

WORKSHEET for Evidence-Based Review of Science for Veterinary CPR

1. Basic Demographics

Worksheet author(s)

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2. Clinical question:

In veterinary CPR providers (P) does assessment of skills post training (I) compared with no assessment (C) improve learning retention after training (O)?

3. Conflict of interest specific to this question:

I do not have any conflict of interest disclosures relevant to this worksheet.

4. Search strategy (including electronic databases searched):

4a. Databases

-MEDLINE via PUBMED (any date to present = 2011) (performed on June 27, 2011):

1. Resuscitat*
2. CPR
3. CPR
4. Train*
5. Educat*
6. Teach*
7. Test*
8. Assess*
9. Quiz*
10. Exam*

1, 4, and 7: 2 of 361 hits were relevant

1, 4, and 8: 2 additional of 877 hits were relevant

1, 4, and 9: 0 additional of 4 hits were relevant

1, 4, and 10: 0 additional of 364 hits were relevant

1, 5, and 7: 0 additional of 400 hits were relevant

1, 5, and 8: 2 additional of 1001 hits were relevant

1, 5, and 9: 0 additional of 3 hits were relevant

1, 5, and 10: 0 additional of 439 hits were relevant

1, 6, and 7: 0 additional of 185 hits were relevant

1, 6, and 8: 0 additional of 426 hits were relevant

1, 6, and 9: 0 additional of 1 hit were relevant

1, 6, and 10: 0 additional of 200 hits were relevant

2, 4, and 7: 0 additional of 156 hits were relevant

2, 4, and 8: 0 additional of 234 hits were relevant

2, 4, and 9: 0 additional of 1 hit were relevant

2, 4, and 10: 0 additional of 111 hits were relevant
 2, 5, and 7: 0 additional of 168 hits were relevant
 2, 5, and 8: 0 additional of 252 hits were relevant
 2, 5, and 9: 0 additional of 1 hit were relevant
 2, 5, and 10: 0 additional of 118 hits were relevant
 2, 6, and 7: 0 additional of 68 hits were relevant
 2, 6, and 8: 0 additional of 98 hits were relevant
 2, 6, and 9: no hits
 2, 6, and 10: 0 additional of 49 hits were relevant
 3, 4, and 7: no hits
 3, 4, and 8: no hits
 3, 4, and 9: no hits
 3, 4, and 10: 0 additional of 2 hits were relevant
 3, 5, and 7: no hits
 3, 5, and 8: no hits
 3, 5, and 9: no hits
 3, 5, and 10: no hits
 3, 6, and 7: no hits
 3, 6, and 8: 0 additional of 1 hit were relevant
 3, 6, and 9: no hits
 3, 6, and 10: no hits

-CAB (1910 to present = 2011)

ab:(resuscitat* OR cpr OR cpcr) AND (train* OR educat* OR teach*) AND (test* OR assess* OR quiz* OR exam*)

4b. Other sources

-Cited by (in google scholar) for:

Kromann, C. B., Jensen, M. L. Ringsted, C. (2009). "The effect of testing on skills learning." *Med Educ* 43(1):21.

-All references of the following relevant article were checked:

Kromann, C. B., Jensen, M. L. Ringsted, C. (2009). "The effect of testing on skills learning." *Med Educ* 43(1):21.

No additional relevant hits

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

Inclusion criteria

Studies evaluating impact of assessment on learning outcomes during human or animal life support training.

Training can involve instructor led, electronic learning, self instruction, skills training, simulation or other form of resuscitation training.

Exclusion criteria

Articles in foreign languages, studies not evaluating assessment in the context of resuscitation training, abstract only, editorials

4d. Number of articles/sources meeting criteria for further review: 6

After detailed review, three articles were relevant.

5. Summary of evidence

Evidence Supporting Clinical Question

Good						Kromann 2009; E Kromann 2011; E
Fair						
Poor						
	1	2	3	4	5	6
Level of evidence (P)						

A = Return of spontaneous circulation
B = Survival of event
studies

C = Survival to hospital discharge
D = Intact neurological survival

E = Other endpoint
Italics = Non-target species

Evidence Neutral to Clinical question

Good						Kromann 2010; E
Fair						
Poor						
	1	2	3	4	5	6
Level of evidence						

(P)						
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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*

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:

A few studies have examined the effect of assessment post training on learning retention of CPR skills. Two studies (Kromann 2009 and Kromann 2011) found a positive effect for learning retention 2 weeks after instruction. One study (Kromann 2010) found a positive, but statistically insignificant effect for learning retention 6 months after instruction.

The model used in all three studies involved a 4 hour course of training in CPR with senior students in human medicine. Students were randomized into a control group which involved 4 hours of instruction, or an intervention group which involved 3.5 hours of instruction and then 0.5 hours of testing. For the first study (Kromann 2009), a single-blinded assessor tested all of the students two weeks after the course, using a 25-item checklist with each item scored 0-5. The learning outcome in the intervention group was significantly higher (p<0.001) with a large effect size (ES=0.93). A later study (Kromann 2011) repeated these findings (p=0.006), but also noted that the effect was significant for male learners (p<0.001) but not for female learners (p=0.11). A third study (Kromann 2010) evaluated the learning outcome 6 months after the training course,

and found a small positive effect (ES=0.40) with the intervention group, although it was not statistically significant (p=0.06).

Considering that all the relevant studies favor assessment as part of CPR training, and the lack of opposing studies, assessment post training seems to enhance CPR instruction. At the same time, the number of studies on this topic is small, each one evaluated students of human not veterinary medicine, and were performed by the same research team. With that in mind, further studies by different research groups, and in the setting of veterinary CPR would strengthen the conclusions.

7. Conclusion

Considering that a few studies with human medical students favored the use of assessment post training in CPR, we should presume that assessment post training in veterinary CPR improves learning retention.

8. Acknowledgement

9. Citation list

1. Kromann CB, Jensen ML, Ringsted C. *The effect of testing on skills learning. Medical Education, 2009;43:21-27.*

OBJECTIVES: In addition to the extrinsic effects of assessment and examinations on students' study habits, testing can have an intrinsic effect on the memory of studied material. Whether this testing effect also applies to skills learning is not known. However, this is especially interesting in view of the need to maximise learning outcomes from costly simulation-based courses. This study was conducted to determine whether testing as the final activity in a skills course increases learning outcome compared with an equal amount of time spent practising the skill. **METHODS:** We carried out a prospective, controlled, randomised, single-blind, post-test-only intervention study, preceded by a similar pre- and post-test pilot study in order to make a power calculation. A total of 140 medical students participating in a mandatory 4-hour in-hospital resuscitation course in the seventh semester were randomised to either the intervention or control group and were invited to participate in an assessment of learning outcome. The intervention course included 3.5 hours of instruction and training followed by 30 minutes of testing. The control course included 4 hours of instruction and training. Participant learning outcomes were assessed 2 weeks after the course in a simulated scenario using a checklist. Total assessment scores were compared between the two groups. **RESULTS:** Overall, 81 of the 140 students volunteered to participate. Learning outcomes were significantly higher in the intervention group (n = 41; mean score 82.8%, 95% confidence interval [CI] 79.4-86.2) compared with the control group (n = 40; mean score 73.3%, 95% CI 70.5-76.1) (P < 0.001). Effect size was 0.93. **CONCLUSIONS:** Testing as a final activity in a resuscitation skills course for medical students increases learning outcome compared with spending an equal amount of time practising the skills.

- LOE 6. Graded as good. Favors question

2. Kromann CB, Bohnstedt C, et al. *The testing effect on skills learning might last 6 months. Adv in Health Sci Educ, 2010;15:395-401.*

Abstract: In a recent study we found that testing as a final activity in a skills course increases the learning

outcome compared to spending an equal amount of time practicing. Whether this testing effect measured as skills performance can be demonstrated on long-term basis is not known. The research question was: does testing as a final activity in a cardio-pulmonary resuscitation (CPR) skills course increase learning outcome when assessed after half a year, compared to spending an equal amount of time practicing? The study was an assessor-blinded randomised controlled trial. A convenient sample of 7th semester medical students attending a mandatory CPR course was randomised to intervention course or control course. Participants were taught in small groups. The intervention course included 3.5 h skills training plus 30 min of skills testing. The practiceonly

control course lasted 4 h. Both groups were invited to a retention assessment of CPR skills half a year later. Participants included 89/180 (50%) of those invited to participate in the study. Mean performance score was 75.9 (SD 11.0) in the intervention group (N = 48) and 70.3 (SD 17.1) in the control group, effect size 0.4. The difference between groups was not statistically significant, P = 0.06. This study suggests that testing as a final activity in a CPR skills course might have an effect on long-term learning outcome compared to spending an equal amount of time practicing the skills. Although this difference was not statistically significant, the identified effect size of 0.4 can have important clinical and educational implications.

- LOE 6 (quality good). Neutral to question.

3. Kromann CB, Jensen ML, Ringsted C. Test-enhanced learning may be a gender-related phenomenon explained by changes in cortisol level. *Medical Education*, 2011;45:192-199.

Abstract

CONTEXT:

Testing increases memory of a topic studied more than additional study or training. The mechanisms by which this occurs are not clearly understood. Testing can be stressful and studies suggest that the stress hormone cortisol has modulating effects on memory, predominantly in men. The aim of this study was to investigate whether cardiopulmonary resuscitation (CPR) skills testing induce a cortisol increase, whether the cortisol increase enhances retention of CPR skills, and how this relates to gender.

METHODS:

We randomised a convenience sample of medical students attending a mandatory course to one intervention and one control group. Students received a 4-hour course on CPR skills. During the final half-hour of the intervention course, participants were tested in CPR scenarios, whereas the control group underwent additional training. We assessed learning outcomes 2 weeks later by rating student performance in a CPR scenario using a checklist and a single blinded assessor. We measured salivary cortisol pre-course, half an hour before the end of the course and post-course, and compared learning outcomes and cortisol responses between groups and genders.

RESULTS:

In total, 146 of 202 (72%) students completed the study. We found a significant difference in learning outcome between the intervention and control groups for both genders (mean \pm standard deviation, 5.0 ± 3.5 ; $p = 0.006$). We found a significant effect of increase in cortisol on learning outcome in men. The correlation between learning outcome and cortisol increase was medium to large for men ($r = 0.38$), but not for women ($r = -0.05$).

CONCLUSIONS:

Cardiopulmonary resuscitation skills testing induces a rise in cortisol in men, which is related to the better retention of skills in men. Cortisol modulates test-enhanced learning in men.

- LOE 6 (quality good). Favors question.