Chest Compression Alone CPR is Associated with Better Long-Term Survival Compared to Standard CPR

Running title: Dumas et al.; CC alone improves long term survival

Florence Dumas, MD, PhD\textsuperscript{1,2,3}; Thomas D. Rea, MD, MPH\textsuperscript{1,4}; Carol Fahrenbruch, MSPH\textsuperscript{1}; Marten Rosenqvist, MD, PhD\textsuperscript{5}; Jonas Faxén, MD\textsuperscript{6}; Leif Svensson, MD, PhD\textsuperscript{7}; Mickey S. Eisenberg, MD, PhD\textsuperscript{1,4}; Katarina Bohm, RN, PhD\textsuperscript{8}

\textsuperscript{1}Emergency Medical Services Division of Public Health for Seattle and King County, Seattle, WA; \textsuperscript{2}Inserm U970, Parisian Cardiovascular Research Ctr, Paris Descartes University; \textsuperscript{3}Emergency Dept, Cochin-Hotel-Dieu Hospital, APHP, Paris, France; \textsuperscript{4}Dept of Medicine, University of Washington, Seattle, WA; \textsuperscript{5}Dept of Clinical Sciences, Div of Cardiovascular Medicine, Danderyd Hospital, Karolinska Institute, Stockholm, Sweden; \textsuperscript{6}Dept of Internal Medicine, Nyköping Hospital, Nyköping, Sweden; \textsuperscript{7}Section of Cardiology, Karolinska Institutet, Stockholm, Sweden; \textsuperscript{8}Dept of Clinical Science and Education, Södersjukhuset, Karolinska Institutet, Stockholm, Sweden

Address for Correspondence:
Florence Dumas
Inserm U970, Parisian Cardiovascular Research Center, Paris Descartes University
56 rue Leblanc
75015 Paris
Tel: + 33 1 58 41 27 07
Fax: 33-153987954
E-mail: florence.dumas@cch.aphp.fr

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Abstract:

Background—Little is known about the long-term survival effects of type-specific bystander CPR in the community. We hypothesized that dispatcher instruction consisting of chest compression alone would be associated with better overall long-term prognosis compared to chest compression plus rescue breathing.

Methods and Results—The investigation was a retrospective cohort study that combined 2 randomized trials comparing the short-term survival effects of dispatcher CPR instruction consisting either of chest compression alone or chest compression plus rescue breathing. Long-term vital status was ascertained using the respective National and State death records through 31st July 2011. We performed Kaplan Meier method and Cox regression to evaluate survival according to the type of CPR instruction. Of the 2496 subjects included in the current investigation, 1243 (50%) were randomized to chest compression alone and 1253 (50%) were randomized to chest compression plus rescue breathing. Baseline characteristics were similar between the two CPR groups. During the 1153.2 person-years of follow-up, there were 2260 deaths and 236 long-term survivors. Randomization to chest compression alone compared to chest compression plus rescue breathing was associated with a lower risk of death after adjustment for potential confounders (adjusted HR=0.91; 95% CI [0.83-0.99], p=0.02).

Conclusions—The findings provide strong support for long-term mortality benefit of dispatcher CPR instruction strategy consisting of chest compression alone rather than chest compression plus rescue breathing among adult cardiac arrest patients requiring dispatcher assistance.

Key words: cardiopulmonary resuscitation; chest compression; resuscitation; long-term outcomes; prognosis; survival
Introduction

Out-of-hospital cardiac arrest (OHCA) is a leading cause of death worldwide\(^1,2\). Resuscitation is challenging but achievable, and relies in part on the chain of survival which includes early arrest recognition and emergency activation, early cardiopulmonary resuscitation (CPR), early defibrillation, expert advanced life support and integrated post-resuscitation care\(^3\). Specifically, early CPR performed by laypersons can double the chances of survival and provides an important foundation for subsequent links in the chain of survival\(^4\). In most communities however, fewer than half of all arrest victims receive bystander CPR prior to the arrival of professional rescuers\(^4\).

Different approaches have been used to encourage and improve bystander CPR. One such approach is for the lay rescuer to provide bystander CPR that consists of chest compressions only in contrast to traditional CPR comprised of chest compressions interposed with rescue breathing. Chest compression alone is easier and quicker to initiate and so might provide for earlier CPR among a greater number of OHCA victims\(^5\). However, the comparative effectiveness of chest compression alone versus traditional CPR performed by laypersons is debatable\(^6\). Some experimental and observational studies suggest that chest compression only CPR may provide more benefit than traditional CPR and yet other studies indicate that the type-specific benefits of CPR may depend on patient or circumstantial factors\(^7\)-\(^12\). In randomized trials comparing dispatcher CPR instruction that consisted of chest compression alone or compression plus rescue breathing, results have not been conclusive\(^5,13,14\). A meta-analysis of these randomized trials restricted to those patients with a cardiac aetiology suggested a short-term survival benefit of chest compression alone\(^15,16\). However the ability to apply type-specific CPR according to arrest aetiology imposes an
artificial selection that cannot be readily achieved in the field by laypersons or by dispatchers.\textsuperscript{17}

We undertook long-term follow-up of subjects enrolled in 2 randomized trials comparing dispatcher CPR instruction to determine if random allocation of type-specific CPR was associated with long-term survival.\textsuperscript{13, 14, 18} The potential benefits of chest compression alone might be amplified following hospital discharge. This premise is derived from the appreciation that arrest survivors with underlying cardiac aetiology have a better long-term prognosis than those with non-cardiac aetiology.\textsuperscript{19} In addition, some evidence suggests that brain recovery in particular may benefit from the chest compression alone strategy and that the effects of brain recovery might not be fully evident until more protracted follow-up.\textsuperscript{20} Hence we hypothesized that dispatcher instruction consisting of chest compression alone would be associated with better overall long-term prognosis compared to chest compression plus rescue breathing.

**Methods**

**Study design**

This investigation was a retrospective cohort study that leveraged randomized trial design from the Dispatch Assisted Resuscitation Trial (DART) and the Swedish randomized trial entitled “TANGO”\textsuperscript{13, 14}. These 2 studies compared whether survival to hospital discharge differed between OHCA victims allocated to dispatcher CPR instruction consisting of chest compression alone versus chest compressions plus rescue breathing. The respective review boards approved the two trials including long-term surveillance to determine post discharge survival. The studies are registered in clinicaltrials.gov (NCT00219687) and in Karolinska Clinical Trials Registry (kctr.se;CT20080012) respectively

**Subjects and settings**
Eligibility and enrollment have been described in detail previously. Briefly subjects were eligible for the DART study if they were unconscious and not breathing normally and bystander CPR was not ongoing and the bystander was willing to receive instruction. Subjects were enrolled from June 1, 2004 to April 15, 2009. Dispatchers attempted to exclude those with cardiac arrest due to obvious trauma, drowning, or asphyxiation (from strangulation or suffocation), as well as patients who were under 18. The current investigation also excluded subjects from the DART study enrolled from the London site because long-term follow-up was not possible at this site.

In TANGO, subjects were eligible if the collapse was witnessed (seen or heard), and the subject was unconscious and not breathing normally. Subjects were enrolled from February 1, 2005 to January 31, 2009 for TANGO. The trial excluded patients with cardiac arrest caused by trauma, airway obstruction, drowning, or intoxication, and those who were under 18.

In both study settings, emergency response is activated by calling an emergency number that connects to an emergency dispatcher. In DART communities, emergency medical services are comprised of a two-tiered system with the first tier consisting of basic life support provided by emergency medical technician-trained firefighters and advanced life support delivered by paramedics. In TANGO communities, emergency medical services are provided by paramedics and nurses. The EMS in both study settings follows the core resuscitation strategy detailed by International Guidelines.

**Study Intervention**

Once determining that a case was eligible, dispatchers opened a sealed envelope (DART) or pulled a paper strip (TANGO) that contained type-specific CPR instruction. Chest compression alone instruction consisted of repeated cycles of compressions without instruction for rescue
breathing. Chest compression plus rescue breathing instruction consisted of 2 initial rescue
breaths followed by alternating 15 chest compressions\textsuperscript{13,14}.

**Covariates**

Data was collected about patient, circumstance, care, and outcome characteristics according to the Utstein data elements\textsuperscript{25}. The study used information available from dispatch, EMS, hospital, and death certificate records.

**Outcome**

In the current study, the outcome was vital status. In the DART study, vital status was determined by using State Vital Records and the Social Security National Death Index. In the TANGO study, vital status was determined by using the national cardiac arrest registry and national registry for personal information. Information about vital status was collected from respective national registries through 31\textsuperscript{st} July 2011 and without knowledge of randomization status.

**Statistical Analysis**

We compared characteristics according to the intervention assignment (chest compression only or chest compression plus rescue breathing) using Pearson’ chi squared test for categorical variables and non-parametric Wilcoxon test for continuous variables.

To compare long-term survival, we first used Kaplan Meier product-limit method to estimate survival at 1, 3 and 5 years according to randomization assignment. Comparison of survival curves used both log-rank test and Tarone-Ware test\textsuperscript{18}. We also used Cox multivariable regression employing Efron method to test the association between the intervention and survival adjusting for potential confounders including age, gender, initial rhythm, etiology of the arrest, witnessed status, location of arrest, interval from call receipt to EMS scene arrival, and study.
The proportional hazards assumption was evaluated graphically and tested based on Schoenfeld residuals. Instead of excluding cases with missing covariates, we performed multiple imputation to incorporate all subjects in the fully-adjusted model. We conducted a sensitivity analysis excluding those with missing covariates from the multivariable model.

We performed secondary analyses that included an efficacy comparison restricted to those who actually received bystander CPR. We evaluated the intervention association stratified by the period of follow-up defined as the early phase during the first 30 days following the arrest and the late phase occurring subsequent to day 30. We also performed subgroup analyses defined by arrest etiology, presenting arrest rhythm, witnessed status, and EMS response interval among witnessed arrests. We assessed for differences in the intervention-outcome association among subgroups by including an interaction (cross-product) term between the intervention assignment and the covariate of interest. Finally, we also assessed the relationship between the intervention and survival among the primary Utstein group, bystander-witnessed arrest due to a cardiac etiology presenting with a shockable rhythm.

All tests were two-sided. A p-value ≤ 0.05 was considered as statistically significant. All analyses were performed using STATA 11.2/SE software (College Station, Texas, US).

Results

The original TANGO trial included 1276 subjects while the original DART trial included 1941 subjects. Of those, 2496/3217 (78%) were included in the current study (Figure 1). The primary reason for exclusion was the London site (n=655) where long-term vital status could not be determined. Although overall cases from the London site were older, less often had witnessed collapse, and less frequently presented with a shockable rhythm, these characteristics were
distributed equally between the intervention groups within the London site.

Of the 2496 subjects included in the current investigation, 1243 (50%) were randomized to chest compression alone and 1253 (50%) were randomized to chest compression plus rescue breathing. Baseline characteristics were similar between the two CPR groups (Table 1). Overall, men were twice as common as women. The median age was 66 years [25th, 75th percentiles, (55, 77)]. About three-quarters suffered an arrest due to a cardiac aetiology while about one-third presented with a shockable arrest rhythm.

During the 1153.2 person-years of follow-up, there were 2260 deaths. Overall survival was 11% (9.8-12.2) at one year, 10.6% (8.9-11.3) at 3 years, and 9.4% (8.3-10.6) at 5 years. The Kaplan Meier curves comparing the two bystander CPR strategies demonstrated better survival for those randomized to chest compression alone compared to chest compression plus rescue breathing (log rank test p=0.03, Tarone Ware p=0.009) (Figure 2). In the multivariable Cox regression model, the proportional hazards assumption was satisfied (chi2 0.18, DF=1, p=0.67). Randomization to chest compression only was associated with a lower risk of death after adjustment for potential confounders (adjusted HR=0.91; 95% CI [0.83-0.99], p=0.02) (Table 2). The beneficial mortality association was similar when those with missing covariate status were excluded from the model (HR=0.91 [0.84-0.99], p=0.03). When stratified by the early and late phase of follow-up (<= day 30 and subsequent to day 30), chest compression alone compared to chest compression plus rescue breathing was associated with a lower risk of death during the early phase (adjusted HR=0.90; 95% CI [0.83-0.98], p=0.02). The intervention was not associated with mortality risk during the late phase (adjusted HR=0.99; 95% CI [0.62-1.58], p=0.99). During the study, 1918/2496 (77%) patients progressed through instructions and received the intended CPR. When restricting to this efficacy cohort, chest compression only was
associated with a lower risk of death after adjustment for potential confounders (adjusted HR=0.90; 95% CI [0.82-0.99], p=0.03).

We did not observe strong evidence of subgroup differences as none of the interaction terms between intervention status and the subgroup of interest attained statistical significance (Figure 3). We did however observe a lower risk of death among those with an arrest due to a cardiac etiology (HR=0.86, 95% CI [0.77-0.97], p=0.01) and those with a witnessed arrest (HR=0.89, 95% CI [0.81-0.99], p=0.03). When restricted to the primary Utstein group – bystander-witnessed arrest due to a cardiac etiology presenting with shockable rhythm (n=713), randomization to chest compression alone compared to compression plus rescue breathing was associated with a lower risk of death (HR=0.83, 95% CI [0.71-0.99], p=0.03).

Discussion
In this large, follow-up investigation of two randomized trials comparing dispatcher CPR instruction, cardiac arrest patients randomized to chest compression alone instruction had better long-term survival than patients randomized to chest compression plus rescue breathing instruction.

Prior investigations have restricted or stratified findings according to arrest aetiology because the survival effects of type-specific CPR may depend upon etiology 7, 8, 11, 27, 28. Although these stratified findings provide useful mechanistic insights, dispatchers are challenged to quickly and correctly determine etiology, making etiology-based instruction impractical for real-world implementation 17. Moreover, no study has evaluated the long-term outcomes of these patients. Although survival to hospital discharge is a clinically meaningful outcome, the short-term survival effects of type-specific CPR could be attenuated or amplified during
convalescence and long-term follow-up. The current results provide important evidence that chest compression alone instruction can achieve better overall prognosis and should be considered the instructional approach for nearly all adult patients for whom dispatchers suspect cardiac arrest.

Based on the survival curve and short-term and long-term stratified analyses, we observed that the survival benefit of chest compression alone appears to be attributable to an early survival differential that persists over subsequent years of follow-up. The overall survival benefit was evident using a number of different statistical comparison tests and multivariable adjustments indicating that the observed difference in the overall study population is robust. We note specifically that the survival difference observed at early on was not amplified following discharge as hypothesized, but rather the survival curves were similar between the 2 groups during this follow-up. The main findings are important because the use of short-term surrogate outcome measures in resuscitation research often belies more meaningful long-term outcomes.\cite{29-31} The results of the current study suggest that potential short-term outcome differences do translate to meaningful long-term public health benefits.\cite{32}

Although not statistically definitive, the subgroup analyses were consistent with the understanding of the differential mechanism of chest compression alone versus chest compression plus rescue breathing such that the enhanced perfusion of chest compression alone would provide more benefit among those with cardiac etiology arrest, shockable rhythm, and/or short collapse interval.\cite{5,33-35} Importantly, we did not observe evidence of harm among those for whom oxygenation and ventilation might in theory be more important such as non-cardiac aetiology or unwitnessed arrest (Figure 3).

The study has limitations. The original studies were conducted independently and were
not originally designed to ascertain long-term outcome. Common entry criteria and the randomization approach help protect against bias and enable combination of the study data. Each study used national and provincial death registries to ascertain mortality. Adjustment for study did not change the results and the results were similar between the two studies. Although we observed survival differences, we were not able to ascertain functional status or quality of live during long-term follow-up though favourable functional status has been associated with better long-term prognosis in the general population. As part of the study design, dispatchers excluded pediatric patients or those with suspected cardiac arrest due to trauma, asphyxia, or drowning, so that the results do not apply to the modest number of arrests in these clinical and demographic groups. Rescue breathing was performed in a ratio of 2 breaths to 15 compressions given the study timeframe. One might expect the differences would be attenuated if the ratio had been 2:30. Such a conclusion is uncertain given the incomplete understanding of the mechanisms responsible for the benefit of CPR and the fixed logistic considerations of providing rescue breathing. Finally, although we leveraged larger sample-size by combining the two studies, the investigation still had limited power to evaluate for subgroup or phase-specific intervention differences in the outcome.

The results are specific to dispatcher-assisted layperson CPR though they provide a useful context to consider layperson CPR training and guidelines. Specifically, some evidence suggests that laypersons are especially challenged to perform effective rescue breathing even after training. Thus the results of the current study support the 2010 Guidelines that prioritize chest compressions regardless of training status or dispatcher assistance. Laypersons are directed to proceed to ventilations only if proficient in the technique of rescue breathing.

In conclusion, the findings provide strong support for long-term mortality benefit of
dispatcher CPR instruction strategy consisting of chest compression alone rather than chest compression plus rescue breathing among adult cardiac arrest patients requiring dispatcher assistance. Emergency dispatchers have a vital role in resuscitation and community stakeholders should leverage this important role to increase early arrest recognition and effective layperson CPR and in turn improve survival following cardiac arrest. Bystanders can proceed with chest compression alone approach with the appreciation that this strategy on average provides optimal long-term survival benefit.

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**Conflict of Interest Disclosures:** None.

**References:**


non-cardiac aetiology: a strategy to allocate rescue breathing during bystander CPR. 
*Resuscitation.* 2012;83:134-137.

18. Tarone RE, Ware J. On distribution-free tests for equality of survival distributions. 
*Biomетrika* 1977;64:165-160.

19. Dumas F, Rea TD. Long-term prognosis following resuscitation from out-of-hospital cardiac 


21. Rea TD, Helbock M, Perry S, Garcia M, Cloyd D, Becker L, Eisenberg M. Increasing use of 
cardiopulmonary resuscitation during out-of-hospital ventricular fibrillation arrest: survival 

22. Bohm K, Stalhandske B, Rosenqvist M, Ulfvarson J, Hollenberg J, Svensson L. Tuition of 
emergency medical dispatchers in the recognition of agonal respiration increases the use of 

Part 3: adult basic life support. The American Heart Association in collaboration with the 


Perlman J, Shuster M, Steen PA, Sterz F, Tibballs J, Timerman S, Truitt T, Zideman D. Cardiac 
arrest and cardiopulmonary resuscitation outcome reports: update and simplification of the 
Utstein templates for resuscitation registries: a statement for healthcare professionals from a task 
force of the International Liaison Committee on Resuscitation (American Heart Association, 
European Resuscitation Council, Australian Resuscitation Council, New Zealand Resuscitation 
Council, Heart and Stroke Foundation of Canada, InterAmerican Heart Foundation, 

publification 2009;72-89.

CW, Bishop D, Vaillancourt C, Davis D, Auferheide TP, Idris A, Stouffer JA, Stiell I, Berg R. 
Chest compression fraction determines survival in patients with out-of-hospital ventricular 


## Table 1. Baseline characteristics according to treatment arm

<table>
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<tr>
<th></th>
<th>CC</th>
<th>CC+RB</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age, years, n (%)</strong></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>18-55</td>
<td>314 (25.3)</td>
<td>321 (25.6)</td>
<td>0.81</td>
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<tr>
<td>56-66</td>
<td>316 (25.4)</td>
<td>314 (25.1)</td>
<td></td>
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<tr>
<td>67-77</td>
<td>331 (26.6)</td>
<td>317 (25.3)</td>
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<tr>
<td>&gt;77</td>
<td>282 (22.7)</td>
<td>301 (24)</td>
<td></td>
</tr>
<tr>
<td><strong>Male gender, n (%)</strong></td>
<td>842 (67.7)</td>
<td>841 (67.1)</td>
<td>0.74</td>
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<tr>
<td><strong>Shockable rhythm, n (%)</strong></td>
<td>423 (36)</td>
<td>421 (35.6)</td>
<td>0.86</td>
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<tr>
<td><strong>Cardiac etiology, n (%)</strong></td>
<td>622 (73.7)</td>
<td>619 (75.6)</td>
<td>0.38</td>
</tr>
<tr>
<td><strong>Location, n (%)</strong></td>
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<tr>
<td>Public</td>
<td>105 (8.7)</td>
<td>89 (7.4)</td>
<td>0.24</td>
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<tr>
<td>Residential</td>
<td>1105 (91.3)</td>
<td>1120 (92.6)</td>
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<tr>
<td><strong>Witnessed, n (%)</strong></td>
<td>893 (72.1)</td>
<td>928 (74.1)</td>
<td>0.26</td>
</tr>
<tr>
<td><strong>Mean interval EMS response, min,</strong></td>
<td>7.9</td>
<td>8.1</td>
<td></td>
</tr>
<tr>
<td>-n (%)†</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>≤6</td>
<td>653 (51.3)</td>
<td>543 (48.3)</td>
<td>0.14</td>
</tr>
<tr>
<td>&gt;6</td>
<td>619 (48.7)</td>
<td>582 (51.7)</td>
<td></td>
</tr>
<tr>
<td><strong>Sites, n (%)</strong></td>
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<td></td>
<td></td>
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<tr>
<td>DART</td>
<td>654 (52.6)</td>
<td>632 (50.4)</td>
<td>0.23</td>
</tr>
<tr>
<td>TANGO</td>
<td>589 (47.4)</td>
<td>621 (49.6)</td>
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</tr>
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</table>

CC= chest compression alone
CC+RB= chest compression plus rescue breathing
EMS= emergency medical services
* Age is described according to its interquartile
† EMS response is described to its median
Table 2. Multivariable Predictors of Mortality.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Hazard ratio</th>
<th>[95% Conf.Interval]</th>
<th>p-value</th>
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<tr>
<td>Intervention</td>
<td>0.91</td>
<td>(0.83-0.99)</td>
<td>0.02</td>
</tr>
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<td>Age, years</td>
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<td>18-55 (referrent)</td>
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<td>--</td>
<td>--</td>
</tr>
<tr>
<td>55-66</td>
<td>1.17</td>
<td>(1.04-1.33)</td>
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<td>67-77</td>
<td>1.27</td>
<td>(1.12-1.43)</td>
<td>&lt;0.001</td>
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<td>&gt;77</td>
<td>1.39</td>
<td>(1.23-1.58)</td>
<td>&lt;0.001</td>
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<tr>
<td>Male gender</td>
<td>1.05</td>
<td>(0.96-1.15)</td>
<td>0.29</td>
</tr>
<tr>
<td>VF/VT as initial rhythm</td>
<td>0.47</td>
<td>(0.42-0.52)</td>
<td>&lt;0.001</td>
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<tr>
<td>Cardiac etiology</td>
<td>1.04</td>
<td>(0.91-1.19)</td>
<td>0.54</td>
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<td>Location of cardiac arrest</td>
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<td>Residential</td>
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<td>Public</td>
<td>0.80</td>
<td>(0.68-0.94)</td>
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<td>Witnessed</td>
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<td>(0.66-0.84)</td>
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<tr>
<td>Time response</td>
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<tr>
<td>&gt; 6 minutes</td>
<td>1.11</td>
<td>(1.02-1.23)</td>
<td>0.01</td>
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<td>Site</td>
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<tr>
<td>DART /TANGO</td>
<td>0.74</td>
<td>(0.66-0.82)</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

VF= Ventricular fibrillation
VT= Ventricular Tachycardia

Figure Legends:

Figure 1. Flowchart.

Figure 2. Association between Intervention and survival according to subgroups of patients.

Figure 3. Overall survival according to the treatment arm. CC+RB= chest compression plus rescue breathing. CC= chest compression alone
Figure 1

- TANGO 2: 1276 patients
  - 58 missing age 8 under 18 yrs
  - 1210 patients with follow-up

- DART 2: 1941 patients
  - 655 patients from London without follow-up
  - 1286 patients with follow-up

2496 patients

1243 Chest Compression alone
1253 Chest Compression plus Rescue Breathing
Figure 2

Log rank p=0.03
Tarone Ware p=0.009
HR=0.90 (0.83-0.98). p=0.02

<table>
<thead>
<tr>
<th>Survival Rate % (CI95)</th>
<th>Person-year</th>
<th>1 year survival</th>
<th>2 years survival</th>
<th>5 years survival</th>
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<tr>
<td></td>
<td>Overall</td>
<td>CC</td>
<td>CC+RB</td>
<td>Overall</td>
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<tr>
<td></td>
<td>291</td>
<td>11 (9.8-12.2)</td>
<td>10.6 (9.4-11.8)</td>
<td>9.4 (8.3-10.6)</td>
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<td></td>
<td>159</td>
<td>12.1 (10.3-14)</td>
<td>11.7 (10-13.5)</td>
<td>10.2 (8.6-12)</td>
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<td>9.9 (8.3-11.6)</td>
<td>9.5 (8-11.2)</td>
<td>8.5 (7.1-10.2)</td>
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