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## Chest Compression Release Velocity Factors During Out-of-Hospital Cardiac Resuscitation

### Background:

- High chest compression release velocity (CCRV) has been independently associated with improved survival from out-of-hospital cardiac arrest (OHCA).
  - Kovacs et al, Resuscitation. 2015;92:107-114.*
- Previous studies demonstrate that the amount of force required to achieve equal compression depth varies significantly between patients suggesting that patient-related factors influence compression dynamics.
  - Tomlinson et al, Resuscitation. 2007;72:364-370.*
- The aim of our study was to evaluate for associations between CCRV and OHCA patient age, weight, and gender.

### Methods:

#### Study Setting:

- Data was supplied by 2 EMS agencies in Arizona between 10/2008 and 12/2016 that participate in Save Hearts in Arizona Registry and Education (AZ SHARE) program.

#### Study Design:

- We conducted a retrospective observational cohort study of prospectively data by the Arizona Department of Health Services Bureau of EMS and Trauma System's AZ SHARE program.

#### Data Collection:

- Chest compression quality information, including CCRV, was obtained from defibrillators (E Series and X Series; ZOLL Medical, Chelmsford, MA) equipped with accelerometer-based compression sensing technology.

#### Inclusion Criteria:

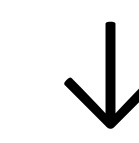
- Adult out-of-hospital cardiac arrest  $\geq$  18 years old.

#### Statistical Analysis:

- The subject-level mean CCRV was calculated for the time interval of the first 10 minutes, then separately for the first five minutes and the second five minutes.
- Subject-level mean CCRV was summarized within each subgroup by the median and inter-quartile range, and were compared across subgroups by the Kruskal-Wallis test.
- All tests were two-sided with a significance level of 0.5.

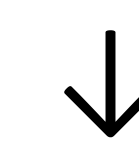
### Results:

2,661 OHCA cases (Between 10/1/2008 and 12/31/2016)



#### Exclusions:

- Pediatric patients or unknown age (126)
- Non-cardiac or unknown etiology (518)
- Medical facility or unknown OHCA location (415)
- Arrest after EMS arrival (98)
- EMS did not attempt resuscitation (63)
- Care terminated on DNR (15)
- No CPR quality data (264)
- Fewer than 20 compressions or duration of compressions less than 1 minute (22)



1,140 cases remaining for analysis

- The 1,140 cases received a total of 852,963 compressions with a median of 790 compressions per subject (IQR 689.5, 858).
- The median duration of compressions was 8.70 minutes (IQR 8.0, 9.1) per subject.
- Mean CCRV was negatively correlated with age and positively correlated with weight (Table 1).
- Male patients exhibited a greater mean CCRV compared to female patients [344.4 mm/s (IQR 307.3-384.6) vs. 331.5 (285.3-385.5),  $p=0.0133$ ]

### Limitations

- Although the results of this study demonstrate a correlation between CCRV and patient-related factors, it is observational and therefore we cannot claim causality.
- Patient characteristics may have influenced rescuer performance, and thus, may have contributed to the observed differences in CCRV.
- The measurement of CCRV by the accelerometer may be affected by the release of other compressible surfaces (beds or EMS stretchers) beneath the patient.

Table 1. Mean CCRV comparison according to patient age, weight, and gender

Variable	Category	n (%)	Mean CCRV	p-value
Gender	Female	385 (33.8%)	331.5 (285.3, 385.5)	0.0133
	Male	755 (66.2%)	344.4 (307.3, 384.6)	
Age quartile	[18,54]	300 (26.3%)	364.4 (323.1, 407.5)	< 0.0001
	(54,65]	286 (25.1%)	341.4 (300.4, 388.6)	
	(65,76]	272 (23.9%)	340.3 (298.2, 379.1)	
	(76,104]	282 (24.7%)	315.8 (282.5, 362.6)	
	Weight quartile	[32,73]	234 (20.5%)	
(73,89.5]	188 (16.5%)	342.8 (308.4, 388.2)		
(89.5,105]	213 (18.7%)	354.2 (312.8, 395.1)		
(105,273]	209 (18.3%)	360.2 (317.3, 409.8)		
Unknown	296 (26%)	334 (295.4, 376.8)		

### Conclusion:

- Patient characteristics including younger age, male gender, and increased weight were associated with a higher CCRV during OHCA resuscitation.
- Further studies may help to determine the significance of these findings with regard to outcomes.