



Commentary

Teamwork and leadership in out-of-hospital cardiac arrest – do these non-technical skills require attention?

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Abstract

The science of cardiopulmonary resuscitation (CPR) is now well established and incorporated into training programs to maximise patient survival. There is an increased understanding that non-technical skills such as teamwork and leadership can play a vital role in improving CPR quality, patient outcomes and clinician occupational health. Despite this, these non-technical skills remain somewhat neglected in the context of out-of-hospital cardiac arrest. With reference to the literature this commentary provides a discussion to reinforce the need for a greater focus to this area of practice and build a case for further research and training.

Keywords:

out-of-hospital cardiac arrest; pre-hospital; paramedicine; emergency medical service (EMS); non-technical skill; teamwork; leadership

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Introduction

Each year, out-of-hospital cardiac arrest (OHCA) has a significant impact on mortality rates, causing millions of deaths worldwide (1,2). Despite advances in research and practice, survival from OHCA has not improved significantly in the past 30 years, with average survival-to-hospital discharge remaining at around 8% (3,4). Application of early high quality cardiopulmonary resuscitation (CPR) is acknowledged as a primary component in the chain of survival. Moreover, it is increasingly apparent that the science of CPR technical skills is now well established to maximise patient survival. International guidelines recommend reducing peri-shock pause, maintaining adequate rate and depth of compressions, fully releasing compressions, and avoiding over ventilation (5). These technical skills often form the main focus of out-of-hospital CPR training programs along with other advanced life support (ALS) skills. Despite clear CPR algorithms based on international resuscitation guidelines, the quality of out-of-hospital CPR can be questionable (6,7).

Paramedics often work in teams of two and are comfortable with making decisions alone. However, OHCA provides a unique challenge, where larger ad-hoc teams of paramedics come together made up of personnel with varying degrees of technical and non-technical skills. To maximise the quality of CPR technical skills, a coordinated team approach and efficient leadership are required. Unfortunately these non-technical skills are often neglected in out-of-hospital CPR education, despite international resuscitation guidelines recommending their inclusion (8-10) and the literature suggesting a positive link with patient outcomes (11-13). Furthermore, the ad-hoc nature of OHCA teams may make it difficult to develop a consistent team approach.

Using pertinent literature, this article aims to provide a discussion around the impacts of teamwork and leadership in OHCA and advocates that a greater focus on non-technical skills in out-of-hospital CPR training would be a defensible and rational decision.

Teamwork

Despite extensive existing research in relation to teamwork, a standardised definition of teamwork has not been developed (14). In its crudest sense, teamwork can be viewed as how people carry out a task together (15). The input, process, outcome (IPO) framework is commonly used to describe how teams perform, suggesting that inputs affect team processes which subsequently affect outcomes (16). Team processes can be defined as the cognitive, verbal and behavioural activities, such as communication, leadership, coordination and decision making, which enable inputs to be converted to outcomes (15,17). In the OHCA setting these outcomes may be represented by process performance measures such as CPR quality or outcome performance measures such as patient survival (18).

The importance of teamwork is not a novel concept within healthcare; over 15 years ago two reports from the United States Institute of Medicine: *To Err is Human*, and *Crossing the Quality Chasm*, identified teamwork as an important factor in improving patient safety (19,20). This notion came about after observing patients being exposed to greater harm as the result of poor practitioner non-technical skills (20). It is now widely agreed that non-technical skills such as teamwork, communication, leadership and performance monitoring are required to complement technical skills and improve quality of care (8,10,21-23). Over the past 35 years the aviation industry has pioneered improvements in teamwork, with a focus on crew resource management, after it was identified that the majority of accidents were the result of poor human interaction (24,25). Similarly, adverse events in healthcare are linked to poor execution of non-technical skills (26,27). Lessons from aviation and other high risk industries such as nuclear power, rail and mining has led to non-technical skills being recognised in training for anaesthesia, surgery and resuscitation teams (23,26,28,29). Comparisons of safety in aviation and healthcare are regularly made however, there are limitations to the generalisability of lessons from aviation and the transfer of data should be nuanced. For example, a pilot will never take off without a co-pilot and full complement of crew. Comparatively, in healthcare it is not uncommon to be understaffed with high levels of staff fatigue. Furthermore, pilots are left to fly the plane without contact with any of the passengers. This is not the case in healthcare where interaction with patients and members of the public take place and can sometimes be a distraction to good teamwork. Finally, a pilot has a vested interest in ensuring the safety of a flight, as their own safety depends on it. A healthcare practitioner does not experience this same level of personal interest in the procedures they perform.

Research from medical resuscitation studies indicate procedural skills and knowledge alone are insufficient to optimise patient outcomes (30). Poor teamwork behaviours have been associated with errors during neonatal resuscitation (28,31). Other studies have indicated that teamwork can influence critical components of CPR quality, with improved teamwork linked to decreased pauses in CPR and reduced time to defibrillation during simulated resuscitation (32,33). There is a paucity of evidence linking teamwork directly with survival outcomes during OHCA, however, it is acknowledged high quality CPR has the greatest influence on survival outcomes (5). It therefore seems intuitive that measures should be taken to ensure good teamwork during OHCA.

Team familiarity is an area of increasing interest with research suggesting that familiar teams outperform unfamiliar teams (34). Teams with more consistent membership allow individuals to refine their teamwork knowledge, skills and attitudes (35). Research from the aviation industry has demonstrated that familiar teams commit fewer errors and are more likely to request and accept backup (36,37). Similar positive associations between team member familiarity and improved

performance have been demonstrated in industry and sport (38,39). Within healthcare, team familiarity has been linked to improved surgical performance and reduction in adverse events (40-42). Furthermore, established teams have been shown to outperform ad-hoc teams during simulated cardiac arrest (32).

The studies cited in this section have identified a number of characteristics that may be important in improving teamwork (Table 1). However, these studies have taken place across varying environments and it is unclear as to how they can be generalised to the healthcare environment, or indeed OHCA. Furthermore, it is unclear from many of the studies which of the characteristics are most important or have the greatest influence on effective teamwork. In general terms, improvements in the characteristics listed resulted in positive effects on team performance as such, they give a starting point on which to create a solid teamwork model for OHCA.

Leadership

Leadership is the act of influencing a team in order that it may set and achieve a common task (43). It is asserted that increased stress and confusion can arise at resuscitations lacking in leadership (44). Along with teamwork, leadership is an important non-technical skill which can potentially influence resuscitation outcomes (13). Leaders require specific characteristics and it is unclear if all individuals are able to fulfil this role (45,46). Some of the characteristics discussed in the literature are listed in Table 2. However, it is unclear which of these characteristics have the greatest influence or impact on the performance of the leader or patient outcomes.

A randomised study by Hunziker et al found that a group of medical students who received an intervention focussing on leadership training performed higher quality CPR during

simulated cardiac arrest than those receiving technical skills coaching. This finding was repeated at 4 months follow up (47). Teams led by leaders with superior leadership skills have also been associated with improved CPR quality (48). In this particular study, groups with better leaders demonstrated shorter time to defibrillation, shorter pre-shock pause and reduced hands-off time, factors which correlate with improved survival (5,49). The authors also concluded that leadership skills can be taught and should be incorporated into resuscitation training (48).

When leaders develop a structured team approach the team displays improved team dynamics and superior CPR quality (50). Leaders who adopt a hands-off approach during resuscitation are more likely to have success developing a structured team (50). Furthermore, a simulated study by Marsch et al identified poor leadership and communication led to team deviation from CPR guidelines and failure to defibrillate a shockable rhythm, despite participants having adequate theoretical knowledge of when to implement this skill (22). Emerging in the literature are details regarding the implementation of specialist OHCA teams, specifically trained in leadership and communication, which have resulted in improved survival outcomes (51-53). However, difficulties remain in understanding which aspects of care associated with these strategies, improve outcome.

There is a paucity of evidence linking leadership behaviour and patient survival during CPR. However, the literature suggests that improved leadership is associated with reduced delays in commencing CPR, reduced chest compression pauses, and adequate rate and depth of chest compressions (48,49). These factors correlate strongly with reduced patient mortality and strengthen the argument to have a greater focus on leadership training for OHCA.

Table 1. Factors which characterise good teamwork

Characteristic of a team	Evidence from	Reference
Consistent membership	Aviation	35
Familiarity	Industry	38
	Sport (basketball)	39
	Medical simulation	32
	Aviation	36,37
	Ambulance service	40
	Surgery	42
Task focus	Medical simulation	32, 33
Information sharing	Aviation	26
	Neonatal resuscitation	31
Situational awareness	Surgery	27
	Neonatal resuscitation	28, 29, 31
Assertion	Surgery	27
	Neonatal resuscitation	28, 29, 31
Contingency management	Surgery	27
	Neonatal resuscitation	28,29

Table 2. Factors which characterise a good leader

Characteristic of leadership	Evidence from	Reference
Direction and command	Resuscitation simulation	22, 46, 48, 49
Task assignment	Resuscitation simulation	22, 46, 48, 49
Decision making	Resuscitation simulation	22, 46, 48, 49
Effective communication	Resuscitation simulation	46
Planned tasks	Resuscitation simulation	48, 49
Initiates structure	Resuscitation simulation	49
Hands off	Resuscitation simulation	50

Teamwork and leadership during OHCA

During OHCA paramedic teams come together ad-hoc in a high pressure environment, with varying levels of experience, skill and familiarity, leaving little time for the normal processes of group development (54). As such, paramedics attempt to form effective teams and focus on patient care concurrently.

Teamwork and leadership is an essential aspect of resuscitation which is recognised by the international resuscitation community. International resuscitation guidelines have recently endorsed the importance of teamwork and leadership training for OHCA and recommended these non-technical skills be incorporated into ALS training (8-10). Despite an increasing evidence base from other areas of healthcare, industry and sport, little research exists around the role of leadership and teamwork in OHCA. A recent literature review on teamwork and leadership during resuscitation identified 10 articles relating to trauma and six relating to medical resuscitation, none of which were from a pre-hospital setting (55). Moreover, a review examining the effect of team processes on clinical performance identified 28 papers from the emergency department, operating theatre and labour suite, three papers were related to in-hospital cardiac arrest (18). This highlights the disparity in OHCA non-technical skills research, despite an awareness of the importance of these skills for almost 20 years.

Despite promising results of the effect of good teamwork and leadership from other areas of healthcare, it is unknown if the results translate to OHCA due to a number of key differences. In the hospital environment, resuscitation is consistently led by a more senior physician. However, given the nature of the pre-hospital model the first clinicians on scene are required to take the lead regardless of their experience or training. This creates a situation where all out-of-hospital clinicians should have some ability to take control at OHCA, despite the literature suggesting that not all individuals may be capable of performing a leadership function. Attempts have been made to address this in some services by dispatching specialist paramedic clinicians trained in leadership and communication. Moreover, teams in the pre-hospital setting come together on a more ad-hoc basis when compared to the hospital environment. The literature

suggests that lack of team familiarity and ad-hoc teams can hinder team performance.

The literature has highlighted key characteristics for teams and leaders (Tables 1 and 2) however, it is unclear if these translate to the diverse working environment faced by the out-of-hospital clinician. Unlike a hospital team, the OHCA team is required to work with a lack of information and in an environment that is affected by the weather, changing physical workspace, bystanders, traffic, hazardous materials and reduced levels of equipment.

Good teamwork and leadership behaviours promote high quality CPR performance in simulated resuscitations improving factors which correlate with survival outcomes. However, these findings have predominantly been derived from in-hospital (doctor and nurse) teams and it is unclear if this would be replicated in out-of-hospital studies. It is widely acknowledged that pre-hospital research is difficult to conduct, and this may explain why this gap in the research remains.

This article has predominantly focussed on how teamwork and leadership enhance quality of CPR and potential patient outcomes. However, it has also been shown that good leadership and teamwork is associated with improved clinician occupational wellbeing, reducing team conflict and promoting good team dynamics (50,56,57). In an era where there is increasing importance in maintaining the mental health and wellbeing of healthcare professionals this is a valid outcome and one which further strengthens the argument for improving teamwork and leadership during OHCA.

Conclusion

Paramedics are responsible for initiating CPR ALS during OHCA, a vital link in the chain of survival. Recent research indicates the non-technical skills of teamwork and leadership can improve the critical components of CPR quality which are associated with improved survival outcomes. Moreover, good teamwork and leadership can have benefits for clinician occupational wellbeing. As such, ambulance services and those responsible for out-of-hospital CPR training programs should consider placing greater emphasis on training staff in these non-technical skills. Furthermore, the role of specialist OHCA teams trained in these skills should also be explored, given their successful implementation and impact within some ambulance services. There is a paucity of research focussing specifically on non-technical skills in OHCA which warrants further exploration to determine the most effective way to teach and implement these skills.

Competing interests

The author has no competing interests to declare. The author of this paper has completed the ICMJE conflict of interest statement.

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