

ORIGINAL ARTICLE

# CPR with Chest Compression Alone or with Rescue Breathing

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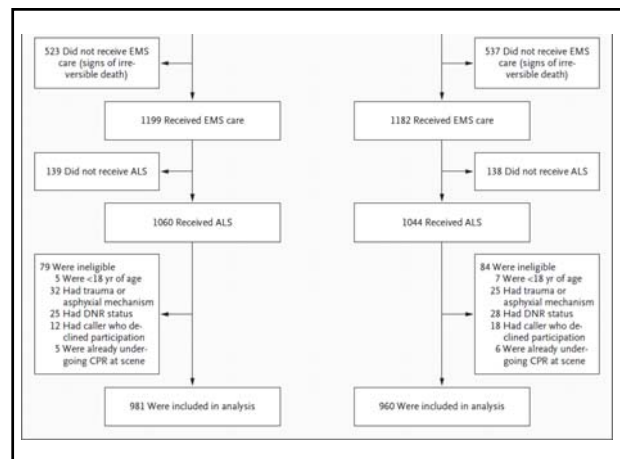
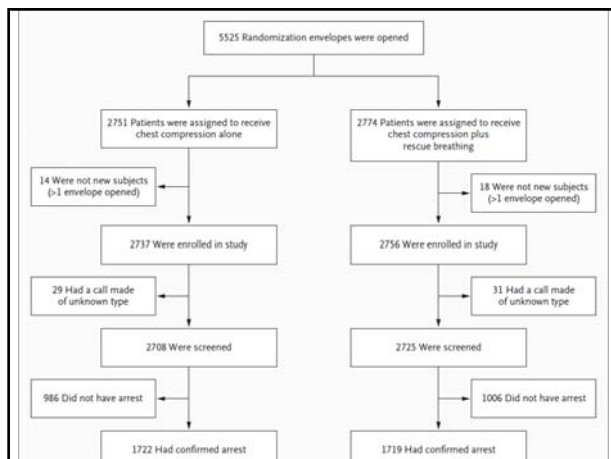
## Introduction

- Out-of-hospital cardiac arrest : hundreds of thousands of lives each year worldwide.
- Successful resuscitation
  - early arrest recognition,
  - early cardiopulmonary resuscitation (CPR),
  - early defibrillation,
  - expert advanced life support, and
  - timely postresuscitation care

- CPR that focuses on chest compressions and rescue breathing ↓ ???
  - 1.路人可否接受人工呼吸?
  - 2.compression alone → circulation increased, but oxygenation 的影響?
  - 3.Animal study:  
Cardiac cause: Improved survival with compression alone  
Respiratory cause: Better result with compression+ breathing
- Weather compression alone or standard CPR is better?

## Methods

- The Dispatcher-Assisted Resuscitation Trial (DART): a randomized trial of dispatcher-assisted CPR instruction.
- King County EMS, (2004/6/1~2009/4/15), Thurston County EMS(2005/6/1~2009/4/15) in Washington State : AHA guidelines, London Ambulance Service(2005/1/1~2008/3/15) (in England): the United Kingdom Resuscitation Council Guidelines participated in the trial.



## Intervention

- 選定的病人,經由一個信封裡面有指示為 Compression alone(50下/一循環)或是 compression+ breathing(15:2)讓急救人員用電話指示路人執行
- 路人執行一循環後,評估病人 signs of life 可行,則繼續

## Outcome

- primary outcome: survival to hospital discharge.
- Secondary outcomes were a return of spontaneous circulation at the end of EMS care and a favorable neurologic status at the time of hospital discharge, defined as a Cerebral Performance Category (CPC) of 1 or 2.

Table 1. Characteristics of the Patients According to Dispatcher's CPR Instructions.<sup>a</sup>

Characteristic	Chest Compression Alone (N=981)	Chest Compression plus Rescue Breathing (N=960)	P Value
Site — no. of patients (%)			0.26
King County	588 (59.9)	552 (57.5)	
London	328 (33.4)	327 (34.1)	
Thurston County	65 (6.6)	81 (8.4)	
Age — yr	61.4±16.5	63.9±16.3	0.46
Male sex — no. of patients (%)	659 (67.2)	613 (63.9)	0.12
Cause of arrest — no. of patients (%)			0.63
Cardiac	700 (71.4)	709 (73.9)	
Respiratory	75 (7.6)	59 (6.1)	
Overdose	74 (7.5)	59 (6.1)	
Neurologic	18 (1.8)	15 (1.6)	
Other	114 (11.6)	118 (12.3)	
Arrest witnessed — no. of patients (%)	418 (42.6)	437 (45.5)	0.23
Location — no. of patients (%)			0.34
Residential location	845 (86.1)	837 (87.2)	
Public location	94 (9.6)	86 (9.0)	
Nursing home	41 (4.2)	34 (3.5)	
Time to initial EMS response — min	6.5±2.8	6.7±3.1	0.18
Time to advanced support — min	9.8±6.0	10.0±6.2	0.46
Shockable rhythm — no. of patients (%)	319 (32.5)	304 (31.7)	0.69

## Results

- 5525 envelopes were opened. Of these patients, 1941 (35%) met the inclusion criteria.

Table 2. Progression of Bystander-Initiated CPR According to Dispatcher's Instructions.<sup>a</sup>

Further Step Taken in DART Instruction Protocol <sup>†</sup>	Chest Compression Alone (N=981)	Chest Compression plus Rescue Breathing (N=960)	Total (N=1941)
	number of patients (percent)		
Envelope opened, only preinstructions provided	143 (14.6)	127 (13.2)	270 (13.9)
Rescue-breathing instruction provided, but no rescue breathing performed	1 (0.1)	46 (4.8)	47 (2.4)
Rescue-breathing instruction provided, only rescue breathing performed	0	49 (5.1)	49 (2.5)
Compression instruction provided, but no compressions performed	30 (3.1)	24 (2.5)	54 (2.8)
Compression instruction provided, compressions performed	790 (80.5)	698 (72.7)	1488 (76.7)
Missing data	17 (1.7)	16 (1.7)	33 (1.7)

- Survival to Discharge**
  - 12.5% (chest compression alone) : 11.0%(CPR), P = 0.31
- Favorable neurologic status**
  - 14.4% (chest compression alone) : 11.5% for CPR, P = 0.13

Table 3. Outcomes.<sup>a</sup>

Outcome	All Sites			
	Chest Compression Alone (N=981)	Chest Compression plus Rescue Breathing (N=960)	Absolute Difference (95% CI) <sup>†</sup>	P Value
	no. of patients/total no. (%)		percentage points	
Pulse present at end of EMS care	335/962 (34.8)	296/942 (31.4)	3.4 (-0.8 to 7.6)	0.12
Survival to hospital discharge	122/978 (12.5)	105/956 (11.0)	1.5 (-1.4 to 4.4)	0.31
CPC 1 or 2 at hospital discharge <sup>‡</sup>	—	—	—	—

Two Sites Assessing Neurologic Status				
Chest Compression Alone (N=653)	Chest Compression plus Rescue Breathing (N=633)		Absolute Difference (95% CI) <sup>†</sup>	P Value
	no. of patients/total no. (%)		percentage points	
279/653 (42.7)	234/633 (37.0)		5.8 (0.4 to 11.1)	0.04
110/653 (16.8)	93/633 (14.7)		2.1 (-1.8 to 6.1)	0.29
94/653 (14.4)	73/633 (11.5)		2.9 (-0.8 to 6.5)	0.13

Outcome	All Three Sites			P Value
	Chest Compression Alone (N=981)	Chest Compression plus Rescue Breathing (N=960)	Absolute Difference <sup>b</sup> (95% CI)	
	no. of patients/total no. (%)	no. (%)	percentage points	
Cause of arrest				
Cardiac				
Pulse present at end of EMS care	263/684 (38.5)	217/693 (31.3)	7.2 (2.1 to 12.1)	0.005
Survival to hospital discharge	108/697 (15.5)	87/705 (12.3)	3.2 (-0.5 to 6.8)	0.09
CPC 1 or 2 at hospital discharge <sup>c</sup>	—	—	—	—
Noncardiac				
Pulse present at end of EMS care	72/278 (25.9)	79/249 (31.7)	-5.8 (-13.5 to 1.9)	0.14
Survival to hospital discharge	14/281 (5.0)	18/251 (7.2)	-2.2 (-6.6 to 1.9)	0.29
CPC 1 or 2 at hospital discharge <sup>c</sup>	—	—	—	—
Arrest rhythm				
Shockable				
Pulse present at end of EMS care	185/315 (58.7)	151/300 (50.3)	8.4 (0.5 to 16.1)	0.04
Survival to hospital discharge	101/317 (31.9)	78/304 (25.7)	6.2 (-0.09 to 13.2)	0.09
CPC 1 or 2 at hospital discharge <sup>c</sup>	—	—	—	—
Nonshockable				
Pulse present at end of EMS care	150/647 (23.2)	145/642 (22.6)	0.6 (-4.0 to 5.2)	0.80
Survival to hospital discharge	21/661 (3.2)	27/652 (4.1)	-0.9 (-3.1 to 1.1)	0.35
CPC 1 or 2 at hospital discharge <sup>c</sup>	—	—	—	—

Outcome	Two Sites Assessing Neurologic Status			P Value
	Chest Compression Alone (N=653)	Chest Compression plus Rescue Breathing (N=633)	Absolute Difference <sup>b</sup> (95% CI)	
	no. of patients/total no. (%)	no. of patients/total no. (%)	percentage points	
Cause of arrest				
Cardiac				
Pulse present at end of EMS care	216/449 (48.1)	167/445 (37.5)	10.6 (4.1 to 16.9)	0.001
Survival to hospital discharge	97/449 (21.6)	77/445 (17.3)	4.3 (-0.9 to 9.5)	0.10
CPC 1 or 2 at hospital discharge <sup>c</sup>	85/449 (18.9)	60/445 (13.5)	5.4 (0.6 to 10.3)	0.03
Noncardiac				
Pulse present at end of EMS care	63/204 (30.9)	67/188 (35.6)	-4.7 (-14.0 to 4.5)	0.32
Survival to hospital discharge	13/204 (6.4)	16/188 (8.5)	-2.1 (-7.7 to 3.2)	0.42
CPC 1 or 2 at hospital discharge <sup>c</sup>	9/204 (4.4)	13/188 (6.9)	-2.5 (-7.5 to 2.2)	0.28
Arrest rhythm				
Shockable				
Pulse present at end of EMS care	160/243 (65.8)	119/218 (54.6)	11.2 (2.3 to 20.0)	0.01
Survival to hospital discharge	92/243 (37.9)	69/218 (31.7)	6.2 (-2.5 to 14.7)	0.16
CPC 1 or 2 at hospital discharge <sup>c</sup>	80/243 (32.9)	56/218 (25.7)	7.2 (-1.1 to 15.4)	0.09
Nonshockable				
Pulse present at end of EMS care	119/410 (29.0)	115/415 (27.7)	1.3 (-4.8 to 7.5)	0.68
Survival to hospital discharge	18/410 (4.4)	24/415 (5.8)	-1.4 (-4.5 to 1.7)	0.36
CPC 1 or 2 at hospital discharge <sup>c</sup>	14/410 (3.4)	17/415 (4.1)	-0.7 (-3.4 to 2.0)	0.61

Outcome	All Three Sites			P Value
	Chest Compression Alone (N=981) no. of patients/total no. (%)	Chest Compression plus Rescue Breathing (N=960) no. of patients/total no. (%)	Absolute Difference <sup>b</sup> (95% CI) percentage points	
Witness status				
Arrest witnessed				
Pulse present at end of EMS care	195/411 (47.4)	178/429 (41.5)	5.9 (-0.8 to 12.6)	0.08
Survival to hospital discharge	88/416 (21.2)	78/437 (17.8)	3.4 (-2.0 to 8.6)	0.23
CPC 1 or 2 at hospital discharge <sup>c</sup>	—	—	—	—
Arrest not witnessed				
Pulse present at end of EMS care	138/546 (25.3)	118/512 (23.0)	2.3 (-2.9 to 7.4)	0.40
Survival to hospital discharge	33/556 (5.9)	27/517 (5.2)	0.7 (-2.1 to 3.5)	0.61
CPC 1 or 2 at hospital discharge <sup>c</sup>	—	—	—	—
EMS response time among witnessed arrests				
≤6 Min				
Pulse present at end of EMS care	119/203 (58.6)	103/223 (46.2)	12.4 (2.9 to 21.6)	0.01
Survival to hospital discharge	59/203 (29.1)	48/225 (21.3)	7.8 (-0.5 to 15.9)	0.07
CPC 1 or 2 at hospital discharge <sup>c</sup>	—	—	—	—
>6 Min				
Pulse present at end of EMS care	76/208 (36.5)	75/206 (36.4)	0.1 (-9.1 to 9.3)	0.98
Survival to hospital discharge	29/213 (13.6)	30/212 (14.2)	-0.6 (-7.2 to 6.1)	0.87
CPC 1 or 2 at hospital discharge <sup>c</sup>	—	—	—	—

Outcome	Two Sites Assessing Neurologic Status			P Value
	Chest Compression Alone (N=653) no. of patients/total no. (%)	Chest Compression plus Rescue Breathing (N=633) no. of patients/total no. (%)	Absolute Difference <sup>b</sup> (95% CI) percentage points	
Witness status				
Arrest witnessed				
Pulse present at end of EMS care	166/303 (54.8)	142/308 (46.1)	8.7 (0.8 to 16.5)	0.03
Survival to hospital discharge	79/303 (26.1)	69/308 (22.4)	3.7 (-3.1 to 10.4)	0.29
CPC 1 or 2 at hospital discharge <sup>c</sup>	70/303 (23.1)	54/308 (17.5)	5.6 (-0.8 to 11.9)	0.09
Arrest not witnessed				
Pulse present at end of EMS care	111/345 (32.2)	92/324 (28.4)	3.8 (-3.2 to 10.7)	0.29
Survival to hospital discharge	30/345 (8.7)	24/324 (7.4)	1.3 (-2.9 to 5.5)	0.54
CPC 1 or 2 at hospital discharge <sup>c</sup>	23/345 (6.7)	19/324 (5.9)	0.8 (-3.0 to 4.6)	0.67
EMS response time among witnessed arrests				
≤6 Min				
Pulse present at end of EMS care	112/178 (62.9)	89/182 (48.9)	14.0 (3.8 to 23.9)	0.007
Survival to hospital discharge	56/178 (31.5)	44/182 (24.2)	7.3 (-2.0 to 16.4)	0.12
CPC 1 or 2 at hospital discharge <sup>c</sup>	49/178 (27.5)	37/182 (20.3)	7.2 (-1.6 to 15.9)	0.11
>6 Min				
Pulse present at end of EMS care	54/125 (43.2)	53/126 (42.1)	1.1 (-11.0 to 13.2)	0.86
Survival to hospital discharge	23/125 (18.4)	25/126 (19.8)	-1.4 (-11.2 to 8.3)	0.77
CPC 1 or 2 at hospital discharge <sup>c</sup>	21/125 (16.8)	17/126 (13.5)	3.3 (-5.7 to 12.3)	0.47

## Discussion

- 1.CPR of chest compression alone did not increase survival to hospital discharge
- 2.Chest compression alone may increase survival— those with a cardiac cause (15.5% vs. 12.3%) & ventricular fibrillation (31.9% vs. 25.7%).
- Possible reasons: 1.the beneficial physiological effects of continuous chest compression> CPR 2.rescue breathing by bystanders may have no physiological effects

- No observe significant differences in outcome with noncardiac causes(14%) of arrest or nonshockable rhythms(21.1%), although the proportion of patients who survived was greater in CPR
- the study was underpowered to rigorously evaluate the type of CPR in these subgroups.

- If correctly applied according to the cause of arrest → 156 survivors with a favorable neurologic outcome per 1000 patients,
- vs 144 per 1000 if chest compression alone
- vs 115 per 1000 if standard CPR

- 3. No outcome differences in neurologic status at discharge.
- Some suggestion :
- Chest compression alone > CPR
  - survival with favorable neurologic status (14.4% and 11.5%) .

- Limit1. This 2:15 ratio was the guideline specified during the first portion of the trial. One might expect that the results — and specifically the differences observed — would be attenuated if the ratio had been 2:30.
- Limit2. This investigation involved dispatcher-instructed CPR. Do not apply to health professionals, bystanders who have been previously trained

- Limit3. Whether the distribution of neurologic status differed at the third site,
- Limit4. the study may still be criticized for having insufficient power to detect clinically important differences.  
Ex: 4200 subjects to have 80% power to demonstrate a significant difference in survival with favorable neurological outcomes (14.4 vs 11.5%)

## Conclusion

- Chest compression alone did not increase survival compared with chest compression plus rescue breathing overall.
- However, there was a consistent trend toward meaningful outcome differences in favor of chest compression alone in key clinical subgroups

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ORIGINAL ARTICLE

### Compression-Only CPR or Standard CPR in Out-of-Hospital Cardiac Arrest

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## Introduction

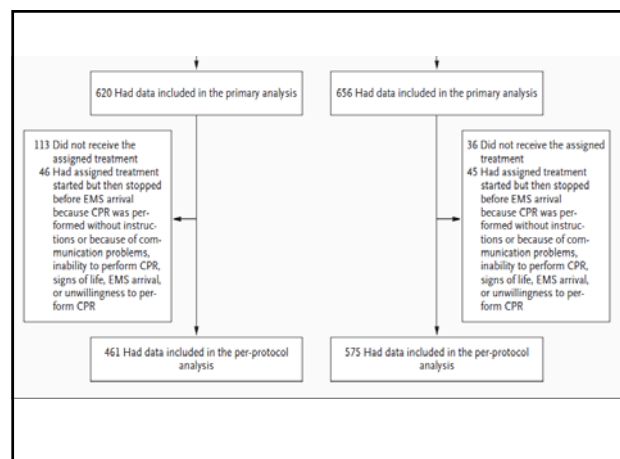
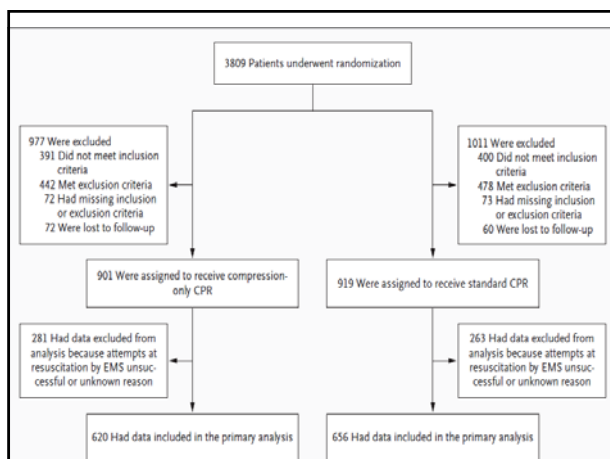
- Emergency medical dispatchers give instructions to perform CPR over the telephone to callers with suspected cardiac arrest, before EMS arriving
- A Previous study: Compression alone CPR with standard CPR have similar treatment efficacy, but with an undersized study population
- this prospective, randomized study was to evaluate : compression-only CPR vs standard CPR with respect to survival.

## Methods

- 1.to confirm whether collapse was witnessed, patient was unconscious and was not breathing or not breathing normally. (inclusion criteria)
- 2.exclusion criteria: cardiac arrest caused by trauma, airway obstruction, drowning, or intoxication; under 8 years; and difficulty of the dispatcher in communicating with the caller.
- Besides, Confirm no one CPR and callers without knowing how to perform CPR

Reason	Compression-Only CPR (N=977) no. of patients/total no. (%)	Standard CPR (N=1011) no. of patients/total no. (%)	P Value
Did not meet inclusion criteria			
Patient not unconscious	14/429 (3.3)	10/433 (2.3)	0.14
Patient not breathing or not breathing normally	46/429 (10.7)	45/433 (10.4)	0.92
Collapse not witnessed	369/429 (86.0)	378/433 (87.3)	0.74
Met exclusion criteria			
Patient <8 yr old	7/135 (5.2)	11/144 (7.6)	0.35
Arrest caused by airway obstruction	21/135 (15.6)	24/144 (16.7)	0.66
Arrest caused by intoxication	77/135 (57.0)	78/144 (54.2)	0.94
Arrest caused by trauma	30/135 (22.2)	31/144 (21.5)	0.90
Other			
Caller and patient in different locations	18/595 (3.0)	26/672 (3.9)	0.23
EMS arrived	20/595 (3.4)	22/672 (3.3)	0.76
Signs of life in patient	107/595 (18.0)	117/672 (17.4)	0.50
Communication problems between caller and dispatcher	61/595 (10.3)	61/672 (9.1)	1.00
CPR already started or caller knew how to perform CPR	178/595 (29.9)	197/672 (29.3)	0.33
Obvious signs of death in patient	17/595 (2.9)	22/672 (3.3)	0.42
Caller not able to perform CPR	116/595 (19.5)	129/672 (19.2)	0.41
Caller not willing to perform CPR	58/595 (9.7)	77/672 (11.5)	0.10
Unspecified	20/595 (3.4)	21/672 (3.1)	0.88

- 確認以上的inclusion & exclusion criteria後,紀錄在data collection sheet上,並且經由上面給的指示急救(compression alone with standard CPR)
- Data were collected from EMS records, and information about survival status was collected from national registers.



## End Points

- The primary end point was 30-day survival.
- The secondary end points
  - 1-day survival, survival until midnight of the day of admission to the hospital,
  - first detected cardiac rhythm
  - survival to discharge from the hospital.

## Analysis

- 2213 p't, power of 80% to detect an absolute difference of 2 percentage points in the 30-day survival rate between the two groups,
- 1000 patients was the largest number include in our study → a statistical power of 78% - an absolute difference of 3 percentage points in the 30-day survival rate between the two groups,

**Table 2. Baseline Characteristics of the Study Patients with Data Included in the Primary Analysis, According to Treatment Group.<sup>a</sup>**

Characteristic	Compression-Only CPR (N = 620)	Standard CPR (N = 656)
Mean age — yr	68	67
Age group — no. of patients (%)		
≤50 yr	58/592 (9.8)	75/626 (12.0)
>50–75 yr	343/592 (57.9)	360/626 (57.5)
>75 yr	191/592 (32.3)	191/626 (30.5)
Sex — no. of patients (%)		
Male	412/620 (66.5)	444/656 (67.7)
Female	208/620 (33.5)	212/656 (32.3)
Location of cardiac arrest — no. of patients (%)		
Home	442/581 (76.1)	461/609 (75.7)
Public place	54/581 (9.3)	51/609 (8.4)
Other	85/581 (14.6)	97/609 (15.9)
Mean interval between call and first EMS response interval — no. of patients (%)	10.2	10.3
≤5 min	132/573 (23.0)	129/595 (21.7)
6–8 min	150/573 (26.2)	175/595 (29.4)
9–15 min	193/573 (33.7)	198/595 (33.3)
>15 min	98/573 (17.1)	93/595 (15.6)
First cardiac rhythm — no. of patients (%)		
Ventricular fibrillation or tachycardia	188/550 (34.2)	212/581 (36.5)
Asystole	318/550 (57.8)	315/581 (54.2)
Pulseless electrical activity	44/550 (8.0)	54/581 (9.3)

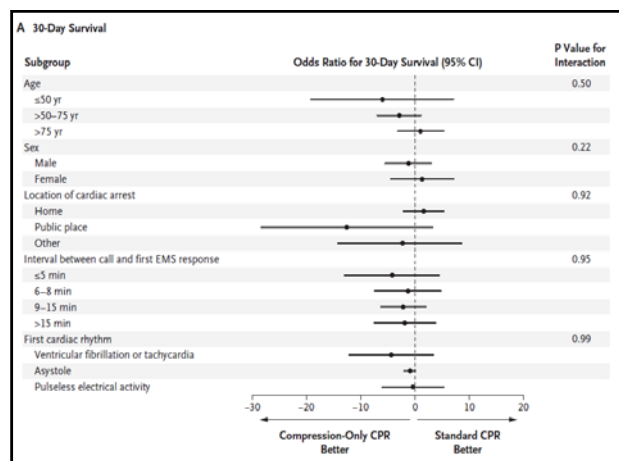
## Results

- February 2005 and ended in January 2009, at which time there had been 3809 randomized cases of suspected OHCA.
- 1820 patients were assigned to receive CPR, 1276 p'ts were involved in this studies, 1036 p'ts included in per-protocol analysis
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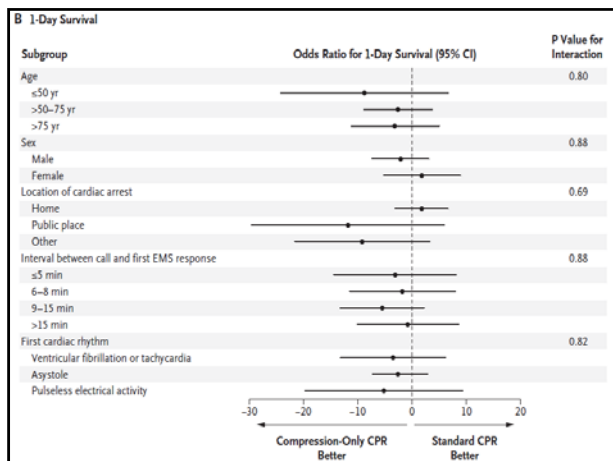
**Table 3. Survival Outcomes in the Study Population, According to Treatment Group.<sup>a</sup>**

Outcome	Compression-Only CPR no. of patients/total no. (%)	Standard CPR no. of patients/total no. (%)	Two-Sided P Value	Difference (95% CI) percentage points
<b>Primary analysis</b>				
30-Day survival	54/620 (8.7)	46/656 (7.0)	0.26	1.7 (–1.2 to 4.6)
1-Day survival	147/613 (24.0)	136/652 (20.9)	0.18	3.1 (–1.5 to 7.7)
Survival to discharge from hospital	54/282 (19.1)	44/297 (14.8)	0.16	4.3 (–1.8 to 10.5)
<b>Per-protocol analysis</b>				
30-Day survival	39/461 (8.5)	43/575 (7.5)	0.56	1.0 (–2.3 to 4.3)
1-Day survival	115/457 (25.2)	123/571 (21.5)	0.17	3.6 (–1.6 to 8.8)
Survival to discharge from hospital	39/220 (17.7)	42/261 (16.1)	0.63	1.6 (–5.1 to 8.4)

<sup>a</sup> Data from 1276 patients were included in the primary analysis, and data from 1036 were included in the per-protocol analysis. Data for survival to discharge were missing for many patients who died before day 30. CI denotes confidence interval, and CPR cardiopulmonary resuscitation.







## Discussion

- Our study population was similar to others (age, sex, location of cardiac arrest, ECG findings)
- The average EMS response time was longer than that in previous studies.
- 1. Our nationwide, randomized study of witnessed OHCA shows that compression-only CPR does not significantly improve the **outcome of patients** as compared with standard CPR.
- 2. there was no significant difference in the rates of survival among various subgroups.

## Discussion

- A. Previous studies in animals have shown no differences in survival or neurologic outcomes with standard CPR and compression-only CPR.
- B. One investigation even showed adverse outcomes while interruption of chest compression in order to perform mouth-to-mouth ventilation

## Discussion

- C. According to AHA Guidelines for CPR, the 2 breaths - a duration of only 1.5 to 2 seconds per breath. In people with not trained, the two ventilations was 16 seconds on average
- D. Both laypersons and health workers hesitate to initiate CPR that includes mouth-to-mouth ventilation, for reasons of health and safety

- E. According to a recent observational cohort study, the more time the rescuers spend on **chest compressions**, the better the chances of survival.
- F. Compression-only CPR results in more compressions per minute than standard CPR and can be started more rapidly, but the quality of the compressions may be inferior

## Discussion

- Limit1. First, 3809 patients were enrolled, approximately 600 patients in each of the two groups. There was a high risk of a type II error.
- although our study did not show a significant difference in the 30-day survival rate, our results are in agreement that there might be a small benefit of compression-only CPR.

## Discussion

- Limit2. some dispatchers had a prejudice against compression-only CPR and a preference for standard CPR. Some callers are the same
- Limit3. Third, during the course of the study, the AHA and the European Resuscitation Council changed their CPR guidelines, 15:2→30:2, But this study did not change

## Discussion

- Finally, the results do not apply to cardiac arrest caused by trauma, respiratory failure, or intoxication or to children <8 y/o or patients in whom bystanders perform CPR without instructions from dispatchers.

## Conclusion

- In witnessed OHCA,
- 1.no significant difference in survival of compression- only CPR compared with standard CPR
- 2.this study support the hypothesis that compression-only CPR, which is easier to learn and to perform, should be considered the preferred method for CPR