

BACKGROUND

High quality chest compressions are associated with improved outcomes after cardiac arrest. Defibrillators record important information about the quality of chest compressions during CPR and can be used in quality-improvement programs. Software made for reviewing defibrillator files can automatically annotate and measure chest compression metrics. However, evidence is limited regarding the accuracy of such measurements.

OBJECTIVE

To compare chest compression fraction (CCF) and rate measurements made with software annotation vs. manual annotation vs. limited annotation of defibrillator files recorded during Out-of-Hospital Cardiac Arrest (OHCA) CPR.

METHODS

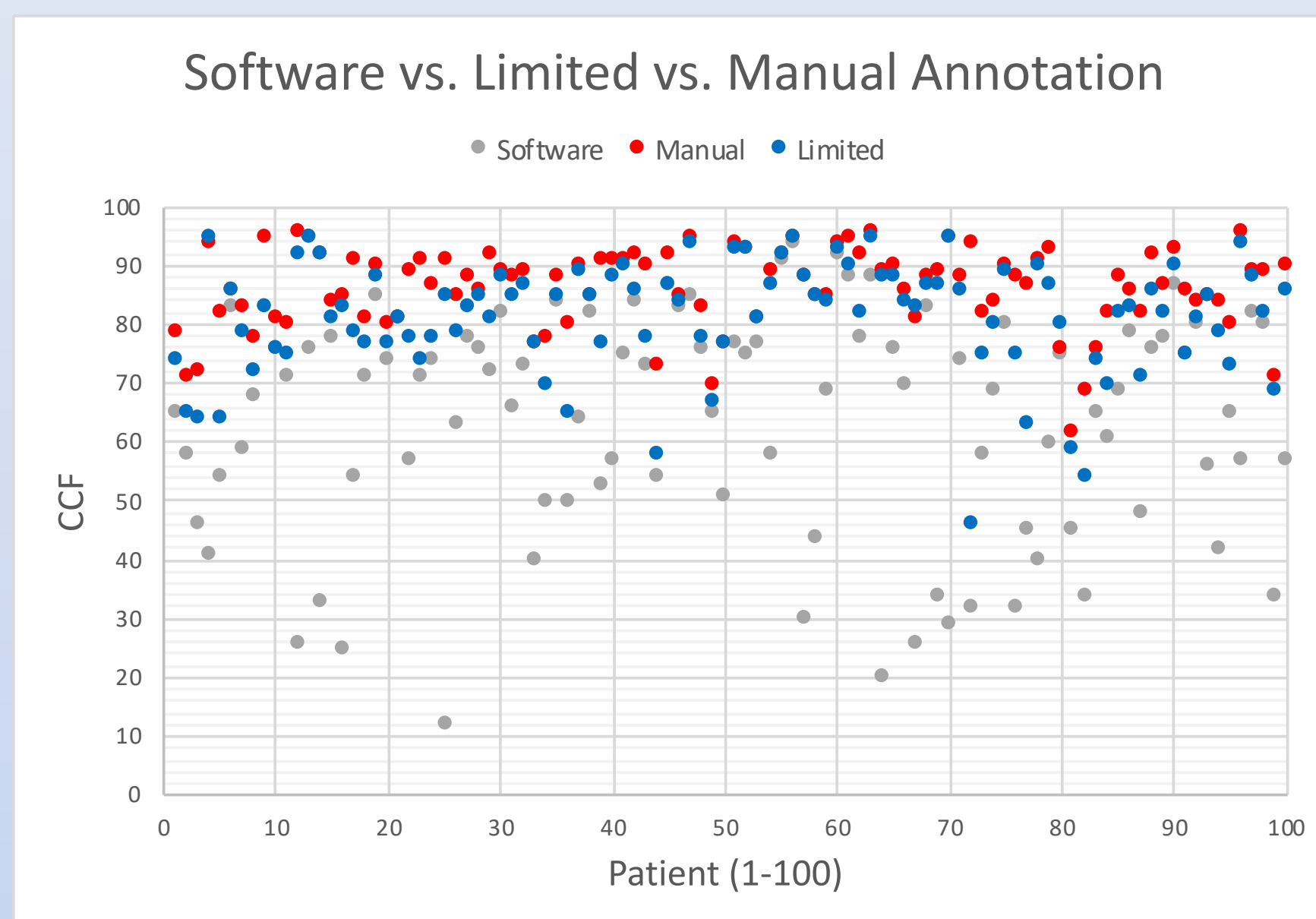
This is a retrospective, observational study from the Dallas-Fort Worth site of the Resuscitation Outcomes Consortium. We reviewed chest compression waveforms from the bioimpedance channel of defibrillator recordings (Physio-Control Lifepak 12 and 15, Redmond, WA) of 100 OHCA patients from 9/8/2018 to 3/9/2019. Included cases were ≥ 18 years, had presumed cardiac cause of arrest, and were expected to have continuous chest compressions.

ANNOTATIONS

Limited annotation: Requires less time and entails marking the beginning and end of CPR and anytime ROSC occurs, but not manually annotating chest compressions.

Manual annotation: A trained reviewer revised the software annotations as needed by annotating compressions that were missed by the software or deleting incorrect annotations and marking the beginning and end of CPR and the occurrence of ROSC. The reviewer assessed chest compression waveforms from the time of initial CPR until the time the defibrillator was removed.

Software, manual, and limited annotation measurements were compared for CCF and rate using intraclass correlation coefficient (ICC) statistical analysis.



RESULTS

- Mean patient age: 63 years with 59% male
- Mean (\pm SD) duration of CPR: 30.4 ± 10.6 min
- Case mean CCF for software, manual, and limited annotation: 0.64 ± 0.19 , 0.86 ± 0.07 , and 0.81 ± 0.10 , respectively.
- **ICC for manual vs. limited annotation was good to excellent.**
- Case mean rate for all three methods was between 108.1-108.6, with no significant difference between the methods.

	Software Annotation mean (sd)	Manual Annotation mean (sd)	Limited Annotation mean (sd)	Software-Manual ICC	Software-Limited ICC	Manual-Limited ICC
Case Mean	0.64 (0.19)	0.86 (0.07)	0.81 (0.10)	0.143	0.249	0.686
Individual Epochs						
Overall	0.64 (0.38)	0.87 (0.19)	0.82 (0.21)	0.739	0.892	0.829
Minutes 1-5	0.76 (0.28)	0.85 (0.20)	0.80 (0.22)	0.807	0.910	0.870
Minutes 6-10	0.75 (0.30)	0.88 (0.17)	0.82 (0.21)	0.766	0.904	0.803
Minutes 10-15	0.70 (0.34)	0.88 (0.17)	0.83 (0.21)	0.684	0.923	0.745
Minutes 16+	0.50 (0.42)	0.88 (0.19)	0.83 (0.20)	0.703	0.850	0.861

Case mean is the ratio of the total number of seconds with compressions divided by the total number of seconds. Individual epochs represent one minute time frames and the overall mean represents the mean of the individual epochs.

The software misidentified epochs before the start of chest compressions, failed to capture epochs after resuscitation ended, and after return of spontaneous circulation, resulting in low ICC for CCF when compared with manual and limited annotation. The ICC was excellent for compression rate because the software only counted epochs where chest compressions were actually given.

CONCLUSIONS

Software annotation performed very well for chest compression rate. With respect to CCF, the difference between manual and software annotation measurements was clinically important, while manual vs. limited annotation compared favorably.

Best Value

	Software Annotation	Limited Annotation	Manual Annotation
Strengths	• Convenient • Detects 90-95% of compressions	CCFs close to Manual Annotation	Most accurate
Weaknesses	Unable to reliably identify: • CPR beginning & end • Occurrence of ROSC	Not as accurate as Manual Annotation	Labor-intensive
Time Needed	0 minutes	2-3 minutes	5-15 minutes
Cost	-	\$	\$\$\$
Useful Situations	No extra budget available	• EMS agencies with limited resources • Quality improvement programs • Large cardiac registries	No shortage of resources

LIMITATIONS

- This study used data from one ROC site.
- This study analyzed annotations using PhysioControl software. Software from other companies may provide different results.

REFERENCES

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