WORKSHEET for Evidence-Based Review of Science for Veterinary CPCR

1. Basic Demographics

Worksheet author(s)

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2. Clinical question:

In veterinary CPR providers (BLS and ALS) (P) does a minimum team size (I) compared with no minimum team size (C), improve outcome (O) (eg. ROSC, survival to discharge)?

3. Conflict of interest specific to this question:

Do any of the authors listed above have conflict of interest disclosures relevant to this worksheet?
None

4. Search strategy (including electronic databases searched):

4a. Databases

Pubmed searches: No date restrictions
CPR and team number (68)
CPR team (636)
CPR crew size (3)
Cardiac arrest crew size (4)
Cardiac arrest team size (12)
Cardiac arrest team (770)

Cab searches: 0 for all the above

4c. State inclusion and exclusion criteria for choosing studies and list number of studies excluded per criterion

Inclusion criteria

Peer-reviewed research papers—retrospective or prospective
Reviews of literature

Exclusion criteria

Editorials
Letters
Abstracts only
Manuscripts in foreign language

Several articles found in references from original search

4d. Number of articles/sources meeting criteria for further review: 7

-Zero (0) relevant veterinary (clinical) studies were identified.

-Seven (7) studies involving humans were identified:

Martin-Gill C, Guyette FX, Rittenberger JC. Effect of crew size on objective measures of resuscitation for out-of-hospital cardiac arrest. Prehosp Emerg Care. 2010 Apr 6;14(2):229-34.

Siebig S, Kues S, Klebl F, Brünnler T, Rockmann F, Schölmerich J, Langgartner J. Cardiac arrest: composition of resuscitation teams and training techniques: results of a hospital survey in German-speaking countries. Dtsch Arztebl Int. 2009 Jan;106(5):65-70.

Brucke M, Helm M, Schwartz A, Lampl L. Two rescuer resuscitation--mission impossible? A pilot study using a manikin setting. Resuscitation (2007) **74**, 317—324

Bayley R, Weinger M, Meador S, Slovis C. Impact of ambulance crew configuration on simulated cardiac arrest resuscitation. Prehosp Emerg Care. 2008 Jan-Mar;12(1):62-8.

Eschmann NM, Pirrallo RG, Aufderheide TP, Lerner EB. The association between emergency medical services staffing patterns and out-of-hospital cardiac arrest survival. Prehosp Emerg Care. 2010 Jan-Mar;14(1):71-7.

Nichol G, Detsky AS, Stiell IG, O'Rourke K, Wells G, Laupacis A. Effectiveness of emergency medical services for victims of out-of-hospital cardiac arrest: a metaanalysis. Ann Emerg Med. 1996 Jun;27(6):700-10.

Hackman BB, Kellermann AL, Everitt P, Carpenter L. Three-rescuer CPR: the method of choice for firefighter CPR? Ann Emerg Med. 1995 Jul;26(1):25-30.

This study may not be applicable but should be evaluated—may be applicable to another REC question

Mailey J, Digiovine B, Baillod D, Gnam G, Jordan J, Rubinfeld I. Reducing hospital standardized mortality rate with early interventions. J Trauma Nurs. 2006 Oct-Dec;13(4):178-82.

5. Summary of evidence

Evidence Supporting Clinical Question

Good						
Fair						*Martin-Gill, 2010, E;Brucke, 2007, E; Hackmann, 1995, E*
Poor						
	1	**2**	**3**	**4**	**5**	**6**
Level of evidence (P)						

Evidence Neutral to Clinical question

Good						
Fair						*Siebig, 2009, E; Bayley, 2008, E;Eschmann, 2010, E; Nichol, 1996, E*
Poor						
	1	**2**	**3**	**4**	**5**	**6**
Level of evidence (P)						

Evidence Opposing Clinical Question

Good						
Fair						
Poor						
	1	**2**	**3**	**4**	**5**	**6**
Level of evidence (P)						

A = Return of spontaneous circulation C = Survival to hospital discharge E = Other endpoint
B = Survival of event D = Intact neurological survival
Italics = Non-target species studies

6. REVIEWER'S FINAL COMMENTS AND ASSESSMENT OF BENEFIT / RISK:

7. Conclusion

There is no existing consensus statement on Team size for resuscitation. Little studies exist in the literature and most are simulated studies. Retrospective studies are difficult to evaluate because different numbers and different personnel are involved. Some studies are in hospital and some are out of hospital. An interesting observation gathered from these studies is that the more people involved the more the basics of CPR are underutilized in favor of ALS. Studies in humans show that BLS is what makes the difference in survival.

8. Acknowledgement

9. Citation list

1. Two rescuer resuscitation——Mission impossible? A pilot study using a manikin setting
Summary
Objective: Advanced life support (ALS) in a cardiac arrest is usually performed by a team consisting of three people. The medical team of a Helicopter Emergency Medical Service (HEMS) often consists of two rescuers only. Due to that reason an algorithm was developed to provide ALS with two people. During the initial phase the rescuer in the over-the-head position provides one man CPR while the second
rescuer prepares all advanced measures. When all preparations are complete both rescuers are able to provide ALS.

Material and methods: A computer controlled manikin (Ambu Mega Code Simulator System MCS®) with online documentation was used to test the entire medical staff during 10 min of persistent VF.
Results: The 20 teams were tested. Following data were recorded: no-flow-time 96.4 ± 11 s (16.1 ± 1.8%), chest compression frequency 120.1 ± 5.1 min−1, ventilation frequency = 9 min−1 , number of chest compressions per session 1013.7 ± 45.9, depth of chest compressions 46.6 ± 2.5 mm, total number of chest compressions = 20,274, total number of ventilations = 1893. For ALS measures the following data were recorded: tracheal intubation (TI) was finished after 60.7 ± 9.8 s, duration of TI maneouver = 15.7 ± 4.4 s, end of initial phase = 188.9 ± 26.3 s, i.v. administration of adrenaline after 387.7 ± 33.6 s, i.v. administration of amiodarone after 507.9 ± 36.9 s and four shocks after: 138.0 ± 15.9, 266.8 ± 16.1, 398.0 ± 20.1 and 526.8 ± 23.6 s.
Conclusion: We proved the feasibility of the algorithm in a manikin setting. Further observations have to prove the algorithm in real CPR situations.
KEYWORDS Advanced life support (ALS); Cardiopulmonary resuscitation (CPR); Manikin; Out-of-hospital CPR; Emergency helicopters
Key points: This was a study using manikins and Helicopter paramedics to see if 2 person CPR can be done effectively. No controls and these personal doing CPR and train often.

2. Cardiac Arrest: Composition of Resuscitation Teams and Training Techniques
SUMMARY
Background:The long-term outcome of patients requiring cardiopulmonary resuscitation depends heavily on swift and appropriate care. The aim of this study was to obtain data on the composition and training of resuscitation teams in specialist departments for internal medicine and anesthesiology.
Methods:Between October 2006 and February 2007,440 questionnaires were sent to departments for anesthesiology and internal medicine in Germany(hospitals with more than 300 beds) and to university hospitals in Switzerland and Austria.
Results:The response rate was 38%. Of 166 participating hospitals,152 have an emergency team. Resuscitation training (RT) takes place in 111 hospitals. Ninety-two hospitals (55%) hold a course more than once a year. Of those hospitals with RT,86% use a simulation dummy, 77% conduct theoretical tutorials,and 65% follow a fixed algorithm.
Conclusion:The majority of hospitals that participated in this survey have an emergency team in place and organize resuscitation training for their medical personnel. The training varies greatly,however,in frequency,size of group, and qualification of the trainer. Implementation of standardized training for and management of in-hospital resuscitation measures might further hone staff skills and therefore improve the long-term outcome for the patients concerned.
Key words:resuscitation,emergency medical care, cardiac arrest,training model,hospital doctor
Key points: This is a study based on a questionnaire sent to hospitals and clinics in Germany. There is only one mention of team size: varies from 2-3 with a physician always present.

3. **Effect of Crew Size on Objective Measures of Resuscitation for Out-of-Hospital**

Cardiac Arrest Abstract

Background—There is no consensus among emergency medical services (EMS) systems as to the optimal numbers and training of EMS providers who respond to the scene of prehospital cardiac arrests. Increased numbers of providers may improve the performance of cardiopulmonary resuscitation (CPR), but this has not been studied as part of a comprehensive resuscitation scenario.

Objective—To compare different all-paramedic crew size configurations on objective measures of patient resuscitation using a high-fidelity human simulator.

Methods—We compared two-, three-, and four- person all-paramedic crew configurations in the effectiveness and timeliness of performing basic life support (BLS) and advanced life support (ALS) skills during the first 8 minutes of a simulated cardiac arrest scenario. Crews were compared to determine differences in no-flow fraction (NFF) as a measure of effectiveness of CPR and time to defibrillation, endotracheal intubation, establishment of intravenous access, and medication administration.

Results—There was no significant difference in mean NFF among the two-, three-, and four- provider crew configurations (0.32, 0.26, and 0.27, respectively; p = 0.105). More three- and four- person groups completed ALS procedures during the scenario, but there was no significant difference in time to performance of BLS or ALS procedures among the crew size configurations for completed procedures. There was a trend toward lower time to intubation with increasing group size, though this was not significant using a Bonferroni-corrected p-value of 0.01 (379, 316, and 263 seconds, respectively; p = 0.018).

Conclusion—This study found no significant difference in effectiveness of CPR or in time to performance of BLS or ALS procedures among crew size configurations, though there was a trend toward decreased time to intubation with increased crew size. Effectiveness of CPR may be hindered by distractions related to the performance of ALS procedures with increasing group size, particularly with an all-paramedic provider model. We suggest a renewed emphasis on the provision of effective CPR by designated providers independent of any ALS interventions being performed.

Key points: This is a study using CPR simulation comparing 2, 3 and 4 people crews. Measurement was NFF. Lower time to intubation trend with larger groups**. They did note that larger groups get too caught up in performing ALS and BLS not done as effectively.** BLS only known form of CPR associated with improved outcome. Less people means more BLS which means better survival.

4. Impact of ambulance crew configuration on simulated cardiac arrest resuscitation.

BACKGROUND:

Despite the widespread use of both two paramedic and single paramedic ambulance crews, there is little evidence regarding differences between these two staffing configurations in the delivery of patient care.

OBJECTIVES:

To determine potential differences in care provided by each of these ambulance configurations in the resuscitation of a cardiac arrest victim in ventricular fibrillation.

METHODS:

Fifteen paramedic-paramedic and 15 paramedic-EMT crews were recruited to perform resuscitation on a high-fidelity human simulator (Laerdal SimMan). Errors and their nature, time to critical interventions, and compliance with continuous cardiopulmonary resuscitation (CPR) were captured by the simulator and videotape.
RESULTS:
Two paramedic crews averaged 0.7 +/- 0.5 more errors of commission, 0.5 +/- 0.4 more errors of sequence, and 0.8 +/- 0.8 more total errors per resuscitation (+/- 95% CI; p = 0.008, 0.017, and 0.036, respectively). For all interventions analyzed, only time required to achieve intubation differed between the two configurations, with two paramedic crews intubating 63.9 +/- 45.8 seconds more quickly (p = 0.009). CPR compliance was highly variable, and a meaningful statistical difference could not be determined, although performance overall was poor, with both configurations averaging less than 50% compliance.
CONCLUSION:
Two paramedic crews were more error-prone and did not perform most interventions more rapidly with the exception of intubation. These data do not support the proposition that two paramedic crews provide higher quality cardiac care than paramedic-EMT crews in a simulated ventricular fibrillation arrest.
Note: Full text not available
Key points: Paramedic is different from EMT; paramedic has more training and should have more expertise. Simulated study. Two paramedics intubate faster than Paramedic-EMT crew.

5. The association between emergency medical services staffing patterns and out-of-hospital cardiac arrest survival.
OBJECTIVE:
To determine whether the number of advanced life support-trained personnel at the scene of an out-of-hospital cardiac arrest (OHCA) was associated with return of spontaneous circulation (ROSC) or survival to hospital discharge.
METHODS:
A retrospective database review using Utstein-style reporting definitions was conducted in Milwaukee County. All adult (>or= 18 years of age) OHCA cases of presumed cardiac etiology from January 1993 through December 2005 were eligible for inclusion in the study. Cardiac arrests resulting from a drug overdose, suicide, drowning, hypoxia, exsanguination, stroke, or trauma were excluded from the study. Also excluded were cases in which no crew configuration or responding unit was available, cases in which no resuscitation effort was attempted, and cases in which no time data were available. Return of spontaneous circulation and survival to hospital discharge for OHCA patients treated by a crew with two paramedics were compared to those patients treated by crews with three or more paramedics. Multivariable logistic regression was used for the analysis and the results are reported as odds ratios (ORs).
RESULTS:
During the study period, there were 10,298 OHCAs of cardiac etiology. Of those, 10,057 (98%) cases had sufficient data to be included in the analysis. There were 4,229 patients treated by two paramedics (9% survived to discharge), 4,459 patients treated by three paramedics (9% survived to discharge), and 1,369 patients treated by four or more

paramedics (8% survived to discharge). In the multivariable analysis, when referenced against crews with two paramedics and controlled for factors that have a known correlation with cardiac arrest survival, patients treated by crews with three paramedics (0.83, 95% confidence interval [CI] 0.70 to 0.97, p = 0.02) and crews with four or more paramedics (0.66, 95% CI 0.52 to 0.83, p < 0.01) were associated with reduced survival to hospital discharge. Return of spontaneous circulation was not influenced by the number of paramedics present.

CONCLUSIONS:

The presence of three or more paramedics at the scene of OHCA was not associated with improved survival to hospital discharge when compared to crews with two paramedics. Additional research is needed to determine the potential cause of this finding.

Note: Full text not available.

6. Effectiveness of emergency medical services for victims of out-of-hospital cardiac arrest: a metaanalysis.

STUDY OBJECTIVE:

To determine the relative effectiveness of differences in response time interval, proportion of bystander CPR, and type and tier of emergency medical services (EMS) system on survival after out of hospital cardiac arrest.

METHODS:

We performed a comprehensive literature search, excluding EMS systems other than those of interest (systems of interest were those comprising one tier with providers of basic life support [BLS] or advanced life support [ALS] and those comprising two tiers with providers of BLS or BLS-defibrillation followed by ALS), patient population of fewer than 100 cardiac arrests, studies in which we could not determine the total number of arrests of presumed cardiac origin, and studies lacking data on survival to hospital discharge. Metaanalysis using generalized linear model with dispersion estimation for random effects was then performed.

RESULTS:

Increased survival to hospital discharge was significantly associated with tier (P < .01), response time interval (P < .01), and bystander CPR (P = .04). A significant interaction was detected between response time interval and bystander CPR (P = .02). For the studies analyzed, survival was 5.2% in a one-tier EMS system or 10.5% in a two-tier EMS system. A 1-minute decrease in mean response time interval was associated with absolute increases in survival rates of .4% and .7% in a one-tier and two-tier EMS systems, respectively.

CONCLUSION:

Increased survival to hospital discharge may be associated with decreased response time interval and with the use of a two-tier EMS system as opposed to a one-tier system. The data available for this analysis were suboptimal. Policymakers need more methodologically rigorous research to have more reliable and valid estimates of the effectiveness of different EMS systems.

Key points: This is a **literature review** on one-tier vs two tier EMS. One-tier is first responders basically giving BLS until the 2nd responders (two tier) arrive to perform ALS. This study also includes bystanders starting CPR before either one or two tiers arrive so this is an OHCA study.

7. Three-rescuer CPR: the method of choice for firefighter CPR?

STUDY OBJECTIVE:

To compare the quality of CPR provided by firefighters performing three-rescuer CPR with that achieved by firefighters trained to provide standard two-rescuer CPR.

DESIGN:

Eight months after training a large number of firefighters to perform three-rescuer CPR, we used a quasi-experimental design to compare the performance of a randomly selected subset of these companies to that achieved by a control group of engine companies that received refresher training in standard two-rescuer CPR. Both groups used bag-valve masks to provide rescue ventilations. Testing was conducted on a no-notice basis with a recording mannequin. Key actions were scored by an experienced observer using explicit pass-fail criteria. Mannequin-generated strip charts were used to calculate the rate and depth of chest compressions and the ventilatory rate, volume, and minute ventilation in a blinded manner.

SETTING:

Fire stations of the Memphis Fire Department. The department is the sole provider of first-responder emergency care to the citizens of Memphis, Tennessee (population, 610,000).

RESULTS:

Three-rescuer teams delivered a mean minute ventilation substantially greater than that produced by two-rescuer teams (7.7 +/- 5.3 L versus 4.9 +/- 4.2 L, $P < .001$). Intergroup differences in the mean depth of chest compressions were less marked, but they were still significant (17.2 +/- 8.3 mm of recorder-needle deflection versus 13.7 +/- 7.0 mm, $P < .001$).

CONCLUSION:

Three rescuers can produce better CPR than two when a bag-valve-mask device is used. The technique is easily learned and readily retained.

Key points: No intubation done: only bag-valve-mask device. Simulated study.

8. Reducing Hospital Standardized Mortality Rate With Early Interventions

ABSTRACT

Henry Ford Hospital is undertaking multiple initiatives to reduce patient mortality. One such project is the deployment of a rapid response team (RRT). Rapid response teams contribute to reducing in-patient mortality rates by identifying and treating patients at risk for physiological

deterioration outside the intensive care unit (ICU) setting. Rapid response teams differ from code teams because they proactively look for ‘‘at-risk’’ patients, whereas code teams are activated after a patient’s arrest. Team members include ICU nurses, medical doctors, house managers, and respiratory therapists, with the ICU nurses acting as primary responders. The RRT at Henry Ford Hospital is available 24 hours a day, 7 days a week. Criteria for the members of the RRT were developed by a committee of physician and nursing leadership. Nurses on the RRT need a minimum of 2 to 3 years of intensive care background. Weekly meetings with planning committee members were held to discuss issues regarding the implementation of the RRT pilot. The RRT committee consists of 3 nurseadministrators, a house manager, a clinical nurse specialist,

2 nurse managers, clinical coordinators, a quality assurance nurse, a statistician, and the medical director of medical critical care.
The population analyzed was a sample of 1,335 RRT consults and 207 medical ICU discharge follow-ups. The processes that were measured were percentage of blue alerts outside the ICU, the number of calls to the RRT, and the location, reason, time, and outcome of an RRT
call. Outcome measures consisted of unadjusted hospital mortality rate, blue alerts per 1,000 discharges, percentage of patients with blue alerts discharged alive, and number of days between blue alerts on the pilot unit. Initial results are positive, with evidence that the number of blue alerts on general practice units is being reduced.
Statistical data collected from the consult forms indicate that the greatest number of occurrences were respiratory triggers. From a sample size of 1,335 consults, 30% of the sample group had low pulse oximetry, 30% presented with respiratory distress, and 20% had respiratory rate issues.
Future implications for the RRT will be along the lines of early sepsis recognition, retention and recruitment tool, education and practice links, and using families as initiators of a RRT consult.
KEY WORDS
Early interventions, Henry Ford Hospital, ICU nurses, Patient deterioration, Quality initiatives, Rapid Response team, Trigger mechanisms