Quality of CPR. How important?

Berzelius symposium on ”Prehospital Care”

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Conflicts of interest: member Board of Governors
Laerdal Medical and Norwegian Air Ambulance

UNIVERSITY OF OSLO

ULLEVÅL University Hospital

STIFTELSEN NORSK LUFTAMBULANSE

F. Maas in Göttingen said it all in 1892:

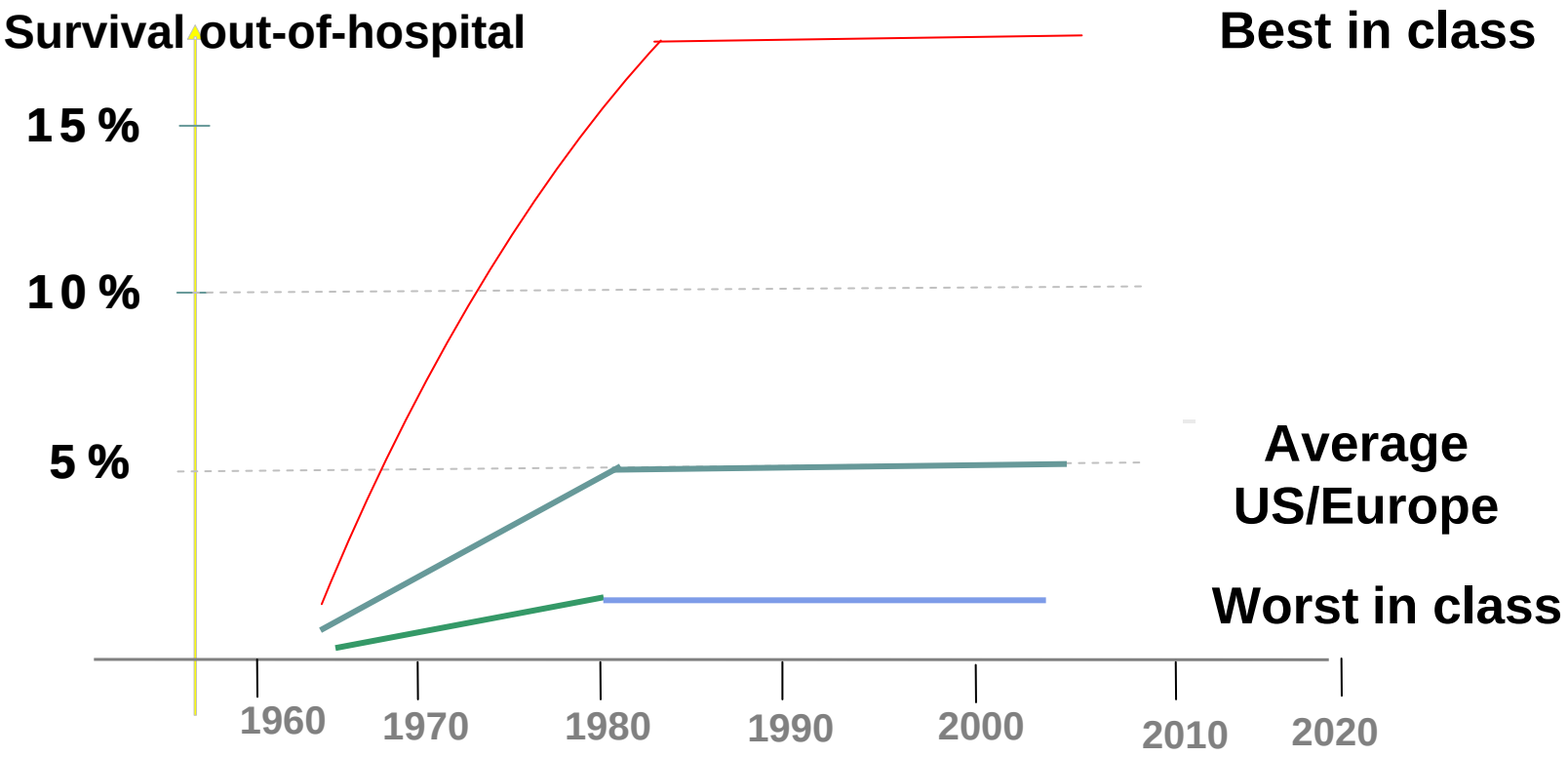
”One… presses *deep* in the heart region with *strong* movements at a frequency of 120 or more a minute. The effectiveness of the efforts is recognised from the artificially produced carotid pulse and the constriction of the pupils”

”In order to …ensure that the air passage remains open, someone stands at the head of the patient. As long as the condition has not essentially improved, it is expedient to *make as few and short pauses as possible*”

Berlin Klin Wochenschr 1892

Survival from sudden cardiac arrest

- did not improve between 1980 and 2000
- varied greatly between systems



Why? More defibrillators, more knowledge, drugs, gadgets etc…

We had underestimated importance of

1. Quality

always important

Food Wine Cars Surgeons ……






"Keep things simple!"

CPR performance decreases with increasing complexity

Rittenberger et al Resuscitation 2005

"The unintended consequences of the complex algorithms are too many interruptions in chest compressions, too many rescue breaths, not enough compressions - - and not enough survivors"

Sanders and Ewy, JAMA editorial 2005

Quality of bystander CPR

relatively poor, particularly ventilation

- They require mean 10-16 sec for two ventilations

  Chamberlain D et al. Resuscitation 2001

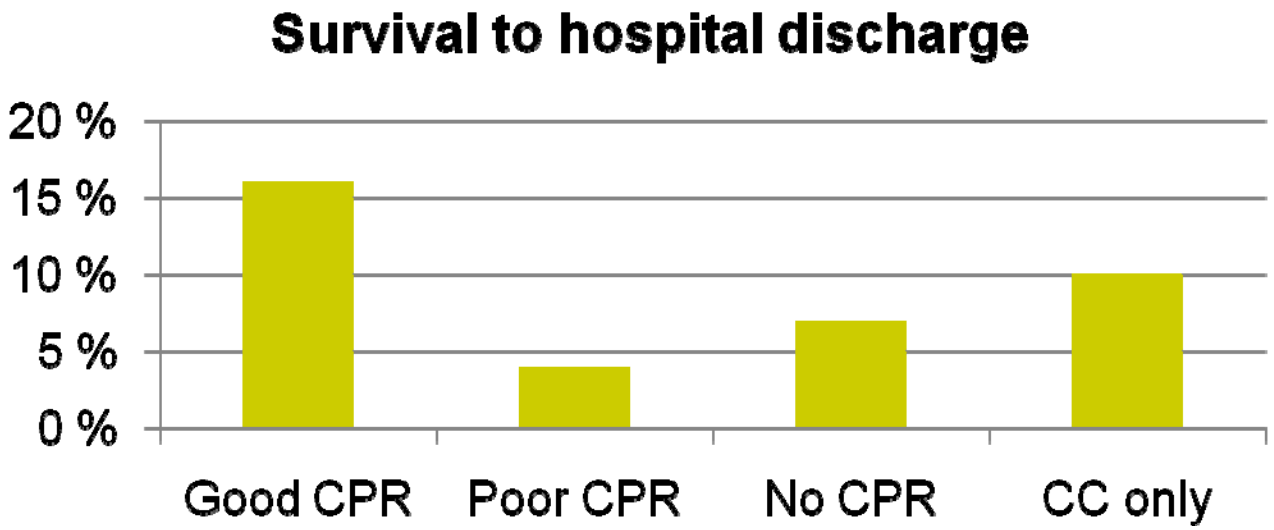
  Odegaard S et al Resuscitation 2006

  - With 2:15 ratio only 40 % time for compressions
  - In addition coronary perfusion pressure and coronary/cerebral blood flow increases gradually with sequential compressions Berg R et al. Circulation 2001

- They fill the stomach with air during m-t-m ventilation with regurgitation in 39 % (50/127) Virkkunen I et al J Int Med 2006

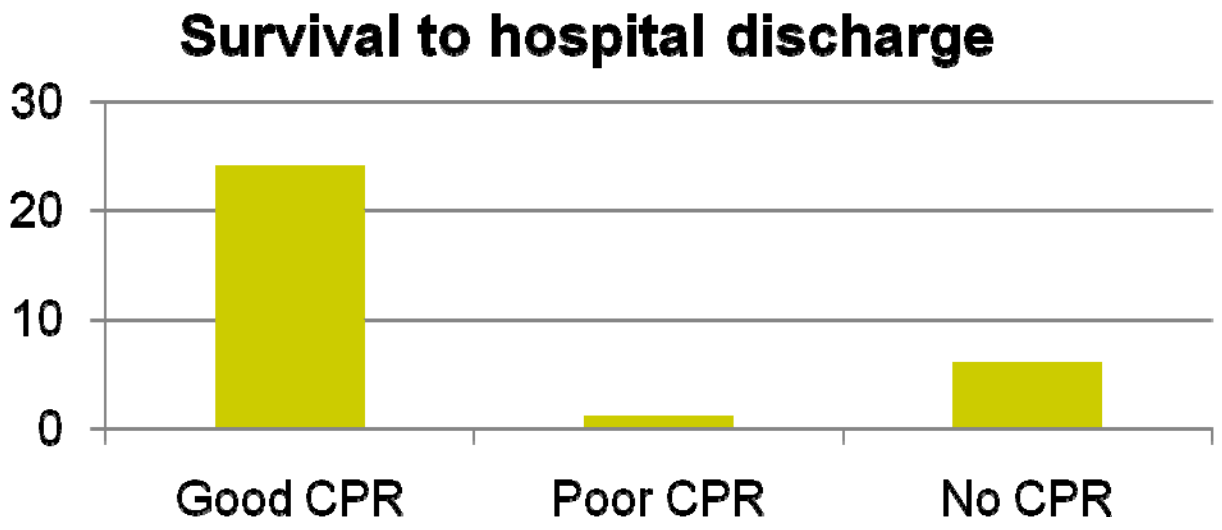
- Therefore 30:2 compression/ventilation ratio in Guidelines 2005

Quality of bystander CPR affects survival by factor of 4



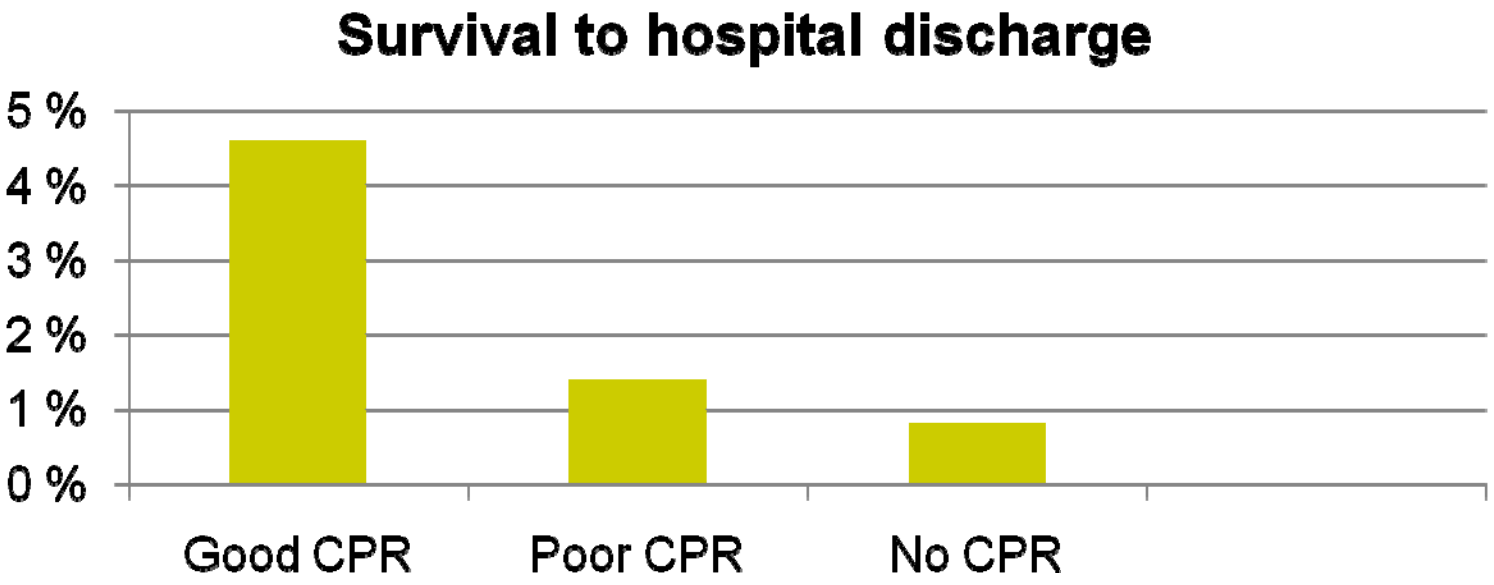
Van Hoeyweghen et al Resuscitation 1993

Quality of bystander CPR affects survival by factor of 4



Wik L et al Resuscitation 1994

Quality of bystander CPR affects survival by factor of 4



Gallagher EJ et al JAMA 1995

Wik et al JAMA 2005

Quality of CPR evaluated via defibrillator

176 out-of-hospital patients in Norway, Sweden and UK

in-hospital Abella et al JAMA 2005

Ventilations measured via transthoracic impedance via standard defib electrodes

Compressions measured via extra chest pad with accellerometer.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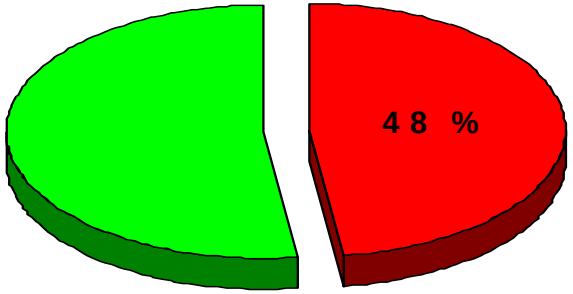
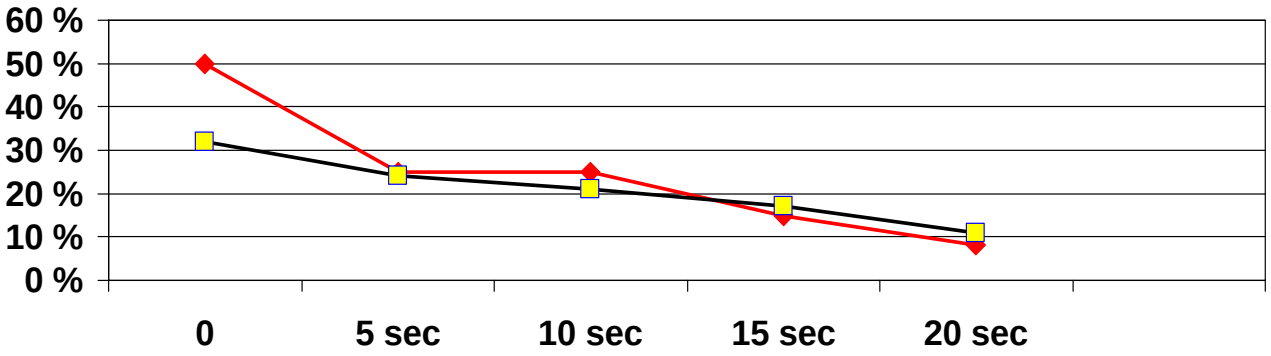
Wik et al JAMA 2005
Eftestol T et al. Circulation 2002 and 2004

Professionals: No CPR 48 % of the time (95%CI 45-51)

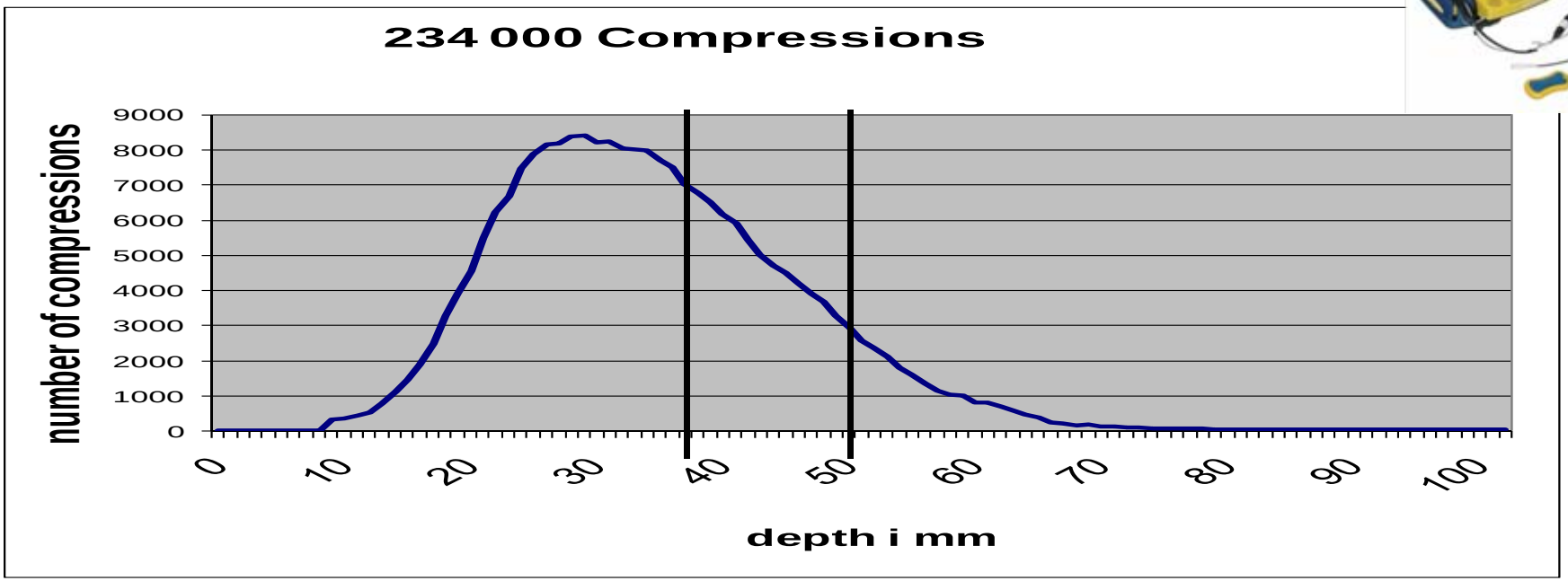


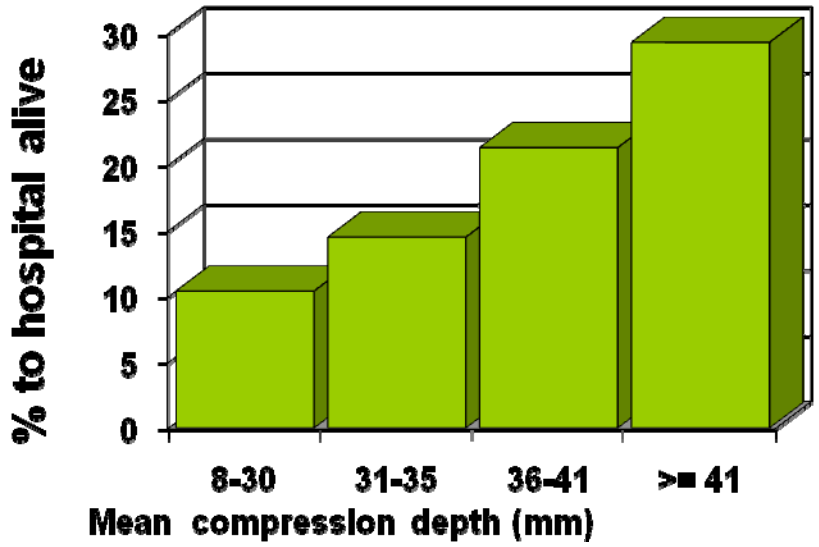
Probability of ROSC decreases during CPR pauses



Probability of ROSC increases during 3 min CPR

Wik et al JAMA 2005
Edelsson et al Resuscitation 2006





CPR Factors

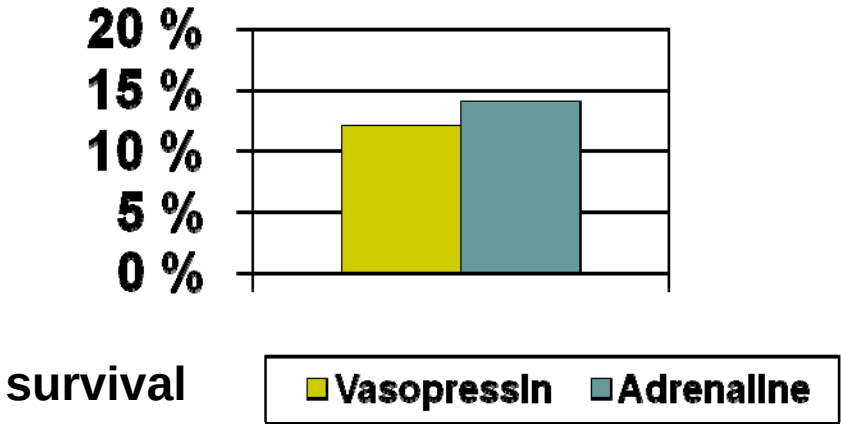
- which improve outcome in experimental animal studies or pilot human studies
- usually fail in randomized, controlled trials

(vasopressine, thrombolysis, anti-arrythmica)

Can poor quality of CPR explain failure of vasopressin clinically?

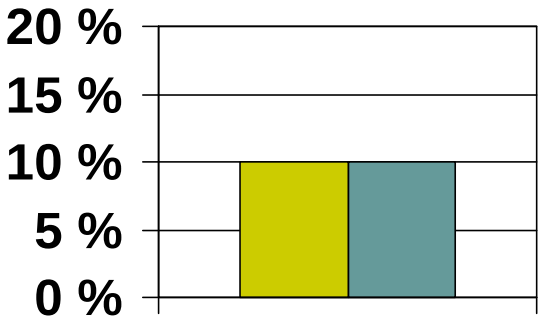
In-hospital 200 patients

Stiell et al Lancet 2001

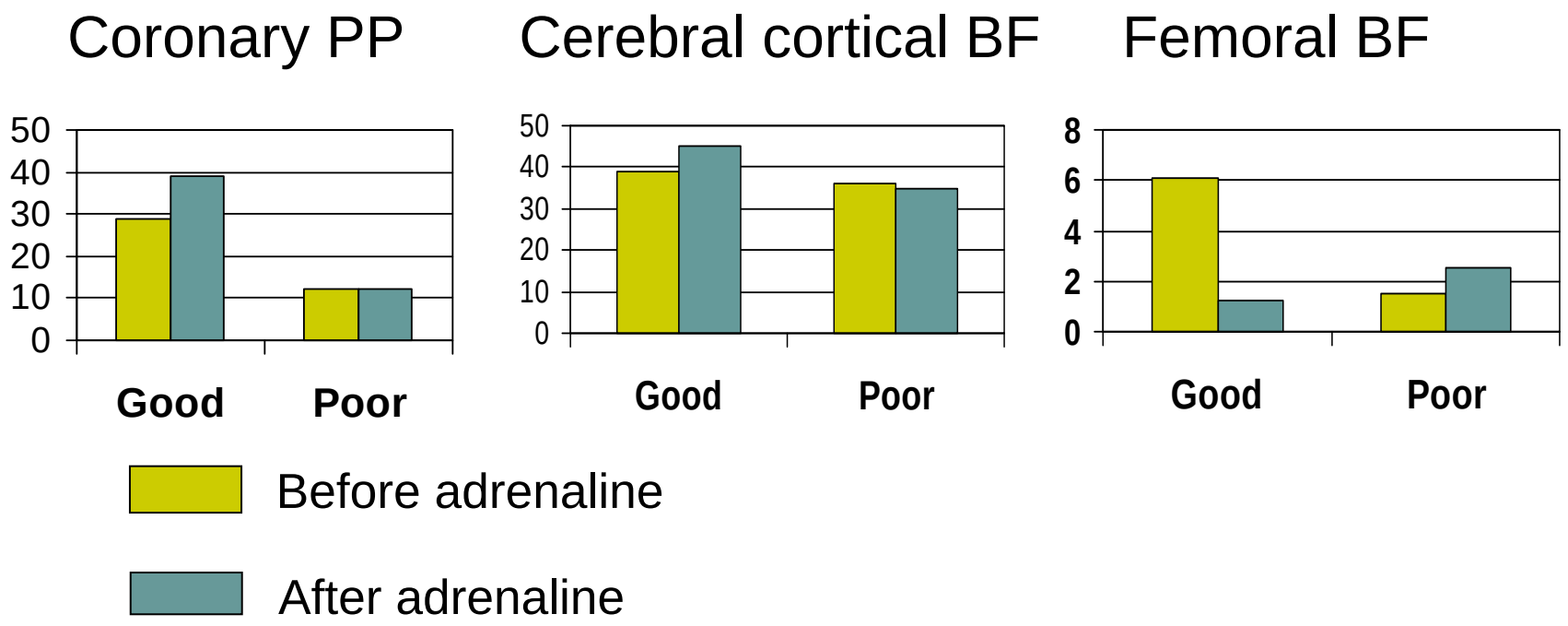


Out-of-hospital 1186 patients

Wentzel et al NEnglJMed 2004



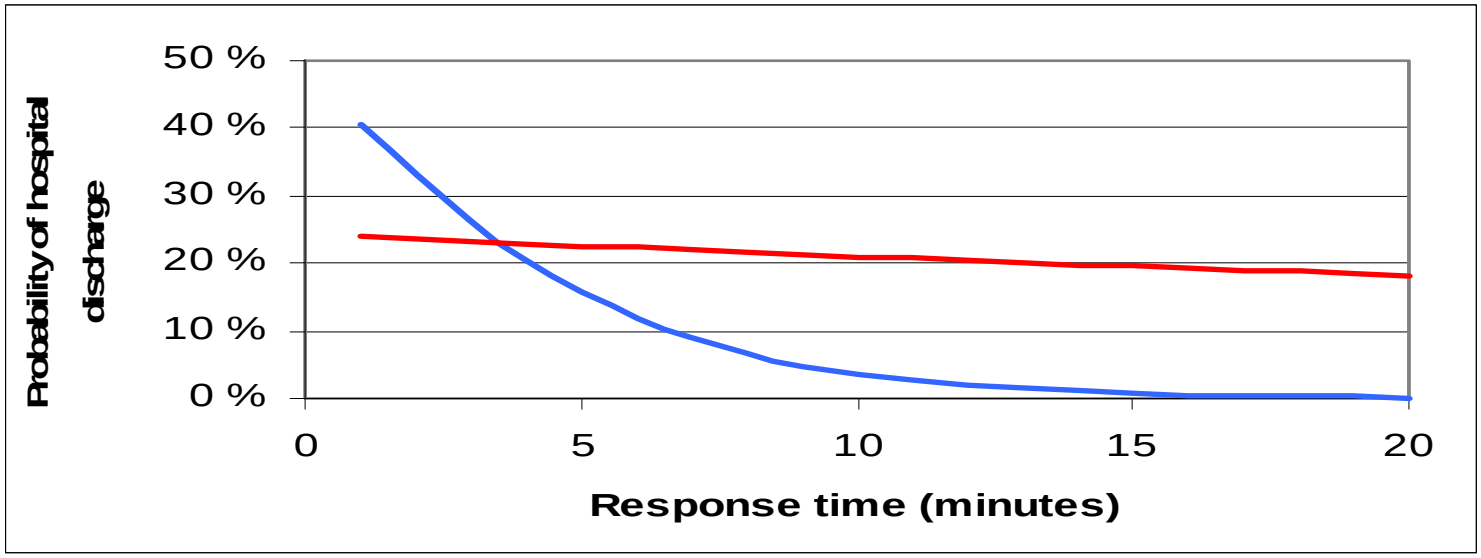
Circulatory effects of adrenaline during good "lab-quality" vs. poor "clinical quality" CPR



Wik et al JAMA 1999

Increased survival with CPR before defibrillation for >4-5 minutes ambulance response times

Seattle and Oslo experience Cobb et al and Wik et al JAMA



CPR first

Defib first

Australian experience *Jacobs et al Emerg Med Austr 2005*

	CPR first	Immediate defib
ROSC	9 %	8 %
Discharged alive	4 %	5 %

Problems: No control of CPR quality
5:1 compression:ventilation ratio
Very low ROSC rates!

My speculative conclusion:
Poor quality CPR does not improve outcome
Needed:Monitoring/reporting of CPR quality in all research!

Manual vs. mechanical chest compressions
The Autopulse studies

Ong et al, Richmond,VA, JAMA 2006

- First responder, mean 4.5 min
- Ambulance response 6.3 min
- VF/VT initial rhythm 21 %
- Bystander CPR 31 %

Hallstrom et al, Seattle +, JAMA 2006

- First responder, mean 5.7 min (5 min)
- Ambulance response 6.8 min (8.5)
- VF/VT initial rhythm 31 % (32 %)
- Bystander CPR 34 %

Survival to hosp discharge

- **Manual CPR 2.9 %**
- **Autopulse 9.7 %**

Survival to hosp discharge

- **Manual CPR 9.9 % (Seattle 26 %)**
- **Autopulse 5.8 % (Seattle 11%)**

Manual vs. mechanical chest compressions The Autopulse studies

Survival to hospital discharge for the two studies combined:

- Manual 5.9 %. Autopulse 7.4 %. No sign.diff.

No report on quality of CPR

- Quality must be registered and reported in all prospective clinical studies of CPR
- Implementation of study protocol and quality of CPR should ideally be studied during simulation in the EMS services before study initiation

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1. Deep, strong continuous chest compressions with minimal pauses
2. Monitor CPR quality
3. If continuous chest compressions without active ventilation, keep airways open

Quality of CPR monitored by defibrillator can be used for:

- Direct on-line feedback to rescuers
- Off-line feedback to rescuers during debriefing
- Monitoring as part of continuous quality improvement
- In multifactorial analysis of clinical research projects