



Quality of Care Review of
Emergency Medicine Services Response to
Fatal Motor Vehicle Collision Involving
Zak Maun Quappe (deceased)

Prepared for Ministry of Home Affairs,
Health and Government,
Cayman Islands

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Executive Summary

Zak Maun Quappe is a 21-year-old male who suffered life-threatening injuries in a motor vehicle crash that occurred in George Town, Cayman Islands, in the early morning hours of May 18, 2013. The response by EMS and other providers was timely and within the established response time standards. Paramedics assessed Mr. Quappe, who was still trapped in his vehicle, and determined that he was unresponsive with no signs of life. Resuscitation was not attempted.

The paramedic response deviated from established protocols for the Cayman Islands EMS service in terms of the completeness of certain aspects of the assessment and in the decision not to initiate resuscitative measures in the absence of specific direction from their medical control physician.

Because a full post mortem examination was not performed, the exact nature and extent of Mr. Quappe's injuries are not known. The injuries which are known with certainty (including bilateral femur and tibia-fibula fractures and blunt trauma to the head) would be considered serious and potentially life-threatening even in the absence of additional internal injuries. Based on the medical literature and the clinical experience in other jurisdictions regarding the survival rates of blunt trauma patients who are vital signs absent with an initial cardiac rhythm of asystole, it is my opinion that that Mr. Quappe's injuries were likely not survivable, and that earlier assessment and/or initiation of CPR and other resuscitative measures by paramedics would not have altered the ultimate outcome.

In reviewing this case, I have identified opportunities for improvement in the quality of care provided by the Cayman Islands emergency response and EMS systems, and I have made six recommendations to support such system improvements:

- 1. Consider equipping Cayman Island police and fire first responders with automated external defibrillators (AEDs) and training them on their use.**
- 2. Develop and implement a paramedic protocol specific to the management of patients with traumatic cardiac arrest.**
- 3. Reinforce existing paramedic policies and protocols through continuing professional education. In particular, this should focus on: indications for seeking direction from the medical control physician; management of the patient with traumatic cardiac arrest, and; decision-making around withholding or discontinuing resuscitation.**
- 4. Consider the development of additional EMS-specific fracture response time standards, linking the target response times to patient acuity.**
- 5. Remind all paramedics of the importance of documenting observations, rather than conclusions or medical diagnoses.**
- 6. Synchronize event recorders throughout the system.**

Background to Review

I was engaged by Ms. Jennifer M. Ahearn, Permanent Secretary & Chief Officer - Health & Culture, Ministry of Home Affairs, Health & Culture, Cayman Islands Government, to conduct a review of Emergency Medical Services (EMS) response to a fatal motor vehicle crash. This review is in response to a complaint lodged by the family of the decedent in the incident, and examines the EMS response to the incident, including the response times and the care provided to the decedent.

Qualifications of Reviewer

My clinical background is in emergency medicine. I completed the Emergency Medicine residency program of the Royal College of Physicians and Surgeons of Canada at the University of Toronto, and practiced at an academic trauma centre Emergency Department in Toronto, Canada for 16 years (10 of these as Chief of Emergency Medicine). Throughout that time, I was involved with EMS activities, both informally in the clinical setting, and as a member of the Paramedic Program Committee for Toronto EMS (now Toronto Paramedic Services) for more than 10 years.

In 2009, I left clinical emergency medicine and accepted a role with the Office of the Chief Coroner for Ontario, initially as Regional Supervising Coroner for Toronto West, and then as Deputy Chief Coroner for Investigations for the province. I served as Interim Chief Coroner for Ontario for a six-month period in 2013. At the Office of the Chief Coroner, I also chaired the Patient Safety Review Committee, which reviewed healthcare-related deaths (including those occurring in the pre-hospital setting) with a view to identifying recommendations to prevent future deaths in similar circumstances.

I hold an academic appointment as Associate Professor, Division of Emergency Medicine, Department of Medicine, at the University of Toronto.

I have recently assumed a new administrative and clinical role at a Toronto hospital. For clarity, I have conducted this review independently, and neither this report nor its conclusions is in any way meant to be representative of the views of my current or past employers.

In preparing this report, I acknowledge my duty to:

- a) Provide an opinion that is fair, objective and non-partisan;
- b) Provide an opinion that is related only to matters that are within my area of expertise; and
- c) Provide such additional assistance as may reasonably be required, to determine a matter in issue.

Further, I acknowledge that the duty referred to above prevails over any obligation which I may owe to any party by whom or on whose behalf I am engaged.

Scope of Review

The review focusses on the specific incident in question; namely, a fatal motor vehicle crash which took place on May 18, 2013, involving Mr. Zac Maun Quappe. The key issues as I understand them relate to the response time, and the actions of the EMS providers. In specific, there have been concerns raised that proper procedures and protocols were either not in place, or were not adhered to. The overall aim of the review is to identify any deficiencies that may exist, with a view to learning from this tragic incident to improve the quality of care by paramedics in the Cayman Islands, and potentially to prevent similar deaths in the future.

In scope:

- The details of the incident itself, including but not limited to ambulance call reports, medical records of the treatment of the decedent by EMS providers and hospital staff and physicians (as applicable)
- Relevant existing policies, procedures and protocols for EMS response from the Health Services Authority in the Cayman Islands
- Relevant training and certification standards for EMS providers in the Health Services Authority in the Cayman Islands
- Relevant standards, best practices and guidelines for EMS response, education and certification from other jurisdictions and/or the published literature which might be useful in guiding practice on a go-forward basis

Out of scope:

- An evaluation of the 9-1-1 call taking and dispatch processes themselves
- An evaluation of subsequent investigations into either the incident itself, or into complaints or concerns raised by Mr. Quappe's family or others

Materials Provided and Reviewed

In reviewing this matter and preparing this report, I have been provided with and have reviewed the relevant sections of the following documents:

Health Services Authority Documents

Cayman Islands EMS Patient Treatment Report – Zack [sic] Quappe [1 page]

Emergency Physician notes – Zak Maun Quappe [1 page]

Statement of EMT Officer – Tracy Gibbs [2 pages]

Radiology reports – Zak Maun Quappe (various) [10 pages total]

Autopsy Final Report [3 pages]

Cayman Islands Emergency Communications Event Report – Event 13-35710 [3 pages]

Cayman Islands EMS Policy and Procedure Manual [304 pages]

Cayman Islands EMS Standing Orders/Protocols Manual [155 pages]

Cayman Islands Emergency Medical Technician Scope of Practice [5 pages]

Cayman Islands Scope of Practice – Emergency Medical Technician - Paramedic [4 pages]

Cayman Islands EMS Adult Trauma Protocols [27 pages]

Cayman Islands Health Practice Law – 2013 Revision [43 pages]

Cayman Islands Health Practice Law – Health Practice Regulations – 2013 Revision [28 pages]

Department of Public Safety Communications (DPSC) Documents

Cayman Islands Public Safety Communication Centre timeline of incident [2 pages]

[same information also provided in Excel spreadsheet file]

Incident Timeline Explanation [1 page]

PSAP Standards Assessment [2 pages]

PSAP Standards Assessment Explanation [1 page]

Cayman Islands Emergency Communications protocols:

- SOG 604 – Major Incident Notification (Effective date: Sept 11, 2012) [7 pages]
- SOG 1000 – EMS/Ambulance Procedures (Effective date: April 1, 2010) [3 pages]

Office of the Complaints Commissioner

Notice of Investigation - letter dated March 29, 2014 from Nicola Williams, Complaints Commissioner to Jennifer Ahearn [3 pages]

Documents Provided by Family of Zac Quappe

e-mail dated April 8, 2015 from Barrie Quappe to Jennifer Ahearn

*Cayman Islands Public Safety Communication Centre timeline of incident [2 pages]

* Emergency Physician notes – Zak Maun Quappe [1 page]

Nursing Assessments – Zak Maun Quappe and Patient Valuables form [2 pages]

* Radiology reports – Zak Maun Quappe (various) [10 pages total]

* Cayman Islands EMS Patient Treatment Report – Zack [sic] Quappe [1 page]

Cayman Islands Fire Service Report Form [5 pages]

Cayman Islands Fire Department – Log Book entry [2 pages]

Letter dated December 3, 2014 from Quappe Family to Chief Officer Bush [3 pages]

Document entitled, “Noted from Calls re: Zak’s Accident” [2 pages]

Letter dated May 5, 2014 from Lizzette Yearwood, CEO of Regional Health Authority to Jennifer Ahearn [3 pages]

Policies/Procedures/Protocols from Cleveland Clinic Regional Hospitals EMS Control (revised 1-2012):

- Asystole/Pulseless Electrical Activity algorithm [1 page]
- Termination of Resuscitative Efforts [1 page]
- Dead on Arrival (DOA)

Excerpt from Peoria Area EMS System Prehospital Care Manual (not dated) – Withholding Resuscitation/Criteria for Death [2 pages]

*= provided previously via other sources, above.

In addition to these documents, I sought clarification via email from Ms. Jennifer Ahearn on some specific questions that arose during my review and generation of this report. I have also conducted my own research into standards, practices and protocols in other jurisdictions, and have referenced these throughout the report.

Circumstances of the Incident and EMS Response

Incident:

[The incident description below is from information contained in the Autopsy Final Report. This Report indicates that Officer PC Harris, PC 291, who was in charge of the investigation, was present at the post mortem examination and therefore would have provided the incident information contained in the Autopsy Report to the pathologist.]

Just after 0300h on Saturday May 18, 2013, the decedent was driving a Ford Taurus southbound on South Church Street in George Town, CI. Also travelling southbound on the roadway at the same time was a Mitsubishi Lancer driven by Person 2. Apparently, both vehicles lost control and crossed onto the northbound side of the roadway. The Lancer struck a stone wall and a parked car in a parking lot and came to rest on top of the stone wall, facing west. The decedent's Taurus struck a concrete wall about 30-40 meters away from the Lancer, and came to rest across the northbound lane, facing east.

There was reportedly extensive damage to the front left side of the Taurus. Both air bags in the vehicle deployed. The estimated speed with which the vehicles were travelling was not provided to me. A statement contained in an email from the decedent's family to Ms. Ahearn makes reference to the police stating that the decedent was involved in "competitive driving". This, coupled with the degree of damage described would support a conclusion that a high rate of speed was involved.

Activation of Emergency Response:

A 911 call was placed by a bystander at 03:11:43. Medic 3, the closest EMS unit to the scene (stationed at Cayman Islands Hospital), was dispatched one minute later, at 03:12:43h. They were designated as being "en route" at 03:15:10 (2 minutes and 27 seconds after being dispatched).

A second medic unit (Medic 4) was dispatched at 03:17:11 and was en route within less than one minute, at 03:17:59. [There are actually two dispatch times shown for Medic 4, and the unit may have in fact been en route at 03:16:54, before it was officially dispatched.] A number of police and fire vehicles were also dispatched within the first few minutes after the 911 call was received.

The first responder to arrive on scene was PC 352 at 03:19:24. This responder gave an update at 03:19:59 which indicated that one victim was "trapped in the car and losing consciousness fast...still breathing", according to the event log.

It is worth noting that event times in this case were logged through a variety of systems, including: the Department of Public Safety Communications (DPSC) Centre Computer Aided Dispatch (CAD) system; the DPSC's 911 system; and the DPSC logging recorder system. These three systems vary by as much as 1 minute and 45 seconds from each other, and it is necessary to manually correct the time points from each system in order to establish a reliable and accurate sequence of events. The Incident Timeline provided to me as part of the documentation included these corrections.

Situation at Scene at Time of Medic 3's Arrival

Medic 3 was the first paramedic unit on scene, arriving at 03:20:46. Sierra 2, a police unit, arrived on scene at almost exactly the same time as Medic 3, at 03:20:44. PC 352 had arrived approximately 1 minute and 22 seconds before Medic 3. Medic 4 did not arrive on scene until 3:32:32.

According to the information provided to me, there were three persons on scene who had been involved in the collision: The decedent, who was found trapped in his vehicle, unresponsive; Person 2, the driver of the Lancer; and a female, Person 3. It is unclear to me in which vehicle Person 3 had been a passenger.

Person 2 was conscious was noted to be walking around at the scene. He had abrasions and was complaining of chest pain.

Person 3 was also conscious; she was reportedly not walking around at the scene. She appeared to have arm and leg injuries.

Medic 3 was staffed with two paramedics; one an EMT-Paramedic (EMT-P), and one an EMT-Basic (EMT-B). The significance of these designations will be discussed below.

Assessment of the Decedent at Scene

The EMS Patient Treatment Report for the decedent appears to have been completed by paramedic T. [Tracy] Gibbs, the EMT-P in Medic 3. The Report notes "significant damage to vehicle. Major intrusion to driver's side of veh[icle]. Airbags deployed". The Report comments that the decedent demonstrated "ϕ [no] signs of life; ϕ [no] breathing; pulseless", and that "asystole noted on ECG". The Report does not indicate whether asystole was confirmed in more than one ECG lead. The Vital Signs Record section of the Report includes the following notation: "3:23 – ϕ [no] pulse, ϕ [no] resp" BP → "-----" ECG rhythm – asystole".

The Report includes the following notations with respect to the assessment by the paramedics of the decedent's injuries: "significant trauma noted – head injury [with] major blood loss"; "?C-spine fracture, femur fractures noted to both legs, fractured L[eft] arm." Additional notations made regarding the assessment of the decedent include: skin – warm and dry; no edema present; neck veins "normal". The assessment sections for "Lung Sounds (On Arrival)" and "Pupils" are both struck out, which I interpret to mean that these were not assessed.

There is no notation within the Patient Treatment Report regarding the initiation of any resuscitative measures; specifically: basic or advanced airway interventions, cardiopulmonary resuscitation (CPR), or vascular access (the section entitled "Vascular Access" contains the notation, "N/A"). The "Communications" section indicates that communication occurred with the hospital; however, there is no detail provided as to whether this represented discussion with a physician regarding the assessment of the decedent, or simply a notification that they would be transporting a (deceased) patient to the hospital.

The Incident Timeline log of communications throughout the incident includes a notation of an update by Medic 3 at 03:28:30, stating, in part, "...DOA on scene...no pulse and brain matter is obvious". Of note, no notation is found on the EMS Patient Treatment Record of the observation of brain matter.

A "Statement of EMT Officer" by Tracy Gibbs, dated August 2, 2013, is very similar to the narrative section of the EMS Patient Treatment Record, and provides no new information or insights. Paramedic Gibbs notes in the section entitled, "After My Examination" that the patient was "DOA (dead on arrival)".

From information provided to me, after making the determination that no resuscitation was indicated for the decedent, Medic 3 paramedics proceeded to assess and treat Person 3, and transported her to hospital. Medic 4 assessed and treated Person 2 and transported him to hospital.

Medic 3 also later transported the decedent to the hospital after the Fire Service extricated him from the vehicle. Based on the times reflected in the Fire Services log, extrication occurred between 04:37 and 04:47. The hospital's nursing assessment for indicates that the decedent arrived at the hospital at 05:06. The official pronouncement of death by Dr. Coin Charles occurred at 0510h. Of note, in addition to documenting the absence of signs of life and pupillary activity, Dr. Charles states, "Apparent brain matter protruding through nostrils".

Injuries Identified

A number of post mortem x-rays were performed in order to document bony injuries. In addition, the decedent's death was investigated by a coroner. A full post mortem (autopsy) examination was requested by the coroner, but based on the wishes of the family, this was limited to an external examination of the body, and a review of the x-rays. This limited examination, while yielding important information about the injuries apparent externally and through x-rays, is not able to ascertain details about the degree of internal injuries that were present.

The following signs of external injury were documented:

1. Multiple lacerations [tears of the skin resulting from blunt impact] with bruises over the right chin and right cheek, with a larger laceration on the right forehead.
2. Large scalp laceration
3. Abrasion [superficial injury to the skin] to the right thigh
4. Bruises and abrasions to the left leg
5. Small lacerations to the right leg
6. Multiple superficial bruises and abrasions involving the right elbow, right forearm and hand.

In addition, note is made that, "Blood is seen oozing from the nostrils and left ear". There is no indication that brain matter was visible.

The pathologist identified the following fractures:

1. Left clavicle [collar bone]
2. Left distal tibia and fibula [lower leg, above the ankle]
3. Right femur [large bone in thigh]

4. Right tibia and fibula

Of note, the pathologist makes reference to only a right femur fracture. However, the radiologist's report refers to fractures of both femurs (in addition to the left clavicle and both left and right tibia and fibula). I have not examined the x-rays myself, and cannot attest to whether or not a left femur fracture was present. However, such fractures are generally not subtle on x-ray. If one accepts the report of the radiologist as being correct, the left femur fracture appears to have been inadvertently omitted from the autopsy report.

The post-mortem x-rays also include a chest film (on which the fractured clavicle is noted). The x-ray report states, "The mediastinum is central. No evidence of lung injury seen. No rib fracture is seen." The pathologist does not comment on the chest x-ray in the post mortem report. I would add that chest x-rays in this setting are useful if they identify significant injuries (such as an accumulation of blood or air in the chest cavity). However, the absence of findings on chest x-ray in no way excludes the presence of significant or even fatal injuries, many of which may not be visible on a single chest x-ray taken in this manner.

No skull fractures were seen on the plain x-rays. However, the pathologist notes that certain skull fractures (such as a basal skull fracture, a fracture at the bottom or base of the skull) may not be visible on the x-rays. The pathologist goes on to state, "Based on the blood in the left ear and nose, I assume basal skull fracture and possible ethmoidal bone fractures which cannot be ascertained on the x-ray investigations alone."

The pathologist gives the cause of death as, "Blunt impact trauma to head and lower extremities consistent with the motor vehicle accident".

Toxicology testing was performed; however, the results are not included in the report. Reference is made to a separate addendum report which was not provided to me for review. Given the cause of death statement and the absence of reference to the toxicology results, I infer that these results were not material to the determination of the cause of death.

Existing Standards and Practices in Jurisdiction

Response times

The Cayman Islands Department of Public Safety Communications (DPSC) has established standards (referred to as the PSAP standards)¹ which outline target times for various processes related to emergency response activation. There are specific targets for Call Processing (time from call answer to dispatch), En Route (time from dispatch to the unit being en route to the scene) and Travel (time from en route to arrival). There are separate En Route and Travel standards established for police, EMS and Fire Service response.

These process targets are expressed as fractile response times; that is, the time in which “X” percent of such processes should be completed. For instance, the target time from ring to call answer is 15 seconds at the 95% percentile. Expressed another way, the target is that 95% of calls are answered within 15 seconds of the first ring.

The Call Processing standard (time from call answer to unit dispatched) is 1 minute and 6 seconds at the 95th percentile. The En Route standard for EMS (time from dispatch until the EMS unit is en route) is 3 minutes. The Travel standard for EMS (time from EMS unit being en route to arrival at scene) is 12 minutes¹.

Assessment and Treatment of Decedent

The Cayman Islands EMS Policy and Procedures Manual² sets out certain expectations in terms of the assessment and management of trauma patients. Excerpts of these policies are included below.

The “EMS Treatment Protocol – General” [p 71] outlines a number of steps to be taken in the assessment of any patient, regardless of presenting problem. The relevant points for the purposes of this analysis include:

- 3. Assess thoroughly patient’s airway, breathing and circulation, if impaired provide the appropriate care based on your scope of training.*
- 4. Control patient’s cervical spine if there is any reason to suspect a fracture, underlying trauma, mechanism of injury or high index of suspicion.*
- 7. All trauma patients should be transported within 10 minutes of the arrival of the Ambulance on scene with the exception of patients who are trapped on scene. In the case of entrapment, consideration should be given to requesting a medical aid team to attend the scene if the entrapment is likely to be for over 30 minutes.*

The “Initial Patient Survey” protocol [p 74] provides additional detail with respect to the steps to be followed in initial patient assessment:

- 1. Primary Survey*
 - A. Secure the patients airway considering potential C-spine injuries and stabilization needs.*
 - B. Check for breathing. Note respiratory noises and effort, skin colour and behavior.*
 - C. Check for circulation. Note presence and quality of pulse, check for major bleeding.*

D. Responsiveness. Note initial level of consciousness.

E. Check for signs of shock-cool, clammy, pale skin, thirst and agitation.

F. The primary survey should take no longer than thirty (30) seconds to complete

The “General Trauma Guidelines” [p 217] offer more specific direction with respect to the assessment and initial management of trauma patients:

GUIDELINES

The following procedure must be followed when dealing with any patient presenting with a traumatic injury

PROTOCOL

1. *Upon scene arrival:*
 - *Observe your surroundings for possible hazards*
 - *Ascertain mechanism(s) of injury*
 - *Determine total number of patients*
 - *Assess the need for additional resources*
2. *Upon patient access:*
 - *Basic Trauma life support, primary and secondary survey*
3. *Load and go situations*
 - *Airway obstruction unrelieved by mechanical means*
 - *Respiratory difficulty / respiratory arrest*
 - *Traumatic cardiac arrest*
 - *Head injury with decreased level of conscious*
 - *Signs and symptoms of shock*
4. *The following care may be given prior to transport of the critical trauma patient*
 - *Basic and Advanced airway management procedures*
 - *Full spinal immobilization*
 - *Control hemorrhage*
5. *All other interventions should be performed en-route to hospital, unless there are extended scene delays*
6. *Rapid transport is a priority, the cause of on scene times > 10 minutes must be documented*
7. *IV therapy*
 - *IV's should be initiated en route to the hospital or without transport delay, unless faced with extended scene times. Trapped patient's should have at least one large bore IV started during entrapment if possible*
 - *Use the largest vein readily available*
 - *When possible use 14 or 16 gauge catheters*
8. *Full spinal immobilization is indicated in the following situations:*
 - *Decreased LOC or loss of consciousness with signs of trauma*
 - *Head or facial trauma*
 - *Post injury neck or back pain*
 - *Pain or noticeable deformity on C-spine palpation*

- Any neurological deficits
 - Any mechanism of injury suspicious for spinal trauma
9. Oxygen
 - 100% via nonbreathing mask or assisted with BVM PRN
 10. Apply the cardiac monitor to all trauma patients. A recording should be made every five minutes

With respect to the management of patients with cardiac arrest, the manual does not include a specific protocol or policy with respect to traumatic (as opposed to medically-caused) cardiac arrest. The “Asystole” protocol [p 118] is included in the section of the manual dealing with Cardiac Emergencies:

GUIDELINES

The following procedure must be followed when dealing with any asystolic patient

IV. PROTOCOL

1. Do a “Quick-Look”. Confirm asystole in two leads
2. Initiate CPR. Ventilate with BVM and 100% oxygen
3. Intubate verify tube placement and secure, attach CO2 detector.
4. Establish an IV of Normal saline KVO
5. Give Epinephrine 1:10,000 1.0mg IV push. Circulate with 30-60 seconds CPR and note effects. Repeat every 3 – 5 minutes. Give 2× Epinephrine dose via ET tube if no patent IV
6. Consider one dose of Vasopressin 40U IV to replace first or second dose of epi.
7. Give Atropine 1mg IV push. Circulate with 30 – 60 seconds CPR and note effects. Repeat every 3 to 5 minutes up to a maximum of 3mg. Give 2× Atropine dose via ET tube if no patent IV
8. Look for underlying cause and rhythm changes, (H’s & T’s)
9. Consider discontinuation of life support protocol (Paramedic’s)

Withholding/Termination of Resuscitation

The Cayman Islands EMS Policy and Procedures Manual² includes a protocol entitled, “Discontinuation of Life Support” [p 115]. (This protocol is referenced in the “asystole” protocol, above.) This sets out the circumstances under which a decision may be made to either not initiate resuscitation efforts, or to cease resuscitation efforts which have been initiated:

GUIDELINES

The following procedure must be followed on each occasion consideration is given either not to resuscitate a patient or to discontinue resuscitation efforts.

CRITERIA

1. Paramedic’s only may clinically confirm a patient deceased.

2. *The patient must be known to have a history of debilitating chronic disease and deteriorating quality of life.*
3. *There is definite physical stigmata that expiration occurred a significant period of time prior to the arrival of the Emergency Medical Service*

PROCEDURE INSTRUCTIONS

1. *Assess for signs of life*
2. *CPR is to be initiated and maintained per protocol unless other wise noted.*
3. *Patient family presents a valid DNR order or injuries sustain are not compatible with life.*
4. *The crew should contact the Accident and Emergency Department Physician and inform them of their findings.*
5. *The A&E Physician shall be requested to make a decision regarding the continuation or discontinuation of life support.*
6. *Asystole in two or more leads recorded and attached to the PCR form.*
7. *Two members of the crew should be informed of the Physicians decision and this should be recorded on the run sheet.*

[...]

V. DOCUMENTATION

All calls must be fully documented on the appropriate forms

The protocol also outlines the requirement for medical approval for deviation from the protocol:

The Accident & Emergency Department Physician on duty must approve any deviation from these protocols by radio/telephone prior to any treatment not included in these protocols.

Relevant Best Practices from Other Jurisdictions

Response times

There are no universally accepted national, state or provincial standards with respect to EMS response times in North American jurisdictions. The establishment of response time targets and their management is generally the responsibility of local EMS services. In some jurisdictions, provincial or state authorities may establish standards or targets regarding response times, or reporting metrics for which the EMS services are accountable.

In Ontario, Canada, the provision of ambulance services is a municipal responsibility. Oversight for operations is provided by each municipal ambulance service. However, standards (including response times and qualifications of paramedics) are set out in provincial legislation (The Ambulance Act) and its regulations.

Regulation 257/00³ of the Ambulance Act establishes certain performance and reporting standards for ambulance services in Ontario. The response time standards, while established by each municipality based on the realities of their geography, population distribution and infrastructure, are reported provincially and certain response expectations are set by the provincial government for all ambulance services. These are tied to patient acuity, using the Canadian Triage Acuity Scale (CTAS) framework^{4,5}.

CTAS has been used for many years throughout Canada, and has been validated in both the emergency department and pre-hospital setting^{4,5,6}. It is a five-point scale based on presenting problem, from CTAS I (Resuscitation) to CTAS V (Non-Urgent). Cardiac Arrest and Major Trauma are two examples of CTAS I presentations.

Call Processing Time

Section 24 of Regulation 257/00 establishes an expectation that dispatch will occur within two of receipt of a call for CTAS 1 patients³:

24. (1) *In this section,*

“response time” means the time measured from the time a request is received to the time a notice is given respecting that request. O. Reg. 267/08, s. 1 (2).

(2) No later than October 1 in each year after 2011, every land ambulance communication service shall establish a response time performance plan for the next calendar year that sets out the percentage of times that the communication service will give notice within two minutes of the time a request is received respecting sudden cardiac arrest patients or other patients categorized as CTAS 1. O. Reg. 267/08, s. 1 (2); O. Reg. 368/10, s. 2 (1).

It should be noted that: (i) this reporting is based on fractile response rates (i.e., the percentage of times that dispatch occurs in two minutes or less), and; (ii) the definition of “response time” in this section of the Regulation differs from the definition in other sections (see below).

En Route Time and Travel Time

In Ontario, provincial standards are not divided into en route times and travel times. Rather, standards are focussed on time from dispatch to arrival at scene. This is also referred to as “response time”, which is defined differently than it is in Section 24, which focusses only on the dispatch process.

Section 23 of Regulation 257/00 establishes expectations around time from call receipt to arrival at the scene³:

23. (1) In this section,

“response time” means the time measured from the time a notice is received to the earlier of the following:

1. The arrival on-scene of a person equipped to provide any type of defibrillation to sudden cardiac arrest patients.
2. The arrival on-scene of the ambulance crew. O. Reg. 267/08, s. 1 (2).

[...]

(3) An upper-tier municipality or delivery agent to which subsection (2) applies shall ensure that the plan established under that subsection sets response time targets for responses to notices respecting patients categorized as Canadian Triage Acuity Scale (“CTAS”) 1, 2, 3, 4 and 5, and that such targets are set for each land ambulance service operator selected by the upper-tier municipality or delivery agent in accordance with the Act. O. Reg. 267/08, s. 1 (2).

[...]

(7) Without limiting the generality of subsection (6), no later than March 31 in each year after 2013, an upper-tier municipality or delivery agent to which subsection (2) applies shall report to the Director on the following matters for the preceding calendar year:

1. The percentage of times that a person equipped to provide any type of defibrillation has arrived on-scene to provide defibrillation to sudden cardiac arrest patients within six minutes of the time notice is received.
2. The percentage of times that an ambulance crew has arrived on-scene to provide ambulance services to sudden cardiac arrest patients or other patients categorized as CTAS 1 within eight minutes of the time notice is received respecting such services.
3. The percentage of times that an ambulance crew has arrived on-scene to provide ambulance services to patients categorized as CTAS 2, 3, 4 and 5 within the response time targets set by the upper-tier municipality or delivery agent under its plan established under subsection (2). O. Reg. 267/08, s. 1 (2); O. Reg. 368/10, s. 1 (2).

It should be noted that: (i) this reporting is based on fractile response rates (i.e., the percentage of times that dispatch occurs in two minutes or less); (ii) the definition of “response time” in this section of the Regulation differs from the definition in other sections (see above); (iii) response time targets are linked to CTAS categories of patients; (iv) the target for an ambulance crew to be on-scene for CTAS 1 patients is within 8 minutes from time of dispatch, and; (v) notwithstanding the above, the target for the availability of defibrillation for any sudden cardiac arrest patients is six minutes. This provision allows for the possibility that defibrillation could be provided by responders other than paramedics (such as police or fire services).

Assessment of Decedent

While numerous EMS policies, procedures and protocols exist regarding the assessment and management of trauma patients, I will focus specifically on the scenario of patients with blunt trauma who are vital signs absent upon EMS arrival.

The advanced care paramedic treatment protocol⁷ [Advanced Care Paramedic Medical Directives, p. 9-12] used by Toronto Paramedic Services for Traumatic Cardiac Arrest (blunt and penetrating) calls for:

- CPR throughout duration of call
- Apply defibrillator pads and analyze rhythm
- For a rhythm of asystole (in patients ages 16 years and older), patch to base hospital physician

- *Paramedic must patch to base hospital physician for authorization to apply Trauma Termination of Resuscitation (TOR). If patch fails, or if TOR criteria do not apply, patient is transported to receiving hospital.*

The decedent's family provided an algorithm⁸ [p 4-12] from Cleveland Clinic Regional Hospitals EMS Medical Control for asystole/pulseless electrical activity (PEA). This indicates that, if "Criteria for Death" and "Criteria for DNR" [not defined in the protocol provided] are not met, cardiopulmonary resuscitation should be initiated for 5 cycles, an airway protocol is followed, intravenous or intraosseous access are obtained, and epinephrine is then given every 3-5 minutes for asystole or PEA. However, of note, this algorithm is part of the Advanced Cardiac Life Support (ACLS) protocols, rather than the trauma protocols. As such, it is intended for use in the setting of medical cardiac arrest (such as resulting from ischemic heart disease), as opposed to trauma.

The Cleveland Clinic Regional Clinics' "Termination of Resuscitation" protocol was also provided by the family. This document states:

"Trauma patients should be rapidly assessed for signs of life. If the patient is apneic and pulseless but has organized ECG activity, and has a down time of less than 20 minutes (less than 10 minutes for blunt trauma) then they should be treated and transported to the nearest appropriate facility. Otherwise, resuscitation efforts should be withheld.

The Cleveland Clinic EMS Protocols do include an algorithm specifically for Trauma Arrest⁸ [p 6-22]. This sets out an approach to assessment, airway management, consideration of needle decompression of the chest, intravenous access, and contacting medical control once the rhythm is ascertained. In the "Key Points" section, the protocol states:

Resuscitation should not be attempted in cardiac arrest patients with....obvious, severe blunt trauma that are without vital signs, pupillary response, or an organized or shockable cardiac rhythm at the scene.

The decedent's family also referenced a policy and procedure entitled, "Withholding Resuscitation/Criteria for Death" from the Peoria Area EMS System Prehospital Care Manual⁹ [p. 268-9]. This indicates that, in the setting of major blunt trauma, if the patient is unresponsive and without vital signs upon EMS arrival, despite a patent airway, the patient is presumed dead.

[Withholding/Termination of Resuscitation](#)

There is consensus among the EMS and Trauma community that the survival rate for blunt trauma cardiac arrest is dismal. Survival rates quoted range from 0 to 5.5% [Pickens¹² describes an overall survival rate of 7.6%; however, cases are not broken down into penetrating vs blunt trauma, with the former typically having a significantly higher survival rate], with survival rates being lowest among those patients who have no signs of life when first encountered by paramedics at the scene. Those patients in whom the initial rhythm is asystole have a virtually zero survival rate^{10,11,12,13}.

The National Association of EMS Physicians (NAMEMSP) and the American College of Surgeons Committee on Trauma developed a joint position statement on the withholding or termination of resuscitation in prehospital traumatic cardiac arrest¹³. This statement indicates, in part:

1. Resuscitation efforts may be withheld in any blunt trauma patient who, based on out-of-hospital personnel's thorough primary patient assessment, is found apneic, pulseless, and without organized ECG activity upon the arrival of EMS at the scene.

[...]

7. Traumatic cardiopulmonary arrest patients with a transport time to an emergency department or trauma center of more than 15 minutes after the arrest is identified may be considered nonsalvageable, and termination of resuscitation should be considered.

11. All termination protocols should be developed and implemented under the guidance of the system EMS medical director. On-line medical control may be necessary to determine the appropriateness of termination of resuscitation.

This joint statement has been widely accepted and adopted in North American EMS systems, and is referenced in the 2010 American Heart Association Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care¹⁴. It is also consistent with the EMS protocols for traumatic cardiac arrest used by Toronto Paramedic Services, Cleveland Clinic Regional Hospitals EMS and Peoria EMS system, noted above.

Analysis of EMS Response and Identification of Gaps

Response times

As a prefacing statement, it is important to note that many of the times noted below are, at best, approximations of actual event times. As stated in the DPSC Incident Timeline Explanation document¹⁵, “Dispatch, enroute, arrival, en route other location, clear, etc. for law enforcement, Emergency Medical Services and fire service units as documented by telecommunications based on radio messages received”. This means that documentation of these times require a person (paramedic, police officer, etc.) to send a radio message to a dispatcher to indicate when they are en route, when they arrive, etc.; and the dispatcher must manually enter that time into the recording system. Thus, if a paramedic forgets to update their status immediately, or if a dispatcher is busy with other communications at the same time, the times logged may not reflect the exact time at which an event takes place.

Call Processing Time

The Call Processing standard (time from call answer to unit dispatched) is 1 minute and 6 seconds. In this case, the time from call answer until Medic 3 was dispatched was between 57 seconds and 1 minute (depending on the timing source used; the values shown in the DPSC analysis are not corrected for this discrepancy).

Conclusion: The time from call answer until Medic 3 was dispatched met the DPSC standard.

The Ontario call processing targets described above aim for a unit to be dispatched within two minutes or less from call receipt. As such, the dispatch time for Medic 3 was also within Ontario standards.

En Route Time

The EMS standard for En Route time is 3 minutes. In this case, Medic 3 was en route 2 minutes and 30 seconds after being dispatched. Medic 4 was dispatched at 03:17:11 and was logged as being en route at 03:17:59. However, there is an earlier log of an en route time for Medic 4 of en route at 03:16:54 – before the unit was officially dispatched. Whether Medic 4 became aware of the incident (such as through monitoring radio calls) and started to move toward the location before being officially dispatched, or whether in fact this earlier time represents an error, is unclear. Regardless, Medic 4 appears to have been en route to the scene at the longest 49 seconds after being dispatched; well within the 2 minute and 30 second standard.

Conclusion: The time from dispatch until both Medic 3 and Medic 4 were en route met the DPSC /EMS standard.

Notwithstanding the fact that the standard was met in this case, the question has been posed by the decedent’s family as to why it took 2 minutes and 30 seconds for Medic 3 to begin travelling to the scene. The en route time would be affected by a number of factors (such as where the paramedics were relative to their vehicle at the time of the call; etc.) about which I do not have specific information. I did clarify that Medic 3 cleared their last call at 20:22h the previous evening; therefore, the crew were not involved in providing care to, or transferring care of, another patient at the time of the call.

Travel Time

The EMS response time for Travel (time from en route to arrival) is 12 minutes. Medic 3 was stationed at ambulance bay at the Cayman Islands Hospital. They arrived on scene 5 minutes and 36 seconds after

they indicated they were en route; and 8 minutes and 3 seconds after being dispatched. Medic 4 showed two different en route times; 03:16:54, and 03:17:59. Medic 4 arrived at the scene at 03:30:47. Depending upon which en route time one accepts as being correct, the travel time for Medic 4 was between 12 minutes and 48 seconds and 13 minutes and 53 seconds. Both of these travel times exceed the 12 minute standard. It should be noted, however, that Medic 4 is a second unit being assigned to the call, due to multiple patients, and is coming from a greater distance (Medic 4 was stationed in West Bay).

Conclusion: The Travel time for Medic 3 met the DPSC /EMS standard. Travel time for Medic 4 exceeded the standard by between 48 seconds and 1 minute, 53 seconds. Medic 4 was a second unit assigned, and travelled from a different district to the scene.

Notwithstanding the standards for travel time, the approximate time that would be required for Medic 3 and Medic 4 to reach the scene from their respective starting points can be estimated using Google Maps. The estimated travel time shown from the Cayman Islands Hospital to the scene is between 5 and 6 minutes (depending upon the route). This corresponds to the travel time observed for Medic 3. The estimated travel time from a central point in West Bay (the exact location of Medic 4 at the time of the call is not known to me) to the scene is 22 minutes; hence, their observed travel time is less than might have been anticipated.

As noted above, the Ontario response time targets do not separate out “en route time” from “travel time”, but considers the entire response time from dispatch until arrival at scene. With respect to the Ontario regulations, the target response time is within 8 minutes for CTAS 1 patients. Medic 3 was dispatched at 03:12:43 and was on scene at 03:20:46, 8 minutes and 3 seconds after being dispatched. This exceeded the target time in the Ontario regulations by only 3 seconds. Given the inaccuracies inherent in recording these times, this would reasonably be considered as meeting the expectations for response times.

In this instance, PC 352 arrived on scene 1 minute and 22 seconds before Medic 3, at 03:19:24. This is 6 minutes and 38 seconds after Medic 3 was dispatched [a dispatch time for PC 352 is not provided in the call log.] Based on the information provided, I am not clear whether or not police in the Cayman Islands are trained or equipped to perform defibrillation with an automated external defibrillator. However, if that were the case, there would have been an opportunity to assess the decedent and provide defibrillation more than one minute earlier than would have been possible by Medic 3. There is no way of knowing whether the decedent was in a cardiac rhythm of ventricular fibrillation or pulseless ventricular tachycardia at that time (or, indeed, at any point) for which defibrillation would have been indicated. Arguably, however, the most critical and effective prehospital intervention in cardiac arrest is timely defibrillation, and consideration should be given in any emergency response system to provide defibrillation as quickly as possible when indicated.

Assessment of Decedent

Most EMS systems use a model of paramedic care which includes various levels of practice for paramedics, from basic to more advanced. Certain skills and knowledge are common to all levels of paramedic, while more advanced procedures are restricted to those paramedics with the highest level of certification.

The Cayman Islands EMS system employs a three-level paramedic model: EMT-Basic (EMT-B); EMT-Intermediate (EMT-I); and EMT-Paramedic (EMT-P). The paramedic team that assessed the decedent (Medic 3) was comprised of an EMT-P and an EMT-B. This means that the EMT-P on scene was able to utilize all paramedic treatment protocols to their full extent. For this reason, I have not included a more detailed description of the implementation of the various paramedic protocols based on level of practice, since all aspects of the protocols were available to the crew providing care to the decedent.

The expectations for Cayman Island paramedics for the assessment and management of trauma patients, including those found to be in asystole, is set out in four protocols as noted above²:

- EMS Treatment Protocol – General
- Initial Patient Survey
- General Trauma Guidelines
- Asystole

The consistent expectation in all of these protocols is for a rapid initial assessment of the patient's airway, breathing and circulation (the "ABCs" of trauma care) with immobilization of the cervical spine (c-spine), followed by transport to hospital as quickly as possible. Only basic and advanced airway management and spinal immobilization are to be performed at the scene. All other treatments are to be performed during transport to hospital.

The exception, of course, involves patients who are trapped and require extrication. In this case, the decedent was noted to be trapped, and assistance was required from Fire Services to remove him from the vehicle. From the Fire Services log, once extrication was undertaken at 04:37, the process to remove the decedent from the vehicle took approximately 10 minutes. I am not able to state how long extrication would have taken if the decision had been to initiate CPR and other resuscitative measures, as the process of extrication may have been more complicated in the setting of ongoing resuscitative activities.

With respect to the actual assessment and management of the decedent, the paramedics established unresponsiveness, absence of pulse and breathing, and a cardiac rhythm of asystole. There is no documentation that any attempt was made to open the airway using either basic (e.g. chin lift; jaw thrust) or advanced (oral or nasal airway, or intubation) techniques. This would typically have been done as the first step in the primary survey, before checking for a pulse or applying the cardiac monitor. While, in this case in the setting of traumatic asystolic cardiac arrest, such maneuvers would have been fruitless (since the decedent's heart had already stopped beating), it nonetheless represents to standard of care to open the airway and assess for breathing before proceeding with the remainder of the primary survey.

Of note, a letter, dated May 5, 2014 from Lizzette Yearwood, CEO of Regional Health Authority to Jennifer Ahearn, includes the following statement:

"Whilst still in the vehicle, Mr. Quappe's airway was established to assess for breathing, utilizing manual in-line stabilization to protect the cervical spine."

The letter indicates that this (and other findings) were "documented on the Patient Treatment Report". I can identify no such documentation on the Patient Treatment Report or in any of the other

documentation provided to me. The actual source of this statement is not known to me, and in the absence of identification of such a source, I cannot accept this as fact.

Similarly, there is no documentation that any effort was made to provide or assist with ventilation (such as through the use of a bag-valve-mask device) or to auscultate the chest. A cardiac rhythm of asystole was documented, but it does not appear that this was confirmed in more than one ECG lead, as per protocol. Despite the determination that the decedent was apneic and pulseless, with a cardiac rhythm of asystole, cardiopulmonary resuscitation was not initiated. Lastly, the pupils were not assessed for size or reactivity.

As has been noted above and will be discussed below, in many jurisdictions, the decision not to initiate CPR and other resuscitative efforts in this situation would be considered appropriate and would conform to protocol. However, in the absence of such protocols in the jurisdiction in question, these represent deviations from accepted practice.

The Cayman Islands EMS Policy and Procedure Manual does contemplate situations where deviation from protocol is appropriate, and sets out the expectations of paramedics in such situations² [p. 9]:

C. Deviation from Protocols

When providing care, EMS personnel must follow the directives of a medical command physician, in the absence of such orders; the applicable protocols should be referenced. Since written protocols cannot feasibly address all patient care situations that may develop, the Department expects EMS personnel to use their training and judgment regarding any protocol-driven care that in their judgement would be harmful to a patient under the circumstances. When the EMS personnel believe that the following protocol is not in the best interest of the patient, the EMS personnel must contact medical command physician. The reason for any deviation should be documented. All deviations are subject to investigation to determine whether they were appropriate. In all cases, EMS personnel are expected to deliver care within the scope of practice for their level of certification.

In this case, the EMS Patient Treatment Report under “Communications”, there is a check mark to indicate communication with the hospital. However, it is unclear whether this was a discussion with the medical command physician regarding the decision to withhold resuscitation, or whether this was simply to inform the hospital about the outcome of the call or for some other purpose. Regardless, even if contact was made with the medical command physician, there is no documentation to indicate that such a discussion had taken place and the rationale for the decision not to initiate resuscitation.

Conclusions: A number of deviations from existing protocols by the treating paramedics are identified in the areas of airway management, assessment of respiratory status, assessment of cardiac rhythm, initiation of CPR, and pupillary assessment. The rationale for these deviations is not documented; nor is there evidence of contact with the medical command physician regarding these deviations.

Lastly, there were concerns raised by the decedent’s family with respect to the documentation of injuries by the paramedics, the A and E Department physician, as well as a statement in the communications log (attributed to Medic 3) that “brain matter is obvious”. Let me briefly recap the concerns here and offer my analysis with respect to the documentation.

In the Patient Treatment Record, the paramedics describe:

“significant trauma noted – head injury [with] major blood loss, ?c-spine fracture, femur fractures noted to both legs, fractured left arm.”

In essence, their conclusion regarding the femur fractures was later borne out through the post-mortem radiographs. (The left arm does not appear to have been x-rayed and no mention is made in the post mortem report of this area, so it is not possible to validate or refute this observation.) With respect to the comments regarding the head injury – these are subjective descriptions (“significant” trauma; “major” blood loss) rather than a conclusion, and therefore are not inappropriate, although arguably are not as helpful as would be a documentation of what the paramedics actually observed (for instance, “15 cm, full-thickness scalp laceration”). Their comment regarding “? C-spine fracture” suggests the possibility of such a fracture, rather than a conclusion, and therefore is not inappropriate.

Notwithstanding the above, best practice with respect to paramedic documentation is to describe what is observed, rather than attempting to make diagnostic conclusions. For instance, one might observe that an extremity exhibits deformity with angulation and bony crepitus to palpation, rather than stating that a fracture is present (unless there is an open fracture where the bone is visible). In this case, I do not believe that the documentation provided by the paramedics fell below the expected standard.

The statement documented on the communications log regarding brain matter being “obvious” is attributed to Medic 3. This is not documented in the Patient Treatment Record completed by Medic 3, and there is no mention of this observation in the statement by paramedic Tracy Gibbs. It is not clear what, if any, role such an observation played in the decision-making by Medic 3 with respect to whether or not to initiate resuscitation.

Of note, the A and E Consultation note, completed by Dr. Colin Charles after the decedent’s transport to hospital, includes the statement, “Apparent brain matter protruding through nostrils”. This observation is made in the context of a number of other statements that indicate that Dr. Charles assessed the decedent himself to confirm death (including observations regarding the decedent’s pupils being fixed and dilated, and the absence of response to painful stimuli, which were not documented by paramedics). Whether Dr. Charles’ observation regarding “apparent brain matter” being present was an independent observation and conclusion, or whether this was in any way influenced by information provided by Medic 3 or other responders, is not clear. However, I would note that these observations by Dr. Charles were not material to the critical decision-making in this case, since they are made some time after the decision was made to withhold resuscitative measures.

Conclusion: Some of the documentation in this case, in particular by the paramedics, is speculative in nature. Documentation of injuries by paramedics should focus on objective findings, rather than conclusions or diagnoses.

[Withholding/Termination of Resuscitation](#)

As discussed previously, the Cayman Islands EMS Policy and Procedure Manual² [p. 115] includes a “Discontinuation of Life Support” protocol. The protocol is intended for use in situations where either the patient has a chronic debilitating condition prior to the cardiac arrest, or there is evidence that a significant period of time had passed between expiration and the arrival of EMS. Neither condition is relevant in this case.

Further, the protocol indicates that, even in circumstances in which consideration is given to withholding/withdrawing life support, this is a decision which is made by the on-duty A and E Department physician via phone or radio patch in discussion with the paramedics on scene.

In this case, the decedent clearly had suffered significant blunt force trauma, and was found to be vital signs absent without a cardiac rhythm upon EMS arrival. The decedent's injuries were obvious and severe (by virtue of his condition at the time of initial assessment, and the apparent head injury and extremity fractures which were documented, in the setting of the mechanism of injury and the degree of damage to the vehicle). However, none of the decedent's visible injuries could be considered incompatible with life (such as in the case of decapitation or transection of the torso).

Thus, the decision by the paramedics in this case to not initiate resuscitation efforts, while potentially consistent with practice in some other jurisdictions, represented a deviation from existing standards in the jurisdiction in question. There is no evidence that this decision was made by or in discussion with the medical control physician, and there is no documentation of the rationale for deviation from the Discontinuation of Life Support protocol or the other treatment policies and procedures referenced above.

Conclusion: The paramedics treating the decedent deviated from existing protocols in their decision not to initiate resuscitative measures at the time of initial assessment. There is no evidence that this deviation was sanctioned or directed by the medical control physician.

I should note that, in this scenario, Medic 3 was the sole paramedic unit on scene until the arrival of Medic 4 nearly 12 minutes later, at 3:32:32. The paramedics on scene were faced with triaging three patients; the decedent, and two other patients. The other patients were conscious; one was ambulatory, and the other was non-ambulatory and appeared to have arm and leg injuries. Based on the mechanism of the incident, these other patients also had the potential for serious or life-threatening injuries.

In a multi-patient scenario, paramedics must make judgements as to the provision of care that will offer the greatest good to the greatest number of patients. At times, this may mean that a difficult decision must be made not to attempt resuscitation of a patient with a very low chance of survival, in order to provide care to patients with potentially survivable injuries. It is not clear in this case whether the decision-making with respect to not initiating resuscitation of the decedent was influenced by the presence of these other two patients with less catastrophic injuries. However, at a minimum, the rationale for such decision-making should be clearly documented in the Patient Treatment Report. No such documentation was provided to support such a triage decision.

Recommendations for Improvements to EMS Response

The following recommendations arise from my review of the facts of this case, and of the paramedic treatment policies, procedures and protocols and response time standards and targets in place in the Cayman Islands, and in other jurisdictions. They are intended to assist with the continuous quality improvement of the EMS system in the Cayman Islands.

1. Consider equipping Cayman Island police and fire first responders with automated external defibrillators (AEDs) and training them on their use.

Rationale: PC 352 arrived on scene 1 minute and 22 seconds before Medic 3, at 03:19:24. If Cayman Islands Police first responders were equipped with and trained to use AEDs, there would have been an opportunity to assess the decedent and provide defibrillation (if indicated) more than one minute earlier than would have been possible by Medic 3. There is no way of knowing whether the decedent was in a cardiac rhythm of ventricular fibrillation or pulseless ventricular tachycardia at that time (or, indeed, at any point) for which defibrillation would have been indicated. Arguably, however, the most critical and effective prehospital intervention in cardiac arrest is timely defibrillation, and consideration should be given in any emergency response system to provide defibrillation as quickly as possible when indicated. This recommendation is particularly germane given the inherent geographic and logistic challenges to ensuring timely response times for paramedic services throughout the Cayman Islands with a limited number of paramedic units in service at a given time.

2. Develop and implement a paramedic protocol specific to the management of patients with traumatic cardiac arrest.

Rationale: As noted above, cardiac arrest from a medical condition is a very different situation from cardiac arrest arising from trauma (in terms of both cause and likelihood of survival), and merits a different approach. In this case, the decision by the paramedics not to initiate resuscitation of the decedent would, in many jurisdictions, have been considered appropriate. However, in order to ensure that paramedic decision-making around the management of trauma patients with cardiac arrest is consistent with accepted practice, it is critical that any protocol used to guide paramedic treatment is clear with respect to the criteria for withholding or withdrawing resuscitation, and who (paramedic or medical control physician) is able to make this decision. In the absence of such a protocol, resuscitation should be initiated and continued unless and until a decision is made with medical input to cease resuscitative efforts.

3. Reinforce existing paramedic policies and protocols through continuing professional education. In particular, this should focus on: indications for seeking direction from the medical control physician; management of the patient with traumatic cardiac arrest, and; decision-making around withholding or discontinuing resuscitation.

Rationale: Notwithstanding the need for a specific Cayman Islands EMS paramedic protocol for the management of traumatic cardiac arrest, several deviations from accepted practice and existing protocols were identified in this case. Ongoing continuing professional education is critical for all health providers, including paramedics, and should include reinforcement of key concepts and critical protocols, especially those which may be used infrequently.

4. Consider the development of additional EMS-specific fractile response time standards, linking the target response times to patient acuity.

Rationale: Standards currently exist for Cayman Islands EMS response times, including the Call Processing Standard, En Route Standard, and Travel Standard. However, these are portrayed as absolute values, irrespective of the condition of the patient. Many jurisdictions have adopted fractile response time targets which are linked to the acuity of the patient's presenting problem, in order to assist with dispatch prioritization and quality assurance efforts. Adopting a validated prehospital triage scale (such as the Canadian Triage Acuity Score (CTAS)) can assist with this process.

5. Remind all paramedics of the importance of documenting observations, rather than conclusions or medical diagnoses.

Rationale: Documentation by paramedics in this case included both objective observations and more subjective conclusions and medical diagnoses with respect to findings. Documentation by paramedics should focus on what is observed through the course of their patient assessment, rather than including definitive statements about the presence of specific diagnoses if this is not, in fact, within the scope of their assessment skills at the scene.

6. Synchronize event recorders throughout the system.

Rationale: Event times in this case were logged through a variety of systems, including: the Department of Public Safety Communications (DPSC) Centre Computer Aided Dispatch (CAD) system; the DPSC's 911 system; and the DPSC logging recorder system. These three systems vary by as much as 1 minute and 45 seconds from each other, and it is necessary to manually correct the time points from each system in order to establish a reliable and accurate sequence of events. While the Incident Timeline provided to me as part of the documentation included these corrections, ideally the three sources should be synchronized to each other (just as the CAD system is synchronized to the atomic clock) to eliminate this potential source of error and the additional effort required to correct these discrepancies.

Concluding Statement

Zak Maun Quappe suffered life-threatening injuries in a motor vehicle crash that occurred in George Town, Cayman Islands, in the early morning hours of May 18, 2013. The response by EMS and other providers was timely and within the established response time standards. Paramedics assessed Mr. Quappe, who was still trapped in his vehicle, and determined that he was unresponsive with no signs of life. Resuscitation was not attempted.

The paramedic response deviated from established protocols for the Cayman Islands EMS service in terms of the completeness of certain aspects of the assessment and in the decision not to initiate resuscitative measures in the absence of specific direction from their medical control physician.

Because a full post mortem examination was not performed, the exact nature and extent of Mr. Quappe's injuries are not known. The injuries which are known with certainty (including bilateral femur and tibia-fibula fractures and blunt trauma to the head) would be considered serious and potentially life-threatening even in the absence of additional internal injuries.

Without knowing the full extent of Mr. Quappe's injuries, it is not possible to state definitively whether or not the outcome could reasonably have been affected by any actions that could have been taken by paramedics. However, based on the medical literature and the clinical experience in other jurisdictions regarding the survival rates of blunt trauma patients who are vital signs absent with an initial cardiac rhythm of asystole, it is my opinion that that Mr. Quappe's injuries were likely not survivable, and that earlier assessment and/or initiation of CPR and other resuscitative measures by paramedics would not have altered the ultimate outcome.

In reviewing this case, I have identified opportunities for improvement in the quality of care provided by the Cayman Islands emergency response and EMS systems, and I have made six recommendations to support such system improvements.

In closing, I would like to extend my personal condolences to the family and friends of Mr. Quappe. While nothing can truly lessen the extent of your loss, it is my sincere hope that the clarification and analysis that I have attempted to provide in this review, coupled with the opportunity to improve care for others in the future, will offer you some degree of comfort in the days ahead.

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