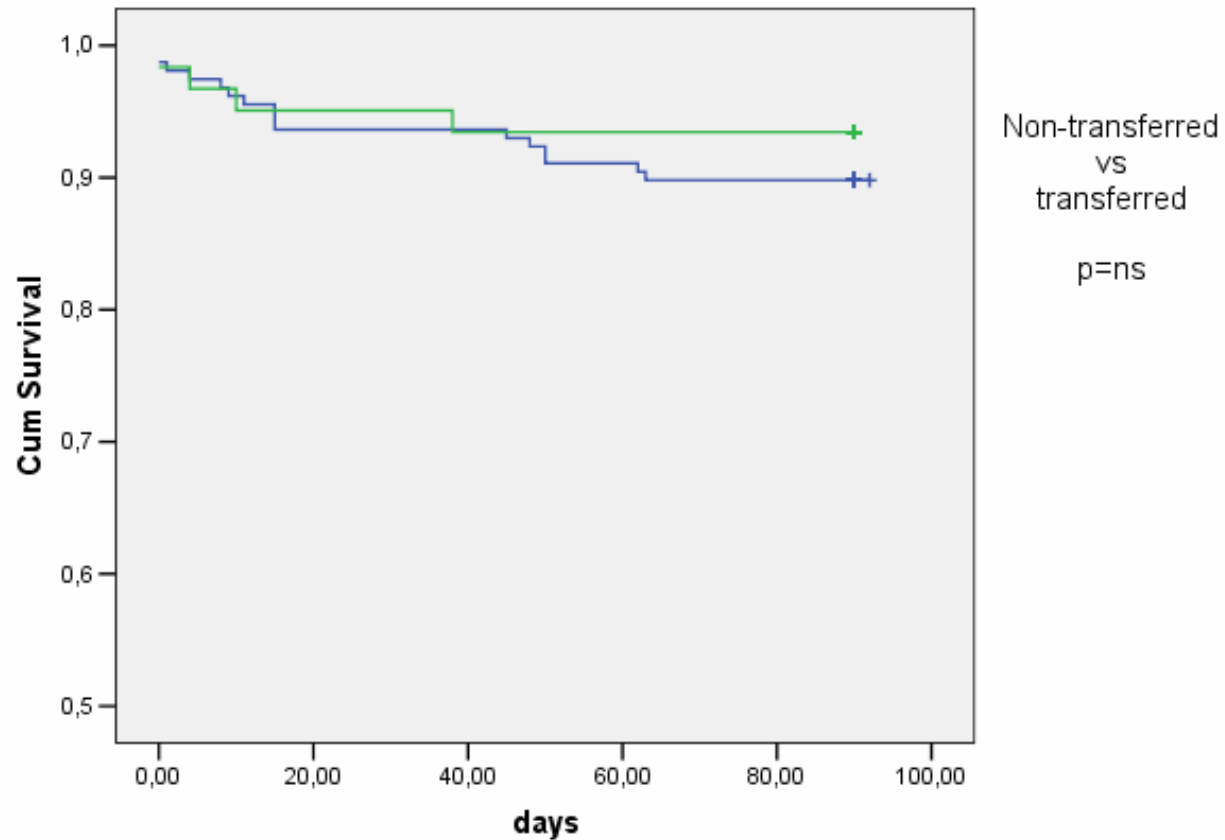
tranferred vs non-transferred



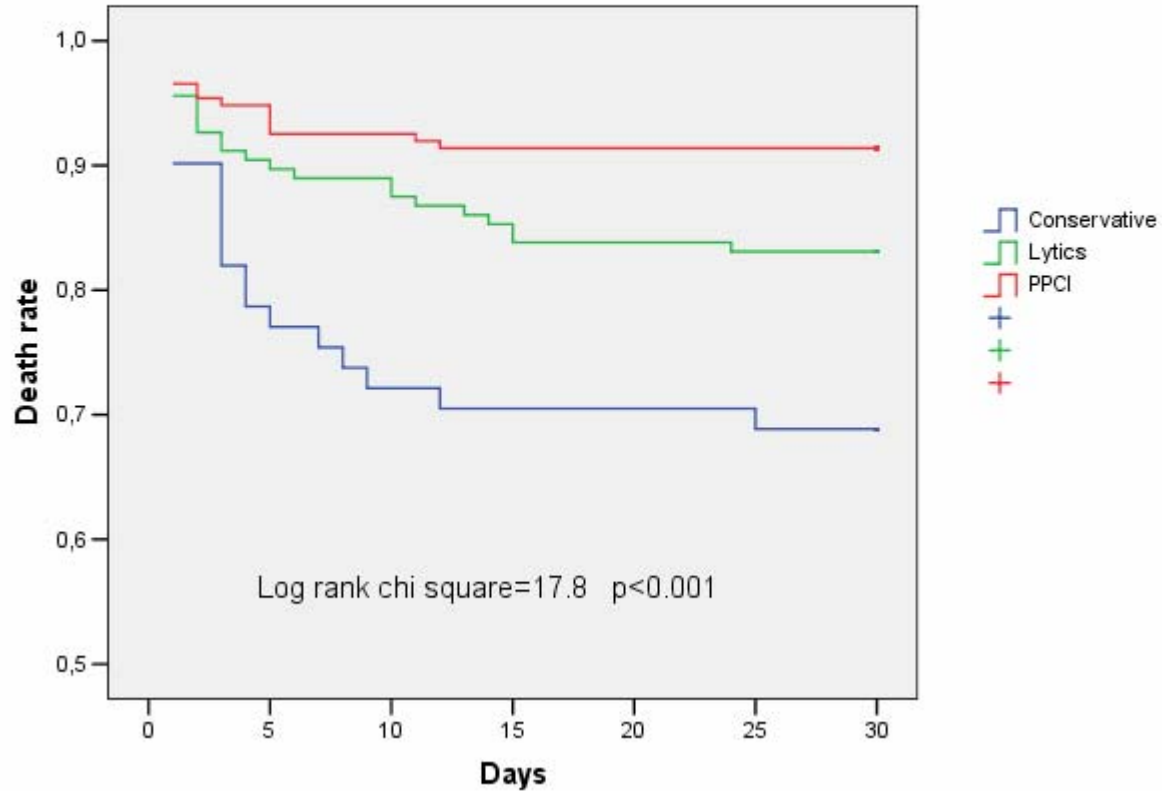
**First contact to balloon
transferred vs non-transferred**



K-M: MACE at 90 days follow-up:



K-M plot: Survival at 30 days follow-up according to revascularisation.



Cost analysis PCI vs thrombolysis in AMI

- Simulation model: complete lifelong follow-up of both treatment groups until all patients are dead
- For a 65 yr old man life expectancy was 8.3 yrs vs 7.6 (PCI vs lytic)
- Lifetime cost was 20.000 vs 30.000 Euro, helicopter 24.000 vs 30.000
- PCI was the dominant strategy with lower cost and superior health benefit

Conclusions

- Efficient networks using emergency centrals, ambulances and helicopters make primary PCI available to large groups of patients with STEMI in rural areas, within acceptable ischemia times
- Prehospital transmission of EKG is feasible and reduces treatment delay times for patients with STEMI in rural areas

Conclusions

- PCI carries less cost and higher health benefit than thrombolysis even if helicopter transport is used, but helicopter transport confers some time delay before the cost effect is seen
- The establishment of new PCI centers without surgical back-up may be a necessary and useful part of STEMI organisation in rural areas