East of England Ambulance Service NHS Trust

Incident date:	14 June 2014
Date of Final Report:	17 December 2014
Investigating Officer:	
Incident Type:	Equipment failure / service delivery
Incident Level:	Level 1 Concise Investigation

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1. Executive Summary

At 13.42 on 14 June 2014, a 999 call was received by the Essex Emergency Operations Centre (EOC) to attend to a cardiac arrest and was coded as a R1, the highest level of response (eight minute standard).

At 13:43 a Double Staffed Ambulance (DSA) crewed by a Paramedic and Emergency Care Assistant (ECA) was dispatched, arriving at 13.47 with a response time of five minutes 42 seconds. The Zoll defibrillator was removed from the vehicle, turned on, and the defibrillator pads attached to the patient's chest. It was recognised that the patient was in a heart rhythm that would respond to defibrillation (Ventricular Fibrillation). However, having charged the machine and pressed the button to enable a shock to be delivered, it was noticed that the visual display showed an error command of 'Defib pads Short'. The Zoll cardiac monitor was recharged and the same error message occurred. The pads were replaced and the command appeared again. The crew were unable to provide a shock to the patient as clinically indicated. The Automated External Defibrillator (AED) was not considered as the Paramedic was surprised by the failure of the Zoll Cardiac Monitor defibrillator and in the heat of the moment did not consider an alternative machine. The ECA's account was that the AED was not immediately considered as the Paramedic was dealing with the patient by ensuring effective CPR and reviewing the possible causes of the equipment failure, and in turn, changing the pads.

At 13:48 a second DSA, staffed by an Emergency Care Practitioner (ECP) and ECA were allocated to the incident, arriving at 14.00 (13 minutes after the first DSA arrived on scene). The Zoll from this vehicle was used and shocks were delivered to the patient as they were still presenting in a heart rhythm where defibrillation was indicated.

At 14:06 the first attending DSA crew made a request for the Helicopter Emergency Medical Service (HEMS) attendance to provide critical care. At 14.12 the Essex and Herts aircraft lifted from North Weald Aerodrome and arrived on scene at 14.21.

The patient was conveyed to the hospital by road with the HEMS crew escorting, arriving at 14.59.

The patient died shortly after the handover was given in the Emergency Department at hospital.

The Investigating Officer has identified the following lessons from this incident:

- Vehicle Daily Inspections (VDI's) need to be completed and documented prior to responding to Emergency calls to ensure that essential equipment can be used in its capacity. Only a partial VDI was completed in this instance, however the essential equipment for a clinical response was checked prior to attending the call (oxygen, defibrillator, response bag and drugs). The initial check showed that the defibrillator was working.
- The Automated External Defibrillator was not considered prior to the arrival of the second DSA to scene which delayed patient care.
- An electronic Patient Care Record (ePCR) was completed by the Paramedic on the first arriving vehicle, however it appears that some of the treatments were carried out by more than one individual, including the HEMS team and these were not recorded accurately.
- The procedure for reporting faulty equipment needs to be robust in order for Clinical Engineering to inspect and test the equipment to the set standard.
- The need for immediate incident report completion within two hours as per the Trusts Incident Management Policy.

The Investigating Officer has made the following recommendations:

- Trust wide communication as to importance of VDI's and the need to complete the Trust's VDI checklist which highlights what is, and in this case, what was not checked. The communication should include the manager's responsibilities in monitoring VDIs.
- Robust process for documenting clinical engineering 'contacts' with hardware repaired or inspected.
- Engineer's reports to include a tick box list of mandatory checks carried out as per manufacturer's instructions for ease of scrutiny.
- Consideration is given to introducing a Zoll failure type scenario on Update training courses and advice to remind all staff of considering use of the AED in such situations.
- An audit into the staff's Patient Care Record completion to ensure accurate recording.

2. Main Report

2.1 Concise description of the incident

At 13:42 a 999 call was made to the Essex EOC to attend a 65 year old male in cardiac arrest. A DSA was dispatched to scene with a response time of five minutes 42 seconds.

The crew were on duty from noon until midnight and received their first call at 12:19, 19 minutes after the start of their shift and immediately after they had booked on duty on the CAD. The crew were two thirds of the way through their VDI before receiving this call having checked the defibrillator, response bag, drug bag and oxygen levels as well as other items of equipment from within the vehicle.

After the crew cleared from this call at 13:38, a note was placed in the Computer Aided Dispatch (CAD) notes stating that the crew had not completed a vehicle check. They were assigned a further call at 13:38 and they mobilised due to the R2 nature of the call from which they were diverted to attend the cardiac arrest.

The patient's wife has stated that her husband was outside pumping up a car tyre when he collapsed. A neighbour was not with the patient but witnessed the patient collapse from her window adjacent. Basic Life Support (BLS) was immediately commenced by the neighbour with pre arrival instructions being relayed to them by the EOC on receipt of the 999 call.

The crew arrived and took over care assisted by two Police Officers that were at the scene. The Police were in attendance as they were driving past on a routine patrol and noticed the incident and offered help.

Advanced Life Support (ALS) care and treatment was provided to the patient along with Critical Care from the HEMS team upon their arrival.

The Patient Care Record shows the following treatment and observations were provided to the patient:

- On arrival (**13:47**):
  Patient outside – active Cardio Pulmonary Resuscitation (CPR) was completed prior to the ambulance arrival (good colour to skin, no signs of breathing).
- Patient in VF, no respiratory output, no palpable pulses. Due to problems with the Zoll, no shock could be delivered. CPR resumed and full ALS protocol commenced.

- **13:48**
  AVPU – unresponsive
  Airway – partly obstructed – tongue
  Absent breathing

Absent pulse

Cardiac arrest

- **13:50**

  Heart Rate 0

  Respiratory Rate 0

  Blood pressure 0

  Spo2 65% on oxygen

  BM 11.2mmol/l

  GCS 3

- **14:00**

  Second crew arrived with a replacement Zoll. Patient still in VF, shocks delivered and drugs given as per Trust protocol.

- **14:21**

  The HEMS crew arrived. The patient was put on a Lucas mechanical CPR device. The patient was thrombolysed due to recent history indicating possible pulmonary embolism.

- **14:54**

  Crew departed scene with the Critical Team escorting.

- **14:59**

  Crew arrived at hospital

Treatment taken from EPCR completed after the incident

13:48	Open airway
13:49	CPR started
13:49	BVM – flow rate 15l/min
13:49	OP airway inserted
13:55	IV access gained 18g
13:58	ET tube attempts (2) size 8 (successful)
14:00	0.9% sodium chloride 1500ml
14:05	Defib shock 120j
14:08	Adrenaline 1:10,000 1mg given
14:12	Adrenaline 1:10,000 1mg given
14:13	Amioderone 300mg given
14:18	Adrenaline 1:10,000 1mg given
14:23	Adrenaline 1:10,000 1mg given
14:25	Ventilator
17:11	Adrenaline 1:10,000 1mg given

Upon review of the electronic Patient Care Record, there are inaccuracies surrounding the sequence of treatment. This is believed to be due to the number of EEAST staff on scene providing treatment (including the Air Ambulance).

A second DSA crew was assigned to the incident as additional support prior to the arrival of the first resource. The decision to assign a second crew was EOC's in order to provide additional assistance. This is not standard practice. The first crew requested HEMS support at 14:06.

Patient Medical History:

The patient was a 65 year old male, who had no medical history. He had last visited his General Practitioner some two years previously for an unrelated event.

Defibrillator issues:

After the incident, the crew took the faulty defibrillator out of service for inspection by Medical Services. It was marked up with a red label and placed ready to be assessed.

The defibrillator was within its service dates. No faults were known.

It is believed that defibrillator pads that were used were Stat Padz II. The pads that were used in this case were disposed of in the clinical waste and not retained for examination or inspection. The Zoll unit has not stored any information regarding the fault codes in its memory for this incident. Due to this, the clinical engineer cannot confirm what pads were used.

The AED was not considered due to the activity around the patient at the time of the failure, the ECA's or Paramedics first action was to change the Pads.

The report from the clinical engineer lists:

1. The routine service of the Zoll was carried out on 15 April 2014 with its next one due in November 2014.
2. The data card and ETCO2 device was not found with the device.
3. A full inspection was carried out on the device in accordance with the manufacturer's procedures and no faults were found.
4. At no point during or while performing the shocks did the device fail to deliver the required shock when tested.

However, after speaking with the member of staff that reported the incident, the engineer and the Head of Medical Devices, the Investigating Officer was not initially confident that the machine was inspected thoroughly.

The engineer reported that he placed the Zoll back into service after an initial inspection not knowing that it was subject to a Datix report. The Datix had not been completed as both crew members thought that the other had reported it (it was reported five days after the event).

The member of staff reports that she challenged this the day after, and subsequently there was some confusion over which Zoll was taken out of service. Bearing in mind two Zoll units were used during the incident, there was some question that, in the heat of the moment the Zoll from the second vehicle and thus the fully functioning unit had been swapped onto the first vehicle on scene. This situation has been discussed with the Head of Medical Devices and a full review of all Zoll Units in the Mid Essex area has been undertaken. No fault was found on any unit and the Investigating Officer has been assured that the checks were completed to an adequate standard.

At the request of the Investigating Officer, a team from clinical engineering spent time in Mid Essex division reviewing every Zoll to try and confirm the identification of a possible faulty machine. It must be remembered that the Zoll itself may not be faulty, however on interrogation of all available Zoll's, none were found to have retained any memorised error codes consistent with the incident.

Subsequently, the ECA has produced evidence of the shock test strip that was taken after the event and it is now believed that the Zoll in quarantine was in fact the right machine.

2.2 Background and context of incident

The East of England Ambulance Trust was created on 1 July 2006 and covers the six counties which make up the East of England - Bedfordshire, Cambridgeshire, Essex, Hertfordshire, Norfolk and Suffolk. The Trust provides a range of services, but is best known for the 999 Emergency Service.

Our diverse area is spread over about 7,500 square miles and contains a mix of rural, coastal and urban areas – from Watford to Wisbech and Cromer to Canvey Island.
Our services are tailored to meet the needs of each community's differing environmental and medical needs.

The Trust employs around 4,000 staff and 1,500 volunteers to deal with over 900,000 999 calls every year. In addition the Trust handles more than one million non-emergency patient journeys to and from routine hospital appointments.

Clinical Engineering is the Trust's in-house team who maintain and repair the majority of re-usable medical devices in service.

The maintenance of medical devices is carried out by Clinical Engineering whose technical staff have been trained by the equipment manufacturer. Devices are logged onto the Trust equipment database where maintenance/repair records are held. Each device carries a unique identifier (asset tag). Where the manufacturer has identified that maintenance or performance verification needs to occur for the device then this is scheduled into the database at the appropriate frequency. Clinical Engineering will endeavour to locate the device prior to the next test date however this is not always possible given the geography of the Trust. To ensure equipment is within service date a 'Next service Due' label is attached prominently to equipment to alert users to the status of the device. Users can exchange the device before the expiry of the Next Service Due date and make the original unit available to Clinical Engineering.

Maintenance and repairs are undertaken in accordance with manufacturer's instructions.

2.3 Terms of reference

- The VDI process that day – did the crew report a compliant Zoll test and complete fully?
- Any issues with the Zoll prior to use that day and previously?
- Identify what pads were used in this case.
- Was there any consideration for AED use? (was there one located on the vehicle)
- What active treatment was given to the patient?
- What actions were carried out by the first attending crew – immediate backup requested?
- Findings of clinical engineering.

2.4 Investigation Lead and Team

The Investigation has been led by [redacted] Assistant General Manager. Following his departure from the Trust [redacted] undertook the investigation and has completed the report.

2.5 Scope of investigation

This investigation focuses upon the equipment checking on the day, and the subsequent actions taken at and from point of the Zoll failure.

2.6 Investigation type, process and methods used

This incident has been graded by EEAST as a Level 1 concise investigation.

- Concise Investigation in line with Trust procedures following the grading as a serious Incident
- Meetings with family
- Telephone contact and updates with nominated family member

- Clinical review of EPCR by investigator
- Interview and statement from the initial attending Paramedic
- Informal conversation with ECA prior to absence
- Clinical engineers report
- Audit of initial 999 call to ensure compliance
- Staff review/ education as to what other actions could have been considered

2.7 Chronology of events

13.42	999 call received in Chelmsford EOC
13.43	1st DSA assigned
13.47	1st DSA arrives and commences treatment
13.48	2nd DSA assigned as additional support to confirmed cardiac arrest.
13.49	Approximate time of defibrillator failure
14.00	2nd DSA arrives at scene
14.06	HEMS requested
14.21	HEMS on scene
14:54	Crew depart to hospital
14.59	Time of arrival at hospital

2.8 Involvement of patient / relatives

The duty of candour has been discharged by the Investigating Officer, The head of the Regional Resource Centre. Subsequent to this, the brother in law of the patient has been nominated by the family to act as liaison between the family and the Trust. The Investigating Officer is in contact with him on a regular basis to keep him updated with progress. The report will be shared with the family.

2.9 Involvement and support of staff concerned

- Incident discussed with attending ECA by the initial Investigating Officer. The member of staff is currently absent.
- Paramedic has been interviewed at length by the current Investigating Officer and a statement was taken (12/11/14)
- Clinical Engineering team.
- The local management team were made aware of the situation and co-ordinated a safety check of all defibrillators across the mid Essex area.

2.10 Notable practice

The initial Paramedic commented on the effective CPR in progress by the neighbour upon their arrival.

2.11 Detection of incident

The Zoll failure was reported via the internal reporting system (Datix) by the attending crew five days after the incident on 19 June. This was due to the crew both being on rest days as well as there being some confusion as to who had reported the matter. The information was reviewed and reported as a Serious Incident on 25 June.

2.12 Care and service delivery problems

The failure of the Zoll unit and or Pads delayed defibrillation to the patient by approximately 16 minutes.

2.13 Contributory Factors

Task factors:

Guidelines, Policies and Procedures

Not adhered to / not followed – the Vehicle Daily Inspection process.

Equipment:

Displays

Interference / unclear equipment display

Education and training factors

Lack of skills

Unsure whether operator error or a transient fault with the defibrillator

Inappropriate experience or lack of quality experience

Did not consider AED

2.14Root Cause Analysis

The VDI was partially completed due to assignment of an R2 call at 12:19. It is hard to determine whether, if this had been completed, that the Zoll would have been able to carry out its function (as Clinical Engineering have been unable to identify a fault with the Zoll). The Paramedic confirmed in his statement that the Zoll had been checked and was functioning. On the first call of the shift the monitoring section of the Zoll was used and was in working order.

Operator error

For the error report 'Defib Pad short' to be seen, this can possibly be attributed to poor placement of the pads containing the electrodes. This does not necessarily mean that the distance between the pads is incorrect, more likely it would be quality of contact with the

surface area of skin. This could be down to insufficient pressure applied to the pads to secure adhesion, or the patient being too wet, dirty or having excessive body hair without preparation. This error message is known to clinical engineering.

However the Paramedic has stated that the pads were applied correctly in the correct position, the patient was not sweaty and did not have excessive body hair. Once the first shock had failed the Paramedic rechecked the position of the pads, their adherence and all the connections. He further stated that the second sets of pads were attached in the same fashion, and he had checked their position again. The second set of pads also delivered the same error message.

Zoll malfunction

The machine itself could have had a fault. However, testing by an engineer has failed to replicate the error message seen. Subsequently, it appears that confidence is high that the machine in quarantined and tested at Barton Mills is the correct machine.

Pad malfunction

The Pads could have malfunctioned or been faulty in some way, however the investigation cannot provide evidence that this is the case as they were disposed of in the clinical waste on completion of the incident and are therefore not available for inspection.

In addition to this, the machine itself, and all others inspected in Mid Essex Division were not found to have any saved memory corresponding to these error codes.

2.15Lessons learnt.

- Vehicle Daily Inspections (VDI's) need to be completed and documented prior to responding to Emergency calls to ensure that essential equipment can be used in its capacity. Only a partial VDI was completed in this instance, however the essential equipment for a clinical response was checked prior to attending the call (oxygen, defibrillator, response bag and drugs). The initial check showed that the defibrillator was working.
- The Automated External Defibrillator was not considered prior to the arrival of the second DSA to scene which delayed patient care.
- An electronic Patient Care Record (ePCR) was completed by the Paramedic on the first arriving vehicle, however it appears that some of the treatments were carried out by more than one individual, including the HEMS team and these were not recorded accurately.
- The procedure for reporting faulty equipment needs to be robust in order for Clinical Engineering to inspect and test the equipment to the set standard.

- The need for immediate incident report completion within two hours as per the Trusts Incident Management Policy.

2.16 Recommendations

- Trust wide communication as to importance of VDI's and the need to complete the Trust's VDI checklist which highlights what is, and in this case, what was not checked. The communication should include the manager's responsibilities in monitoring VDIs.
- Robust process for documenting clinical engineering 'contacts' with hardware repaired or inspected.
- Engineer's reports to include a tick box list of mandatory checks carried out as per manufacturer's instructions for ease of scrutiny.
- Consideration is given to introducing a Zoll failure type scenario on Update training courses and advice to remind all staff of considering use of the AED in such situations.
- An audit into the staff's Patient Care Record completion to ensure accurate recording.

2.17Arrangements for shared learning

This report will be shared with the Commissioners, Locality Directors, Senior Locality Managers and the Trust Board and the family.

Glossary of Terms

EMT	Emergency Medical Technician – a rank within the ambulance similar to that of a paramedic but without the advanced skills such as intravenous drug therapies or advanced airway management
DMA	Double Manned Ambulance – this is the conventional ambulance used to convey ill patients to places of definitive care. They are fitted with blue lights and marked accordingly. They will usually have on board two ambulance staff members.
RRV	Rapid Response Vehicle – the Trust uses specially equipped ambulance cars marked with blue lights to arrive at patients quickly. These will usually only have a single member of staff on.
EOC	Emergency Operations Control – the Trust's control room where 999 calls are answered and where our dispatch staff communicate with our vehicles.
ALS	Advanced Life Support
QSAP	Qualified Student Ambulance Paramedic
HEMS	Helicopter Emergency Medical Service
CAD	Computer Aided Dispatch – a system by which the HEOC staff dispatch and log permanently details of incidents that the ambulance Trust attend.