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Leadership of resuscitation teams: 'Lighthouse Leadership'

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Abstract

Aim: The purpose of this study was to determine the relationship between leadership behaviour, team dynamics and task performance. *Methods*: This was as an observational study, using video recordings of 20 resuscitation attempts. The Leadership Behaviour Description Questionnaire (LBDQ) was used to measure the level of structure built within the team. Interpersonal behaviour and the tasks of resuscitation were measured with a team dynamics and a task performance scale. The degree to which the leader actively participated, 'hands on', with the tasks of resuscitation, and their previous training in advanced life support (ALS), and experience of resuscitation attempts, were evaluated against the leadership rating. *Results*: The degree to which the leader built a structure within the team was found to correlate significantly with the team dynamics ($P = 0.000$) and the task performance ($P = 0.013$). Where the leaders participated 'hands on' they were less likely to build a structured team ($P = 0.005$), the team were less dynamic ($P = 0.028$) and the tasks of resuscitation were performed less effectively ($P = 0.099$). Experience gained over a 1-year period did not enhance leadership performance, but leaders who had up to 3 years experience were more likely to be effective in this role ($P = 0.072$). Interestingly, ALS training did not enhance leadership performance per se. However those leaders who had had recent ALS training were more likely not to participate 'hands on' ($P = 0.035$). There were some notable shortcomings in the performance of the task and some interesting correlations relating to duration of resuscitation, survival rate estimations, the leaders' attitudes and the teams' level of experience. *Conclusion*: Leaders must build a structure within a resuscitation team in order for them to perform effectively. An emergency leadership training programme is essential to enhance the performance of leaders and their teams.

Keywords: Advanced life support (ALS); Basic life support (BLS); Cardiopulmonary resuscitation (CPR); Education; Emergency medical services; Emergency treatment

1. Introduction

Resuscitation teams need to be organised in such a way that the individual skills of the team members can be used efficiently and effectively. Teams are only effective when those people responsible for organising them have paid attention, not only to the level of skills of the individual team members, but also to their attitudes to the tasks they have to perform.

We normally think of teams as groups of people who regularly work together, but this is unlikely to be the case with general hospital resuscitation teams. Instead each member needs to come to a resuscitation with a clear understanding of what is required, in addition to their technical skills. This includes an understanding of how decisions are made within the group; what resources are needed and how they are to be utilised; how leadership is exercised, and how staff new to the situation are integrated into the group.

The leadership role includes the explanation of the collective aims and requirements of resuscitation, whilst motivating staff to achieve high levels of performance. On occasion this may mean taking risks in the interests of task performance and inspiring the rest of the team by demonstrating confidence and determination in the leader. Some of the effectiveness of the leader is due to personality, but in a medical team a great deal of the

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effectiveness is contingent on the particular situation. Should the leader delegate, participate or tell the team what to do? At times all these approaches can be seen, since in each team there are likely to be different levels of experience and maturity among the staff, including the leader.

This report is based on the Leadership Behaviour Description Questionnaire (LBDQ), first developed in the late 1950s for the Ohio Leadership School [1,2], and later developed into LBDQ (Form XII) [3,4]. It is frequently used and a widely evaluated measure of leadership behaviour [5–7]. A summary of the main results, relating to leadership, can be found in Table 1.

There are two factors, 'consideration' and 'initiating structure', used to describe leadership behaviour. 'Consideration' is the extent to which leaders show consideration towards the members of the team. A considerate leader, for example, shows appreciation for good work, and supports, maintains and strengthens the self esteem of the individual team members. By contrast an inconsiderate leader would criticise team members in front of others and would refuse to accept suggestions from team members, or even explain his actions.

For the study of emergency situations the degree of 'consideration' was considered to be relatively unimportant, the restricted time available severely limiting the demonstration of such behaviour and the building of relationships. Considerate behaviour is more likely to be apparent in the post resuscitation phase, where leaders debrief the team. The second factor within LBDQ measures is the extent to which a leader defines, initiates and organises the activities within the team. In the literature this is referred to as 'initiating a structure' within which there are elements such as maintaining standards, detailing what needs to be done and how it should be done with clear communication, and patterns of organisation during resuscitation. What is of particular relevance is the way the leaders define their own roles and that of the rest of the team. A team leader who scores low in 'initiating structure' would be described as 'hesitant' about taking the initiative; would fail to take the necessary actions; would only respond when directly questioned; and would leave the individual team members to work in any way they like.

Table 1
Correlation results relating to leadership performance

	Correlation	Probability
Initiating structure and team dynamics	0.7318	0.000*
Initiating structure and team task performance	0.4955	0.013*
'Hands on' and initiating structure	−0.572	0.005*
'Hands on' and team dynamics	−0.444	0.028*
'Hands on' and team task performance	−0.3096	0.099**
Initiating structure and experience over 1 year	0.2619	0.132
Initiating structure and experience over 3 years	0.3386	0.072**
Initiating structure and ALS training	−0.1837	0.219

* $P > 0.05$.
** $0.05 > P \leq 0.10$.

Table 2
Original LBDQ (Form XII)

1. He lets group members know what is expected of them
2. He encourages the use of uniform procedures
3. He tries out his ideas in the group
4. He makes his attitudes clear to the group
5. He decides what shall be done and how it will be done
6. He assigns group members to particular tasks
7. He makes sure his part in the group is understood by group members
8. He schedules the work to be done
9. He maintains definite standards of performance
10. He asks that group members follow standard rules and regulations

The 'initiating structure' part of LBDQ (Form XII), which consisted of ten items (Table 2), was adapted and reworded to apply to a resuscitation team. One of the items, 'He tries out his ideas in the group', was removed, since it was not considered relevant during resuscitation. If it were to be considered it would most likely to be observed during training. Two items were merged 'He encourages the use of uniform procedures' and 'He asks that group members follow standard rules and regulations' to form a new item, namely that 'The leader demonstrated the use of uniform guidelines'. One of the original items was split into two; the original asked two questions in one, 'He decides what shall be done and how it will be done' giving 'The leader decided what should be done' and 'The leader decided how things should be done'. This gave a total of nine items rated on a semantic scale of 0 to 4 (Table 3). For comparative purposes the total score for each leader was summed.

Table 3
Adapted LBDQ (Form XII): LBDQ (initiating structure)[a]

1. The leader let the team know what was expected of them (through direction and command)
2. The leader demonstrated the use of uniform guidelines
3. The leader displayed a positive attitude
4. The leader decided what should be done
5. The leader decided how things should be done
6. The leader assigned group members to particular tasks
7. The leader made sure that his part in the team was understood by the team members
8. The team leader planned the work to be done
9. The team leader maintained definite standards of performance

[a] Each item scored using the following rating (score): A = Always (4); B = Very often (3); C = About as often as not (2); D = Seldom (1); E = Never (0).

The scale was found to have excellent unidimensional validity [8] with all but one item being inter-correlated.

1.1. Team dynamics

'Team dynamics' was measured by a scale developed from factor analysis [9–13]. It was considered important to measure not only what individuals do, in terms of their tasks, but also how they interacted together and how this was related to the measure of leadership. There were seven items all rated on a semantic scale 0 to 4. For example, the observer rated the level of co-operation, the degree of initiative shown and the team spirit and moral (Table 4). For the purposes of analysis the total score for each team was summed. Again the scale was found to have excellent unidimensional validity with all but two items being inter-correlated.

1.2. Team tasks

The team task scale was developed from analysis of the performance criteria set for the assessment of competence on ALS courses [14], with specific rankings based on evidence from the 'chain of survival' [15–17]. A total of seven key criteria were measured (Appendix A) covering basic and advanced ventilation, chest compression, defibrillation, intravenous access, drugs and 'other treatments' such as pericardiocentesis. For each task a Resuscitation Training Officer rated team members on when, and how well they performed. In addition the time from cardiac arrest to intubation, defibrillation and adrenaline (first dose) were measured. Rankings were allocated for the choice of specific therapies based on the evidence available relating to predictions of survival. Defibrillation was ranked the 'most important' treatment with a maximum score of 30 points for each of the two key assessment criteria. Basic ventilation, chest compression and advanced ventilation were scored at a maximum of 20 points and intravenous access, drugs and 'other treatments' at a maximum of 10 points. As the tasks performed varied for each resuscitation attempt the mean score for each team was calculated for the purpose of comparison.

Table 4
Team dynamics[a]

1. Information transfer (communication skills)
2. Adaptability (within the roles of their profession)
3. Co-ordination
4. Co-operation
5. Initiative
6. Work effort
7. Team spirit and morale

[a] Each item scored using the following rating (score): A = High (4); B (3); C (2); D (1); E = Low (0).

2. Methods

2.1. Setting

The study was undertaken at Derriford Hospital, Plymouth a 1300-bed district general hospital employing 4500 staff. All facilities are present under one roof enabling easy access to all departments, with an estimated 2-min response from the time of the arrest to the arrival of the first member(s) of the resuscitation team. In addition to the general wards there is a six-bed Coronary Care Unit (CCU), an eight-bed Intensive Care Unit (ICU), and a six-bed Cardiothoracic ICU.

2.2. The resuscitation team

The designated team leader is a medical Senior House Officer (SHO) who has designated full authority over all team members, including any senior grades who happen to be present. Team members include a medical House Officer to administer drugs and to defibrillate, and an Intensive Care SHO and nurse to manage the airway. Ward nursing and medical staff may also be present. The team members are trained at regular intervals in Basic and Advanced Life Support following the guidelines of the European Resuscitation Council [18]. Critical Care Nursing staff are trained in Basic Life Support and defibrillation. General nursing staff are trained in Basic Life Support.

2.3. Definitions

The study defined cardiopulmonary arrest as an absence of palpable pulse with no effective spontaneous respiration. Cardiopulmonary resuscitation is defined as closed chest compression and artificial ventilation, following the European Resuscitation Council guidelines for basic and advanced life support [18].

2.4. Ethical issues

The regional ethics committee approved the study with strict guidelines on patient and staff confidentiality. It was obviously not possible to gain prospective permission from the patient, so to maintain confidentiality, the video recordings could only be observed by those attending the resuscitation, the researcher and two academic supervisors. These recordings were to be stored securely and destroyed after 1 year. However, in three cases approval was gained from the ethics committee and all the staff involved, to keep the recordings for training purposes. In these records the patient was defocused ('fuzzed out') and all times, dates and identifying references to the patient removed.

2.5. Briefing the staff

As the main focus of the study was leadership, only potential team leaders (medical SHOs) were contacted, prior to commencement. They were informed that a study of 'resuscitation teams' using video recording was planned. All gave their permission with the option of withdrawal at any stage of the study. Other members of the team, nursing and medical staff were deliberately not contacted and publicity kept to a minimum, in the hope that this would reduce the Hawthorne effect [19], a change of behaviour when being observed. The camera was placed at the scene as quickly as possible, whilst the team and the leader were concentrating on the resuscitation, so that they would not be aware that they were being observed. It was clear, however, that after the event the camera would be seen, so an information sheet was produced to explain the purpose of the study.

This approach, had its problems, after the third recording a number of nurses made complaints, on the grounds that the study was a breach of patient confidentiality. Visits to wards and departments were then arranged to further explain the purpose of the study, with the result that the staff in all but one ward agreed to participate, supporting the aim of the research and also asking for feedback on their performance.

2.6. The sample

Data were collected over a period of 16 months, June 1997 to October 1998. Only full cardiopulmonary arrests were included where the resuscitation attempt lasted for longer than 3 min up to a maximum of 19 min (the mean was 9 min). This enabled the researchers to make a valid and reliable judgement of leadership and team performance over an acceptable period of time. All teams in the study had more than five members present. A total of 18 leaders were studied, one of them on three separate occasions. A total of 20 resuscitation attempts were observed (19 on video) from 114 calls that met the criteria, a sample of 18%.

2.7. Data collection and reporting

Data was collected through video recordings[1] in 19 of the cases. In one case a nurse refused the researcher access with the video and observational records were made from memory. A device was manufactured to hook the camera into a suspended ceiling, lifting it above the line of vision and thus reducing its intrusiveness[2]. On receiving a call the researcher, or at night one of two trained research assistants, who were both ICU nurses, would run to the call area and hook the camera

[1] The camera used was a Sony Handycam CCD - TRV61E PAL - Hi8 format with a timer and semi fish eye lens (0.42 ×). Included in this model is a flip out viewing screen which was a convenient way to play back to the team after the resuscitation event.

[2] The 'Hawthorne Effect' [19], i.e. changes in behaviour due to the researchers' direct observation, was judged to be minimal in this situation as the whole operation is completed in a matter of minutes, and the attention of the staff is highly focused on the job in hand.

into the ceiling. The angling of the camera was made considerably easier by the flip out viewing screen. A hospital standardised report form was completed by the ICU doctor to verify and confirm the observed data and to identify the patient.

2.8. Hypotheses and measurement

On completion of each video recording the researcher made full and comprehensive notes on all the verbal and non-verbal behaviour, timings, tasks and actions. Only after this comprehensive review had been performed were the measurements made, in line with the following hypotheses.

2.8.1. Hypothesis one

The first hypothesis encompassed the belief that resuscitation team leaders who initiate a structure within a team will improve team dynamics and increase task performance. However, because many resuscitations are completed in ~ 3 min, there are some who may be of the opinion that this is insufficient time for anyone to exercise leadership skills. Our research and experience has indicated otherwise.

2.8.2. Hypothesis two

Where the leader participated 'hands on' in the resuscitation, there will be a negative correlation between the leadership rating and the team dynamics and task rating. The notion is that if the leader is involved in the tasks they are in no position to observe, monitor or guide the resuscitation. Until recently there have been few written references to the form of behaviour required to lead a resuscitation team [20]. Cardiac arrest scenarios (CAS Teach) are part of training in advanced life support and it is here that a team leader is encouraged to stand back ('hands off'), delegating and monitoring the process. This clearly defines the leadership role and develops a holistic approach to patient and team management. In this study the time was measured (to the nearest second) that the leader spent performing a task, such as defibrillation, chest compression and intravenous access, that he/she could have delegated. There were of course situations that as a result of being the senior doctor present, the leader was required to perform a particular task, pericardiocentesis is one such example. Such tasks were not included as part of the 'hands on' time. The 'hands on' time was calculated as a percentage of the total duration of the resuscitation attempt, making it possible to compare performance between leaders.

2.8.3. Hypothesis three

It might be expected that there would be a positive correlation between a leader's experience of resuscitation attempts and their leadership rating [20]. After each observation the team leader was contacted and asked to estimate the number of resuscitation attempts they had attended over the last year and over the last 3 years. This estimate included time as a team leader as well as a team member, both of which were considered relevant to leadership performance. Each rating could only be an estimate, as there are no records and staff tend not to remember the number of resuscitation attempts they have attended, unless it is only a few. Team leaders were encouraged to make a judgement by calculating the number of times they had been on duty for the team (usually one in 5 days) and multiplying this by the average number of resuscitation attempts, which at Plymouth was one per day [17].

The team's level of experience was also measured to see how it correlated with the 'team dynamics' and 'task performance'. The rating of 'experience' was problematic. It was not possible to interview every team member after each observation, to get a measure of their experience, because the number of arrests attended are often difficult to recall. As a compromise the following criteria were selected. The Intensive Care doctor is responsible for managing the airway, but may not be an anaesthetist, therefore non-anaesthetists were given a score of 1 and anaesthetists, as the more experienced, a score of 2. House Officers have a training period of 1 year, 6 months in medicine (as part of the resuscitation team) and 6 months in surgery. Their experience was estimated from the number of months they had been in a medical post, for example a score of 1 if it was the first 2 months of their contract, a score of 2 for the following 2 months and 3 for the last 2 months. Nursing staff were rated on their place of work, a score of 3 was given to those working in areas such as Coronary Care and the Accident and Emergency department, where there are frequent resuscitation attempts, 2 for general medical wards and 1 for surgical wards and 'other' areas. The total score for each team was then summed as an estimate of total team experience.

2.8.4. Hypothesis four

Hypothesis four proposed that there is a positive correlation between advanced life support training and the leadership rating. This was based on the assumption that existing systems of training produced more effective leaders. After each observation leaders were asked what training they had received, and this was categorised as either

1. the full 3-day Resuscitation Council (UK) ALS course within the last year (Full ALS), or
2. the same course within the last 3 years, or
3. a short ALS course (usually half a day) taught 'in house' within the last year (Short ALS), or
4. the same course within the last 3 years, or finally
5. no training, or training more than 3 years ago.

Additionally, team leaders were also asked to estimate the percentage of immediate survivals (survival for 1 h), for the resuscitation attempts they had attended[3]. It was then possible to correlate the reported survival rates of each leader against their attitude towards the resuscitation attempt (item 3 in LBDQ). For example, if low rates of survival were reported did the leader display a less positive attitude towards the resuscitation? It did not matter if their estimate of the survival rate was inaccurate since it was their attitude based on this assessment which was being tested.

2.9. Inter-observer agreement

In observation based studies it is recognised practice to use more than one observer and establish an estimate of how far observers agree [21]. In this study, Cliff Mann, an ALS instructor and Specialist Registrar in Emergency Medicine, and an experienced video rater [22], also scored two randomly selected video recordings. Cohen's kappa (K) or kappa scores were calculated by measuring the agreement between every item on the LBDQ and the Team Dynamics measure. Fleiss [23] suggests that a kappa of 0.40–0.60 is a 'fair' inter observer agreement, 0.60–0.75 is 'good' and above 0.75 is 'excellent'[4]. In this study the inter observer agreement was 'good', for LBDQ 72% and for Team Dynamics 71%. For both measures, where there was no agreement, the rating was only one point out, except for two scores which were two points out. As LBDQ is a tried and tested measure it was interesting to note that this first test of the Team Dynamics measure showed agreement only 1% less than LBDQ.

2.10. Statistical analysis

Statistical calculations were performed using the Windows 95 version of the Statistical Packages for Social Sciences (SPSS). Univariate analysis of nominal data was performed using chi-squared analysis (χ^2) with Yates correction, ordinal and nominal data with the Mann–Whitney U test, interval and nominal with the independent samples t-test, ordinal data and ordinal and interval with Spearman (ρ) rank correlation and interval data with Pearson's (r) product-moment. Multivariate analysis using multiple forward logistic regression (and linear regression for interval data) was performed on factors that reached significance (<0.05) in univariate analysis. Results that reach significance of <0.05 are indicated by * and where >0.05 but ≤ 0.10 by **. Confidence intervals of 90–95% have been included as the relationship is likely to have a greater significance in a larger sample.

3. Results

Just over half (11/20, 55%) of the resuscitation attempts were observed on the medical wards, there were 5/20 (25%) on the surgical wards and 3/20 (15%) in Coronary Care and 1/20 (5%) in Intensive Care Units. The patients' ages ranged from 50 to 88 years with a mean of 74 years. A total of ten patients survived with return of spontaneous circulation, for at least 1 h (immediate survival), while ten did not survive the resuscitation.

[3] From a full audit of all resuscitation attempts at the hospital, this was known to be in the region of 43% [17].

[4] In behavioural studies complete agreement is highly unlikely as kappa scores rely on two observers rating exactly the same on a semantic scale. For example, if one observer was to rate an item as a 4 whilst the other rated it as a 3 there is no agreement.

3.1. Leadership ratings (team dynamics and team tasks)

For the first hypothesis there were two main findings, showing that the null hypothesis can be rejected. Firstly where the leader initiated a structure the team was more dynamic ($0.7318/P = 0.000$*). For example, where the leader 'demonstrated the use of uniform guidelines' ($0.7039/P = 0.000$*), 'made sure his part was understood by team members' ($0.6045/P = 0.002$*), and 'decided what should be done' ($0.5541/P = 0.006$*), the team worked more effectively together.

Secondly where the leader initiated a structure the team were more likely to perform the tasks of resuscitation correctly and at the right time ($0.4955/P = 0.013$*). For example, the time to intubation was quicker ($-0.6270/P = 0.015$*) especially where the leader had 'planned the work to be done' ($-0.6429/P = 0.012$*) and where the leader 'demonstrated the use of uniform guidelines' the tasks were performed more effectively ($0.6293/P = 0.001$*).

In general, team leaders had low ratings when it came to 'assigning group members to particular tasks' (75% were assigned a value of 1). The tendency was to ask for something in a general manner without specifically asking one individual. For example, a leader would ask for adrenaline, and two or three of the team would rush off to fetch it. When it came to 'maintaining a definite standard of performance' ratings were also low (55% were assigned a value of 1). The pressure of time possibly limits attention to enhancement of detail, but in most cases leaders rarely corrected performance or encouraged a high standard of performance. Leaders also very rarely 'decided how things should be done' (70% were assigned a value of 0), this may be due to the time restraint in an emergency situation, or that the leader had not noticed how tasks were being performed. It was clear from the task ratings that there were plenty of cases where the leader should have given assistance and advice to team members.

3.2. Leadership ratings ('hands on')

For hypothesis two there were three main findings, showing that the null hypothesis could be rejected. Firstly the leader who had 'hands on', was less likely to initiate a structure within the team ($-0.572/P = 0.005$*) and in these cases the leadership was less effective. Secondly, when the leader was 'hands on' the team was less dynamic ($-0.444/P = 0.028$*), showing less interaction and co-operation. Logistic regression analysis was performed on results which reached significance in univariate analysis. High performance leaders were more likely to improve the 'team dynamics' ($P = 0.000$*). Removing 'team dynamics' from the model indicated that effective leaders were more likely to be 'hands off' ($P = 0.003$*). Finally where the leader was 'hands on', the team's task performance had a lower rating ($-0.3096/P = 0.099$**), the tasks of resuscitation being more likely to be performed incorrectly and at the wrong time.

The percentage of time the leaders spent 'hands on' varied from 0 to 67% of the resuscitation, with a mean of 25%. The majority, therefore, were 'hands on' at some stage performing tasks that he/she could have delegated. Neither team size (five to 12 members) nor constitution of the team were factors, in that there were always enough people with the right skills. It is likely that the smaller the team becomes the more likely the leader will be 'hands on'; in the larger teams the leader was less likely to be 'hands on' ($-0.5455/P = 0.008$*).

3.3. The leader's experience

Interestingly, there were no significant correlations between the leadership rating and the leaders' experience of resuscitation attempts over the last year ($0.2619/P = 0.132$), but there was a correlation between the leadership rating and experience gained over 3 years ($0.3386/P = 0.072$**), especially when the data was categorised ($0.4427/P = 0.025$*). Therefore the null hypothesis is supported in part (hypothesis 3); leadership performance was enhanced by experience, but only if gained over a 3-year period. Experienced leaders were more likely to make their 'part in the team understood by team members' ($0.3364/P = 0.073$**), 'plan the work to be done' ($0.3715/P = 0.053$**) and 'let the team know what is expected of them' ($0.3698/P = 0.054$**).

Leaders' estimates of the number of arrests they had attended over the previous year ranged from 1 to 50, with a mean of 20. Their estimates of the number over the previous 3 years was 1 to 200, with a mean of 68.

3.4. The leader's training

The results were unexpected for the predicted relationship between training and leadership. There was no correlation between the leadership rating, 'initiating a structure', and Advanced Life Support (ALS) training. This remained the case even when the five original categories were recategorised into a nominal form, 'Full ALS within 1 year' or 'No recent Full ALS'. Therefore the null hypothesis stands (hypothesis 4). However, where the percentage time spent 'hands on' was placed in three categories, $<25\%$, >25 to 50% and $>51\%$, those who had had ALS training, especially the 'Full ALS' course, were more likely to be 'hands off' ($0.4236/P=0.035$*).

When using the categories 'Full ALS within 1 year' and 'No recent Full ALS', a correlation was found between the leaders' experience over the last 3 years. Those who had had recent ALS training were also the least experienced ($0.5132/P=0.010$*). The more experienced were less likely to have had recent training. This may be because experienced leaders feel they do not require training and that those with less experience are more likely to seek training.

The amount of training varied amongst the sample, five had had full ALS training within the last year, six within the last 3 years. A total of four had attended a short ALS course in the last year and one within the last 3 years, whilst four had no training, or no training within the last 3 years. This gave a total of five who had had full ALS within the last year and 15 who had not.

3.5. Team dynamics

The team size varied from five to 12 members with a mean of nine. The more dynamic teams were more likely to perform the tasks of resuscitation more quickly and effectively than the less dynamic teams. For example, the dynamic teams were more likely to perform basic ventilation when it was required ($0.4540/P=0.039$*), perform chest compression as required ($0.4112/P=0.040$*) and to intubate more quickly ($-0.5997/P=0.020$*). When the team dynamics were categorised as 'poor', 'average' or 'good', there was a significant correlation with the total task rating ($0.4169/P=0.034$*), more dynamic teams being more likely to perform the tasks of resuscitation more effectively.

Table 5
Task performance issues

Ventilation
In 12/16 (75%) the chest failed to rise with a bag/valve/mask
In 6/14 (43%) intubation took >30 s
Chest compression
In 14/19 (73%) chest compression was performed at an incorrect rate[a]
In 4/19 (21%) the hand position was incorrect
In 5/19 (26%) the depth of compression was incorrect
Defibrillation
In 4/9 (44%) there was no 'stand clear' warning
In 3/6 (50%) paddles were recharged in mid air
In 5/6 (83%) there was a delay of >15 s between each shock
Drugs (i.v.)
In 12/20 (60%) drugs were not 'flushed' after each peripheral injection

[a] Compression rates were measured after 2 min of chest compression and calculated by multiplying the number of compressions by 60 and dividing the total by the seconds it had taken to complete a cycle (rounded to the nearest five) [26]. For example if there were five compression completed in 3 s this would be $5\times60=300$, then divided by 3 giving a rate of 100 a minute. The compression rate was judged as 'correct' if between 90 and 110.

In addition the more dynamic teams were also found to be the more experienced ($0.3858/P=0.046$*).

Frequencies from the team dynamics scale showed that teams generally had low ratings on the degree of 'information transfer' (40% assigned a value of 1), which included not only verbal but non-verbal cues. In general, information tended to be one way, from leader to team, rather than from team to leader or between team members. Teams were, however, generally good at 'co-operating' together (45% assigned a value of 3) and good at working hard 'work effort' (55% assigned a value of 3).

The correlation results relating to leadership performance are summarised in Table 1.

3.6. Team tasks

Team task performance issues are condensed and summarised in Table 5, problems are highlighted based on current guidelines [18,24]. Timings were recorded in order to correlate against team performance and to standardise reporting in line with the Utstein guidelines [25]. There were some interesting correlations, for example, it was found that older patients tended to be intubated earlier ($-0.7648/P=0.002$*) and given adrenaline earlier ($-0.4017/P=0.055$**). Larger teams were found to be significantly slower to intubate ($0.4571/P=0.068$**) and they also took longer to defibrillate ($0.5655/P=0.056$**). Although not statistically significant, doctors tended to be quicker than nurses when a series of shocks was required. It was also found that the longer it took to give adrenaline the longer it took to intubate ($0.8020/P=0.001$*) (no tracheal drugs were given). Thus teams which were slow at doing one thing tended to be slow at other tasks as well.

3.7. Duration of resuscitation

The resuscitation attempts ran from 3 to 21 min, with a mean of 10 min. There were some interesting correlations between the leadership ratings and the duration of arrest, for example the resuscitation lasted longer where the leader (a) followed the guidelines ($0.4539/P=0.022$*), (b) displayed a positive attitude ($0.4674/P=0.019$*) and (c) decided how things should be done ($0.3031/P=0.097$**). The resuscitation attempt was also extended when the leader had had less recent or no ALS training ($-0.3604/P=0.059$**). When the team spirit and morale were high the resuscitation tended to go on for longer ($0.3767/P=0.051$**) as was the case where an anaesthetist was in attendance ($0.3181/P=0.086$**).

3.8. Survival rate estimations

Most (17), judged the survival rate to be less than the reported mean rate of 43.2% by Cooper and Cade in 1997 [17]. Interestingly, the experienced leaders (over the previous year) were more likely to estimate the survival rate as being lower than the actual mean rate for the hospital ($-0.3574/P=0.061$**). Leaders who predicted a high survival rate were more likely to continue the resuscitation for longer ($-0.3948/P=0.043$*).

3.9. Leader's attitude

Item three of LBDQ asks for a rating of the leaders attitude: 'the leader displayed a positive attitude towards the resuscitation'. When their estimation of the survival rate was correlated against this item it was found that the leader's attitude was not influenced by their prediction of the survival rate ($0.0204/P=0.466$), nor was the leader's attitude influenced by the patient's age ($0.0871/P=0.358$).

3.10. Team experience

The more experienced teams were more likely to resuscitate the patient effectively ($23.5/P=0.019$*) and were quicker to intubate ($-0.5225/P=0.041$*). They were also quicker to give adrenaline ($-0.3983/P=0.057$**) and tended to have a higher rating on the dynamics scale ($0.3658/P=0.057$**).

4. Discussion

The results of this study clearly indicate that where leaders initiate a structure within the team, not only do teams work better together, but they also perform the tasks of resuscitation quicker and more effectively.

Direction and command (verbal or non-verbal) are essential components of this process of initiating a structure, but should not be confused with autocratic leadership. The leader needs to be flexible, but at the same time engender trust and respect from his team. Quite the opposite was observed in one case, where the observer commented that the leader was 'arrogant and standoffish—he lacked knowledge with only a degree of command'. What many 'leaders' failed to do was to take command and give direction, guidance and assistance; without these elements of leadership, a confusion of responsibility developed, causing disorientation within the team. After one case the observer assumed that a particular SHO had been in charge, however he denied this fact and indicated that it had been one of the others. This individual, in turn, pointed to yet another doctor. Such unclear demarcation of roles is often quite obvious to the team, in this particular case the anaesthetist commented it was 'a bit shambolic really'. This was not the only such case. After another resuscitation the observer commented 'I was left with the general impression that no one had been in control'.

Part of the process of team building is to develop a uniformity of approach: this is one of the reasons why the resuscitation guidelines are so important. For example, in one case a nurse who was compressing the chest seven times within a cycle, instead of the recommended five, threw the anaesthetist out of cycle and the ventilations ended up during compressions. One leader commented that 'a rigid adherence to the guidelines, despite the situation, is a problem', but the impression was that he did not know them in the first place and was therefore not in a position to judge. A leader who is not sure of the guidelines confuses those team members who are familiar with them, and stalls the process of resuscitation, with loss of respect for the leader and inevitable delays in the process.

The leader needs to display a positive attitude, motivate and encourage the team, in a situation that is often unpleasant and disturbing. It is generally accepted that over half of resuscitation attempts will not be successful, however many patients go home with no obvious neurological deficit. There will come a time in any resuscitation attempt when to continue would be pointless, yet the team leader should remain positive and supportive of his team, even when their attempts have been fruitless. For many team members however, the role is challenging and exciting, rushing through a hospital to unusual and demanding situations. As one leader commented, tongue in cheek, 'I came to haematology to get away from this', but the impression was that he had found it a positive experience.

Team leaders who did not decide 'what should be done' and at times 'how things should be done' were ineffective. Making such decisions is not only time saving but also positively influences standards of performance both of individuals and the team as a whole. The leader must maintain an awareness of his team's abilities, aptly illustrated in one case where 'one had the impression that his (the leader's) performance was influenced by the high degree of skills within the team' and in another, 'she led the team to a degree, but the team were efficient and autonomous, with less requirement for direction'. Competent teams may require less input from a leader who may rarely be required to decide how tasks should be performed. This does not negate the role but changes the emphasis to monitoring and assessment. Rapid decisions are often described as 'gut reaction', a process more accurately described by Klein [27] as 'recognition primed decision making', where similar situations, based on experience, are used to enhance the decision making process. Effective leaders, therefore, are fully aware of the 'leader-follower' relationship, and have a flexible and holistic view of the process and an ability to intuitively draw on their experience to speed the decision making process.

One essential aspect of team leadership, which was often forgotten, is the assigning of team members to particular tasks. It is assumed that team members will automatically fulfil a role without the requirement of allocation: this is quite appropriate for the anaesthetist, but it is often not the case for the other members of the team. To facilitate the process it is essential that the team leader asks a specific individual to perform tasks such as defibrillation and intravenous access. For example, it was noticeable that team leaders tended to ask for adrenaline without referring to a specific individual, which often resulted in two or three nurses leaving the room to fetch the adrenaline. The team leader may not know the individual by name but this should not stop direct reference to them by, for example, eye contact, or a touch on the arm. In one case the leader not knowing the name of the nurse looked directly at her and said 'student nurse, would you pass me that syringe please' thus saving two or three people trying to perform the task, or conversely ignoring the request because they had assumed that someone else was doing it. In contrast, one leader asked for the patient to be defibrillated, but without reference to an individual, as a result there was some stalling and hesitation until the nursing sister asked if her staff nurse could perform the procedure.

The leaders who made it clear that they were in charge had the most effective control with less confusion within the team. Many leaders 'shared' their responsibility with another senior team member: two individuals then gave orders which at times contradicted and countermanded each other. In one case the leader was assisted by a more senior member of staff, a senior registrar, who attempted to give advice and direction: the leader resisted this by not responding, or at times turning away whilst continuing to direct the team. In another case a senior registrar was determined to take control, the SHO sensibly allowed her to continue and even supported her at one point by saying 'you're doing very well Amanda, I'm enjoying taking a back seat'. By relinquishing her leadership role the authority of her more senior colleague was not undermined and the team was able to follow the direction of the one clearly defined as the leader. Problems did occur, however, where the leader was clearly incompetent, lacking both knowledge of the procedures required and the skills of team management. In one such case the anaesthetist gradually took over having first of all attempted to guide and assist the leader, a form of leadership emergence which has been noted by other observers [28]. There were other times when there was a clash over authority, which was particularly difficult and hard to give advice on. There were times when it would have been better for the leader to have relinquished control, yet to do so would have caused tensions and problems within the team. Because resuscitation is conducted in such a short time frame, it is perhaps better to discuss the issues after the resuscitation attempt in the hope of establishing a system of control and command for future situations.

A few leaders showed that they had a vision of the whole process: they were in control and demonstrated an ability to plan their schedule whilst remaining flexible to changes in the patient's status. The best leaders made it clear what the team should be doing: comments like 'OK we'll do another ten cycles with adrenaline then consider our options' kept the team informed and involved, which is particularly important when it comes to the end of an unsuccessful resuscitation. In one case, for example, the leader was heard to say 'Shall we call it a day after this one?'. A team member replied 'Yep, I think that sounds fair enough'. The leader replied, 'We've been going 15 minutes', and then checking the pulse he shook his head and looked around the whole team. They all shook their heads in response, and the leader responded with 'Yes, OK, Thank you very much everybody'. In contrast there were other cases where the process just fizzled out. The following account by an experienced observer, of a patient in cardiac arrest, is a just such an illustration:

> For the next 4.5 minutes the whole team stand around the patient, discussing the background to the arrest, whether or not to extubate and her condition: 'Has she got a pulse?, 'Is she breathing?'. They continue to watch the monitor which throughout had shown a normal sinus rhythm. There is no clear ending to the arrest: the leader continued to look doubtful, stressed and concerned. The team appear to have accepted that the resuscitation should be stopped, but were doubtful whether or not the leader would start it all up again at any moment. Throughout this resuscitation the designated team leader had 'shared' his responsibility with another SHO; he had failed to make clear decisions which left the team in limbo. He did however have insight. As he left the scene he commented to the observer 'I know what you'll say—too much conferring with Janice'.

For many years instructors in Advanced Life Support have been advising leaders to stand back from their team, in other words remaining 'hands off' during a resuscitation, in order to effectively monitor the patient and the team. It is felt that this encourages a holistic approach to the whole process of resuscitation. The results from this study clearly indicate that a 'hands off' approach is indeed the most effective way of enhancing the leader's performance, improving the dynamics within the team, and increasing the level of task performance. Most of the team leaders in this study were 'hands on' at some stage of the resuscitation: in one case the observer reported 'he got stuck in when other people were available—consequently there were a lot of wasted people standing around with no guidance'. This was not the case for those who had had recent ALS training, who had learned to stand back and delegate. Most junior medical staff see their role as being 'hands on', patient centred work, and many therefore appeared to find it difficult to stand back and manage a small group of people.

On questioning the leaders after each resuscitation attempt, half reported attending more than 20 cardiac arrests over the previous year, yet this level of experience did not make them more effective leaders. Only those with a great deal more experience (half the leaders had attended more than 50 resuscitation attempts), over a 3-year period, were likely to be more effective. Longevity and depth of experience, therefore, was important. However, there were cases where leaders had very low performance ratings despite a great deal of experience. This result is surprising until you consider their training background, remembering that there was no correlation between ALS training and leadership performance. This suggests that individuals are not being taught to lead, nor do they have a model to positively influence their behaviour. Mackway-Jones and Walker [29] report, "Learners cannot improve unless they know where improvement is necessary and how the improvements may be made". Yukl [20] says "Learning from experience depends on getting accurate feedback from people and using this feedback to develop skill". The Resuscitation Council (UK) ALS course, begins to address this issue by emphasising the importance of being 'hands off', and encourages candidates to practice their leadership role in cardiac arrest scenarios and assessments (CAS Teach and CAS Test). An advanced cardiac rhythm generating mannequin is used to mimic a patient event and candidates are allocated team roles whilst taking it in turn to lead the team. In the 3-day course, a candidate will lead about two cases, of 10 min each. The emphasis during these sessions is on the guidelines, following the correct processes and encouraging safe practice. Good instructors will encourage candidates to consider their role in a broader prospective, and begin to emphasise the importance of team management. Role play, however, is time consuming and many candidates need time to hone their skills in this unfamiliar situation. On the courses nurses and doctors take the lead role, despite the fact that hospital based nurses will rarely be in this situation. This gives them insight into the difficulties of the role encouraging them to empathise with their medical colleagues. However, when time on each course is limited it may be more useful to allocate the leadership role to those who are most likely to lead a resuscitation team.

From the results of this study it is clear that some individuals are better leaders than others, not simply because of their training or experience, but because they are predisposed to the form of behaviour required to manage an emergency. This is not support for the 'born and not made' theory of leadership, since many [20,28] report that leadership training can, and does, change behaviour. However, there are some individuals who come to the situation with the required personality, self confidence and communication skills which makes training for leadership that much easier. The question therefore arises as how best to enhance the skills of those who are less skilled. The first part of this process is to increase awareness of the true requirements of effective leadership, which the research behind this paper has started to address. The second phase is the development of a leadership training programme that can be easily incorporated into an ALS course; this should identify those who are less inclined to be effective leaders and offer them ways of adapting their behaviour. At the time of writing the authors are in the process of developing such a programme.

The results showed that the more dynamic teams (flexible, adaptable, co-ordinated, co-operative, etc.), were much more likely to perform the tasks of resuscitation quicker, at the correct time and with fewer mistakes. These teams were the more experienced, but they were also led by team leaders who had built a structure for the team. Effective leadership and team performance were characterised by a one way system of verbal and non-verbal communication, leader to team, usually with direct orders and commands. There were of course times when the team fed back to the leader, but this was more likely to be non-verbal. For example, hesitation when performing tasks indicated doubt and uncertainty, or a glum nod of the head in response to the indication from the leader that resuscitation was unsuccessful.

Many teams were too large with up to 12 people around the patient. In one case the medical team were called to a surgical unit. Four members were present led by a SHO but there were also two ward nurses, two ward doctors, one technician and three consultant surgeons. The medical SHO attempted to take control but fought a losing battle. The observer reported "Too many people—a chaotic and uncontrolled group—no clear leader, but a valiant attempt from the medical SHO". It is often the unfamiliar which causes such chaos [30]. After 10 min of resuscitation the patient was returned to theatre for surgery and a calm rapidly spread over the group, as they returned to a more familiar scenario.

Many teams failed to meet the criteria for the performance of certain tasks. For example, the airway tended to be poorly managed when it came to bag/valve/mask technique. Most airway managers, 18 of whom were non-anaesthetists, failed to make the patient's chest rise with each ventilation, and very few asked for assistance with the technique. Many failed to intubate within 30 s of commencing the procedure, whilst some never attempted to intubate despite a clear failure to ventilate adequately. Training [31] is obviously an issue here as the Intensive Care SHO may have been from any speciality. Prior to the study, training of non-anaesthetists was undertaken in the operating theatre with a short spell of practice on a manikin with a Resuscitation Officer. The operating room sessions had limited value as it was often difficult to find a case where intubation, as opposed to laryngeal mask insertion, was likely to be performed. Currently, in an attempt to resolve these issues, formal assessments are performed by a Resuscitation Officer. If a candidate fails to meet the required standards, the SHO is supported by an anaesthetic registrar until they reach an appropriate standard. In addition laryngeal masks are carried by the ICU nurse to be used as a holding measure before intubation.

With chest compressions there were many cases where the rate at which it was performed was incorrect; the general tendency was to be too fast, (greater than a rate of 100 per min), but this was rarely corrected by the leader or members of the team. It is difficult to judge the correct compression rate so some form of metronome and compression indicator may be of use here [32]. Defibrillation was required in nine of the cases, and there were times when the procedure was performed in an unsafe manner, waving charged paddles in mid air and shocking without prior warning. There were also occasions when there was a significant delay to defibrillation and between each shock. These teams tended to be unfamiliar with the equipment, an issue for training but also for the standardisation of equipment. Most areas had Hewlett Packard Code Masters, but many new staff were familiar with other makes of machine. As discussed, team size played a large part in the management of resuscitations but the old adage ‘too many cooks spoil the broth’ was relevant to both defibrillation and intubation. The greater the number of team members the slower they were to defibrillate and to intubate. It is difficult to stop large numbers of staff members flocking to arrests, but it was clear that the leader should ask those not actively involved to leave.

Resuscitation attempts tended to last for longer when the ALS guidelines were followed (the guidelines include time intervals and task performance standards), the implication being that those who did not follow them were spending less time, not more, on the resuscitation. Positive, enthusiastic leaders were also likely to extend the duration of the resuscitation attempt, which was the case when they were having to explain to the team how tasks should be performed. However, when it came to training, those who had no recent ALS training were likely to spend more time at a resuscitation. It is unlikely that they were following the guidelines, so one explanation may be that their lack of training made them indecisive and insecure thus prolonging the resuscitation attempt.

Leaders generally estimated the average survival rate, of the arrests they had attended, to be lower than the mean rate for the hospital. However their poor predictions did not appear to influence their attitude during resuscitation. This result should be treated with some caution. Leaders could have displayed a positive approach because they were aware of being observed.

The measure of ‘team experience’ was based on a sum of individual ratings, in order to ease the data collection problem. Although some individual ratings lacked accuracy, the summed score was considered to be a reasonable estimate of ‘team experience’. Experienced teams were more likely to perform tasks quicker and work together more effectively.

‘Lighthouse Leadership’ the title of this paper, is an analogy related to lighthouse keeping. Leaders might like to imagine themselves as a lighthouse keeper whose ‘light’ should guide and direct the team from afar, only occasionally launching themselves into the situation for those that require assistance. The key findings indicate that there is an effective way to lead an emergency team, namely through the initiation of a structure and establishing a system of control that directs, guides, co-ordinates and maintains performance standards. In addition the truly effective leader demonstrates a holistic approach to the process of resuscitation; they not only encourage action but transform their teams approach. With such leadership, the teams are more dynamic and the tasks are performed quicker with fewer mistakes. Most leaders will need training, so the next phase of this study is the development of a suitable training programme. Parallels can be drawn with other emergency teams, advanced trauma life support teams, major incident teams, ambulance and fire services, aircraft cockpit crews and the military [28]. Many of these teams have addressed the leadership issue, and from them the speciality of emergency medicine can learn some useful lessons.

Appendix A. Team task performance

Appendix 1

TEAM TASK PERFORMANCE

Time of patients collapse =

1. Basic Ventilation:

Minutes from collapse = -------------

Minutes from arrival of team = --------------------

(A)

Performed as required? *Yes* *No* *[score 20]*

(Timing criteria = within 30 seconds of team arriving)

SCORE

> NOTE
> *'Performed as required' (i.e. 'was it done when it should have been')* includes:
> - not performed but should have been
> - performed but shouldn't have been
> - performed at an incorrect time
>
> During respiratory arrest basic ventilation, (e.g. mouth to mouth, mouth to mask, bag and mask) should be performed continuously, accept during defibrillation and a brief break for intubation. If performed as required throughout the resuscitation then the maximum score should be allocated. If not performed as required, throughout the resuscitation, a zero score.

(B)

Performed correctly *[score 20]*

(i.e. when performed was it done so correctly)

SCORE

Oral airway (sized & inserted correctly)	*Yes*	*No*	*N/A*
Adequate ventilation (pocket mask)chest rises	*Yes*	*No*	*N/A*
Adequate ventilation (bag & mask) chest rises	*Yes*	*No*	*N/A*
Oxygen connected	*Yes*	*No*	

> NOTE: when scoring '*performed correctly*' each applicable individual task score must equate to the total task weighting. E.g. if an oral airway, bag & mask and oxygen was performed correctly each task score would be 6.6. But if a pocket mask was used correctly the individual task score becomes 5.0.

Performed by whom ---

Comments --

2. Chest compression:

Minutes from collapse = -------------

Minutes from arrival of team = --------------------

(A)

Performed as required? *Yes* *No* *N/A* *[score 20]*

(Timing criteria = within 30 seconds of team arriving)

SCORE

> NOTE
> In cardiac arrest chest compression should be performed continuously except during defibrillation and possibly a brief break during intubation. If performed as required throughout the resuscitation then the maximum score would be allocated. If not performed as required, throughout the resuscitation, a zero score.

(B)

Performed correctly? *[score 20]*

Correct ratio *(1:5 and/or 2:15)*	*Yes*	*No*	SCORE
Correct position *(two hands 2 finger widths above the ziphy sternum)*	*Yes*	*No*	
Correct depth *(one third the depth chest wall)*	*Yes*	*No*	
Correct rate *(rate of 100 min + or - 10)*	*Yes*	*No*	

Compression rate to be calculated for the first cycle, after two minutes of observation. Calculation for compression rate:

$$\frac{\text{No. Compressions} \times 60}{\text{Seconds to complete cycle}}$$ (rounded to nearest five compressions)

Note below if more than one team member performs chest compression.

Performed by whom ---

Comments ---

3. Advanced Ventilation:

Minutes from collapse = -------------

Minutes from arrival of team = ---------------------

(A)

Performed/attempted as required? *Yes* *No* *N/A* *[score 20]*

NOTE: The task of intubation takes skill and experience, it is not always essential if basic ventilation is adequate (therefore N/A). There are times however when it must be performed/attempted, e.g. where ventilation is inadequate via any other method, or the airway is at risk (e.g. aspiration). There may also be a situation where however skilled the doctor, it is impossible to intubate the patient, they should then be rated on the basis of intubation attempted but failed. The rating scale, therefore, indicates '*attempted*' as required. If performed/attempted as required then the maximum score should be allocated. If not performed/attempted as required, throughout the resuscitation, a zero score.

SCORE

(B)

Performed/attempted correctly? *N/A* *[score 20]*

Correct head position	*Yes*	*No*	SCORE
Correct use of laryngoscope	*Yes*	*No*	
Intubation < 30 seconds	*Yes*	*No*	
Cuff inflation	*Yes*	*No*	
Check position of tube	*Yes*	*No*	
Tube secured	*Yes*	*No*	

Performed by whom ---

Comments ---

4. Defibrillation

Minutes from collapse/required = -------------
Minutes from arrival of team/required = ---------------------

(A)

Performed as required? *Yes* *No* *N/A* *[score 30]*
(Timing criteria = within 30 seconds of VT / VF being identified where defibrillator available)

NOTE: Defibrillation may never be required, if so the question is not applicable, however it may be required but not given, or required and not given at one stage and required and given correctly at another. It may also be given when not required. If performed as required then the maximum score should be allocated. If not performed as required, throughout the resuscitation, a zero score.

SCORE

(B)

Performed correctly? *[score 30]*

Confirm Cardiac Arrest *(pulse check)*	*Yes*	*No*	
Confirm VF / pulseless VT from monitor trace	*Yes*	*No*	
Correct energy level	*Yes*	*No*	
Place gel pads on patient's chest	*Yes*	*No*	
Charge defibrillator with paddles in machine or on patient's chest	*Yes*	*No*	
Warn team to 'STAND CLEAR' and perform visual safety check	*Yes*	*No*	
Check monitor trace and discharge shock with appropriate paddle pressure	*Yes*	*No*	
Confirm rhythm on monitor	*Yes*	*No*	
Recharge defibrillator to correct level with paddles on patient's chest and repeat safe defibrillation without interruption for BLS	*Yes*	*No*	N/A
Was each shock given in <15 seconds	*Yes*	*No*	*N/A*

SCORE

Performed by whom ---
Comments ---

5. Intravenous Access (including central access)

Minutes from collapse/required = -------------
Minutes from arrival of team/required = ---------------------

(A)

Performed/attempted as required? *Yes* *No* *N/A* *[score 10]*

SCORE

NOTE: The process itself may be difficult in which case it should be marked accordingly. An attempt which is appropriate even if that attempt fails should still be scored. In many cases access will already be available in which case the question is not applicable. If performed/attempted as required then the maximum score should be allocated. If not performed/attempted as required, throughout the resuscitation, a zero score.

(B)

Performed/attempted correctly? *N/A* *[score 10]*

SCORE

Correct technique of insertion	*Yes*	*No*
Flush with position check	*Yes*	*No*
Securing of canulae	*Yes*	*No*

Performed by whom ---

Comments ---

6. Drugs

Minutes from collapse = -------------

(First dose of adrenaline only)

Minutes from arrival of team = ---------------------

(First dose of adrenaline only)

Was adrenaline given at least every three minutes from start of resuscitation = **Yes / No**

(calculate the number of 3 minute blocks and divided by total number of doses of adrenaline)

(A)

Given as required? *Yes* *No* *N/A* *[score 10]*

NOTE: Drugs may be given appropriately, inappropriately or not given at all. The observational parameters (of this study) state that only cardiopulmonary arrests lasting more than 3 minutes will be included, so at least one dose of adrenaline should be given. Giving of drugs, therefore, will always be appropriate. They may not be given as required if intravenous access is not achieved, however in that case a good team will intubate and give drugs via the endotracheal tube. If given as required the maximum score should be allocated. If not given as required, throughout the resuscitation, a zero score.

SCORE

(B)

Given correctly? *[score 10]*

Correct dose	*Yes*	*No*
Most appropriate route	*Yes*	*No*
Flushed	*Yes*	*No*

SCORE

Performed by whom --

Comments --

7. Other treatment *(by team members)* **N/A**

Minutes from collapse = -------------

Minutes from arrival of team = --------------------

NOTE: Other treatments during a resuscitation may include, for example, pericardiocentesis & needle thoracotomy. Scores should be allocated for each treatment.

Indicate treatment performed ----------------------------------

Performed / attempted as required? *Yes* *No* *[Score 10 per task]*

SCORE

Performed correctly? *Yes* *No* *[Score 10 per task]*

SCORE

Performed by whom --

Comments --

Task Score (%) = $\dfrac{\textbf{Sum of Task Score Performance}}{\textbf{Sum of Applicable Task Ratings}}$

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