

The importance of the team in small animal CPR

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This review draws on evidence from human medicine to assess the team factors most relevant to small animal cardiopulmonary resuscitation (CPR). It is increasingly being recognised that leadership, team building, communication and situational awareness all impact both the team's experience and clinical outcomes. Leadership training, nurse-led teams, debriefing, closed-loop communication and cognitive aids have all been shown to improve CPR performance and thus deserve consideration alongside the practical elements of arrest and resuscitation. There is limited primary evidence to support this claim in veterinary medicine. However, the mental models underpinning clinical human factors are largely seen as transferable, with veterinary governing bodies supporting their inclusion in practice culture and training.

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Cardiopulmonary arrest results in death without immediate intervention (Hoehne et al, 2023). Cardiopulmonary resuscitation (CPR) promotes a return of spontaneous circulation for the patient (Dazio et al, 2023). It has been shown that survival to discharge in small animals is approximately 5% (McIntyre et al, 2014). In contrast, human hospitals are believed to discharge around 25% of patients following in-hospital cardiac arrest (Andersen et al, 2019). The reasons for this difference are multifaceted; however, it may be sensible to look to the human medical field when suggesting improvements to current CPR training. CPR human factors are an emergent focus in human CPR, and include leadership, psychological safety, situational awareness, debriefing and communication. It is believed that if these principles are examined within the veterinary field, small animal CPR can improve both in patient outcomes and team experience.

Leadership

The leader is one of the most influential CPR team factors. Leaders require effective delegation, observation and time management skills (Haskey, 2016). Leaders allocate roles to the team, ensuring all aspects of basic life support and advanced life support (ALS) are performed. Additionally, they ensure proper timing of cycles and guideline adherence. The consequences of leadership failure can be severe. Leadership failure is the cause of 4% of the total errors submitted to veterinary insurance claims (Oxtoby et al, 2015).

Effective leadership is vital for teamwork, and there is increasing evidence within human medicine that it also improves clinical outcomes. In one randomised study, 180 fifth year medical students received CPR training and were allocated to two groups. One group formed teams who had additional advanced life support instruction, while in the other, one member from each team was randomly selected to receive leadership training (Fernandez Castelao et al, 2015). The teams then performed simulated CPR. Teams with leadership training demonstrated significantly better adherence to advanced life support guidelines. The study concluded that training only one leader benefits the entire team. This conclusion is also valuable in demonstrating the importance of human factors during CPR; while practical advanced life support training is vital for proper technique, it is most effective when combined with non-technical leadership training.

This conclusion is supported in the human literature (Gabr, 2019). However, guidelines from the Reassessment Campaign on Veterinary Resuscitation (RECOVER) (undergoing updates at time of writing) have revealed a lack of research into this area in veterinary medicine (McMichael et al, 2012). The importance of leadership in veterinary CPR is acknowledged in the literature (Haskey, 2016). However, there are some key differences between the human and veterinary fields. In human medicine, it is desirable for the team leader to be hands-off, and not actively perform resuscitation (Hunziker et al, 2010). This view stems from a 1999 observational study, which found that teams with a hands-

off leader benefitted from both superior team structure and better task completion (Cooper and Wakelam, 1999). The age of this study is a significant limitation, yet it remains seminal in the field as this specific research question has not been effectively repeated. The practical application of this to veterinary medicine is challenging, as it was found in a large internet survey of over 600 participants that 78% of CPR in first opinion American practices was performed in teams of under three people (Boller et al, 2010). All available team members will likely be required for resuscitation, making hands-off leadership impossible in many teams. However, leadership is still important when this is the case, and including delegation, organisation and effective communication in teamwide CPR training can help prevent smaller team sizes from impacting the effectiveness of the resuscitation attempt.

Nurse-led CPR

Traditionally, doctors or veterinary surgeons have led CPR. Often, however, it is nurses who identify cardiopulmonary arrest and initiate resuscitation (Rajeswaran et al, 2018). Basic life support involves accurate chest compressions, establishing an airway and providing ventilation (Haskey, 2016). In human medicine, it has been suggested that if nurses lead basic life support, the lead physician can focus better on advanced life support and planning (Armstrong et al, 2021). Armstrong et al (2021) explored leadership via multi-method, in situ simulations. In total, 15 senior nurses were observed before and after leadership training. Post-interventional surveys showed resoundingly positive reactions, such as feelings of 'empowerment'. There was also a statistically significant increase in leadership scores among the participants. A similar small animal model has been described where a confident veterinary nurse leads CPR while the lead veterinarian focuses exclusively on diagnostics and planning (Yagi, 2017). Yagi (2017) claims anecdotally that this tactic has led to drastically improved CPR.

Empowering veterinary nurses to take on a leadership role in CPR could benefit both patients and the team. As described by Armstrong et al (2021), nurses trusted to lead CPR report feelings of renewed confidence, job satisfaction and a full use of skills. Additionally, if nurses are competent in this position, it helps overcome the limitations of a small team. If only one veterinary surgeon is present, the knowledge that a veterinary nurse will take charge of the CPR attempt can allow for them to focus on other essential tasks, such as diagnostics and client communication. Encouraging nurse-based leadership will require significant trust within the team. Practice-wide education is necessary for acknowledging the limitations of the nurse's role including drug prescription, and appropriate support must be offered for advanced life support procedures such as electrocardiography interpretation. To help encourage nurse-based leadership during CPR, there must be an open and honest dialogue between veterinary surgeons and nurses to establish both confidence and trust.

Team dynamics

Psychological safety relates to the ability of professionals to challenge error (Manthous and Hollingshead, 2011). It is suggested that overly directive styles prevent teams from raising concerns and can lead to feelings of distress and breaches of patient safety. Maintaining psychological safety during CPR can be challenging, as speed and accuracy are absolute necessities, meaning that a directive leadership style consisting of a one-way flow of instruction coupled with unquestioning compliance has generally been favoured (Ford et al, 2016).

Open communication, once the arrest has passed, may help negate negative emotions, as can adopting a practice culture that prioritises positive interprofessional relationships between veterinary surgeons, veterinary nurses and other members of the clinical team. In one study, 39 veterinary and veterinary nursing students from the same institution participated in focus groups and CPR roleplay. A 'readiness for interprofessional learning scale' that has been validated in human medicine was used before, immediately after and four months following the trial. Statistical analysis was supplemented by qualitative statements (Kinnison et al, 2011). Both professions' code of professional conduct state that interprofessional communication is critical; however, most taught courses do not incorporate interprofessional education (Kinnison et al, 2011). No students had previously learned with the other group. In the study, one student from each course was assigned to a group, making a resuscitation team of two. The teams simulated CPR and were scored via a five-point scale for technical skill performance, teamwork, leadership and communication.

Before the intervention, the only significant difference between the two groups was a heightened sense of professional identity in the veterinary students. Interestingly, professional identity scores decreased post-intervention, while teamwork and patient centredness significantly increased. Nurses reported feeling less intimidated by vets and understanding of the other discipline's role showed all-round improvement. It was also a popular intervention among the students, with 97% claiming the session to have been enjoyable.

It is well known that veterinary teams require regular CPR training (Haskey, 2016). The findings of Kinnison et al (2011) demonstrate that the most impactful method of preparing teams for CPR is ensuring that veterinary surgeons, nurses and animal care assistants are trained together. Interdisciplinary sessions help improve team cohesion and promote adequate psychological safety, ensuring that teams share a mental model and are sympathetic to the challenges that colleagues face.

Debriefing

Debriefing after cardiopulmonary arrest can be used to improve both leadership and psychological safety. Debriefing following a stressful clinical scenario permits acknowledgement of feelings and helps prevent adverse mental states (Jones, 2021). There is also compelling evidence to

support the impact on clinical outcomes: one observational study of human cardiopulmonary arrest patients concluded that 52% of patients survived cardiopulmonary arrest once debriefing had been incorporated into clinical protocol, a huge improvement on the 33% before the intervention (Wolfe et al, 2014). One method of pulling focus onto communication is raised by Timothy et al (2021) in the form of a novel post-arrest debriefing tool. This sheet includes check boxes for technical and non-technical skills, including intubation, defibrillation, role allocation and closed-loop communication (Timothy et al, 2021). In a review of this subject, Jones (2021) concluded that a 'hot debrief' immediately after CPR could not only help improve survival rates in small animals, but also cultivates a positive mental environment for the team, where feelings can be acknowledged once the urgency of the arrest has passed. Use of a debriefing tool post CPR is a simple yet highly effective way of merging human and technical factors to promote both emotional wellbeing and technical skills.

Communication

Closed-loop communication (CLC) consists of three parts: the initial call-out of the message, a verbalisation to acknowledge it, and finally confirmation from the first person that the message has been correctly interpreted (Härgestam et al, 2013). Closed-loop communication is recommended for emergencies and is also encouraged by RECOVER for small animal CPR to reduce errors (Fletcher et al, 2012). Despite consistent endorsement, use of closed-loop communication in veterinary practice is limited. One study which took place across a year within a veterinary hospital recorded closed-loop communication in only 27% of resuscitations (Timothy et al, 2021). As closed-loop communication is known to prevent misunderstanding, reduce background noise and increase the speed of orders being followed, it is recommended that veterinary teams use this method of communication (Haskey, 2016). Limited use of closed-loop communication in practice may be because of a lack of understanding surrounding this non-technical skill.

As discussed, debriefing post-arrest can help the team to come together and discuss what went well, as well as areas for potential improvement. Including reference to non-technical skills like communication alongside practical skills such as compression will help ensure that they are appropriately acknowledged. Discussing communication during the debrief, as well as incorporating it into prearrest training will help veterinary teams to improve the quality of their teamwork, and by extension increase the effectiveness of resuscitation.

Situational awareness

Situational awareness is an evolving concept. RCVS Knowledge define it as the ability to foresee adverse events and respond appropriately. They report that a veterinary surgeon or nurse who becomes fixated on a task may fail to notice

the passage of time or other factors. A famous example from human medicine, is the case of repeated attempts to intubate a patient, despite saturation levels and protocol demanding another response (Silver-MacMahon, 2022). In this case, the concerns of other team members who correctly identified the appropriate procedure, and their subsequent challenge to the lapse of situational awareness were ignored.

Highly stressful clinical scenarios demand a rapid response and sustained situational awareness. The RCVS concludes that this emerges from experience: familiarity with a scenario permits pattern identification, creating an efficient mental model. From this perspective, veterinary professionals with a richer clinical experience will react more appropriately to complex situations and are less likely to experience task fixation (Silver-MacMahon, 2022).

These conclusions are not unanimously accepted. Some claim that if a novice with recent training is vigilant, someone qualified for longer may move unintentionally towards complacency (Fore and Sculli, 2013). These differing perspectives highlight that a loss of situational awareness can occur in any team member, of all experience levels. Neither conclusion is drawn from primary research; however, the unique position of the RCVS to oversee the profession means that its views are drawn from an extensive evidence and experience base.

A logical conclusion is that teams should be trained in situational awareness. However, there is some evidence that this skill cannot be learned via traditional didactic techniques. In one study, several behaviour parameters, including situational awareness, were measured on a 4-point scale before and after a 9-hour training session in non-technical skills for staff in a human hospital (McCulloch et al, 2009). Observations were made from 103 real operations. The study yielded positive results, with incidence of clinical error decreasing with a concurrent improvement in teamwork. There was not, however, an increase in situational awareness scores. This implies that situational awareness, unlike other non-technical skills, does not respond to traditional teaching.

Subsequently, lapses of situational awareness are highly challenging to prevent. However, there are several practical steps that teams can take. One example in veterinary medicine is the cognitive memory mnemonic PACE (Probe, Alert, Challenge, Emergency). This permits team members to challenge task fixation, using increasingly urgent language (Silver-MacMahon, 2022). Such mnemonics are highly practical. The 'probe' section involves an open question; however, if this is not sufficient it can be progressed to 'alert' where a specific team member's name is mentioned, followed by 'challenge' and finally 'emergency' where actions are taken to prevent harm. Correcting lapses of situational awareness often requires other team members to speak up, linking this human factor with teamwork, leadership and communication. Tools such as PACE can help to make this less intimidating and ensure a structured response.

Training

The most frequently reached conclusion across the veterinary and human literature is that CPR teams benefit from regular training sessions. Retraining is critical to retain practical skills and improve survival rates and should occur at a minimum of every 3 to 6 months (Jones, 2021). CPR training across the literature is described almost exclusively in the context of practical skills, with efficiency of compression and ventilation being commonly assessed. Much less data have been gathered to support non-technical skill training. However, there are resources available to veterinary teams looking to improve team cohesion, including the debriefing sheets and RCVS Knowledge-approved cognitive aids for situational awareness. Using these and other sources, as well as including communication and leadership in CPR training roleplay, can all work harmoniously to promote the most efficient CPR teams.

Conclusions

The team itself is a hugely influential part of CPR which must be considered alongside patient and equipment factors. The current evidence supports the incorporation of leadership, team building, communication, debriefing and situational awareness into practice culture and training. The evidence base in human medicine suggests that this improves both patient outcome and team satisfaction. Further primary research into this area is required in the veterinary industry, however current knowledge also suggests that if the needs of the team are considered alongside the needs of the patient, resuscitation will prove all round more effective. **VN**

Conflicts of interest

The authors declare that there are no conflicts of interest.

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KEY POINTS

- Cardiopulmonary arrest is a true emergency with significant implications for patient health and team wellbeing.
- Traditionally CPR training has focused on technical skills such as compression and ventilation, usually via roleplay.
- There is increasing evidence to support the incorporation of team factors into CPR training.
- Leadership, communication, team dynamics, debriefing and situational awareness are closely interlinked, with each impacting the team's performance.

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