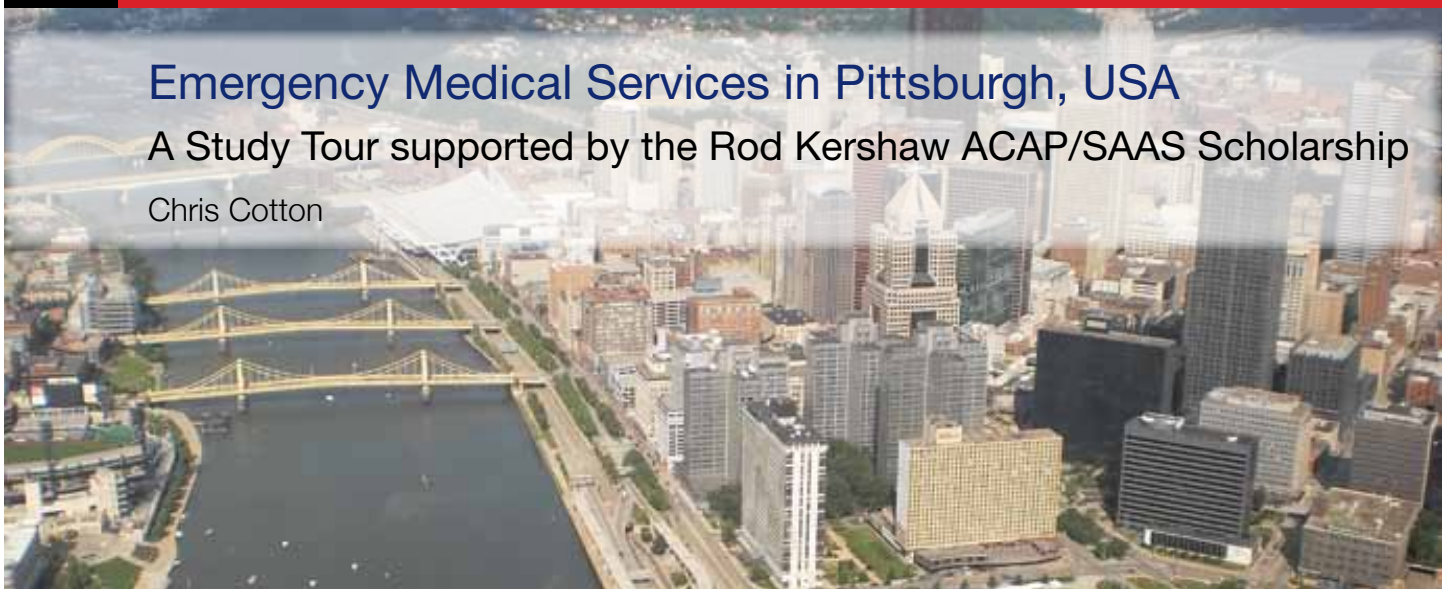
Emergency Medical Services in Pittsburgh, USA

A Study Tour supported by the Rod Kershaw ACAP/SAAS Scholarship

Chris Cotton



Pittsburgh and UPMC

Overview

Commencing in 2009, the Rod Kershaw scholarship gives one SAAS employee who is also a member of ACAP the opportunity annually to submit an application to go anywhere in the world to investigate a pre-hospital system or allied concept and report back to SAAS and ACAP on their findings. The successful applicant is then joint funded by ACAP SA branch and SAAS to undertake this activity.

The scholarship

I was the awarded this scholarship for 2010 and travelled to the USA where I visited three EMS systems; Pittsburgh, San Diego and Los Angeles. I also visited the JEMS journal management team in San Diego for discussions on how ACAP can collaborate with them, as well as attending the annual Safar Symposium in Pittsburgh and the annual Society for Academic Emergency Medicine conference in Phoenix Arizona.

I am grateful for the opportunity to undertake this scholarship, and as part of my conditions of accepting this award I have been asked to write up my experiences for Response and the SAAS internal magazine, SAAScene. My trip was huge, and is too long to write up in one instalment. I will present it over two or three articles.

A county ambulance in Pittsburgh

PITTSBURGH

Hospital system in Pennsylvania

There are three level one trauma centres in Western Pennsylvania, all of them within a few miles of each other in the city of Pittsburgh. Outside the city limits there are many smaller hospitals, so serious cases are usually transported by ambulance or helicopter to the level one centres. There appears to be competition between some of the hospitals for certain types of cases; STEMI's in particular, as PCI attracts a greater fee for example than thrombolysis does and whichever hospital gets the PCI gets more money (especially from insurance).

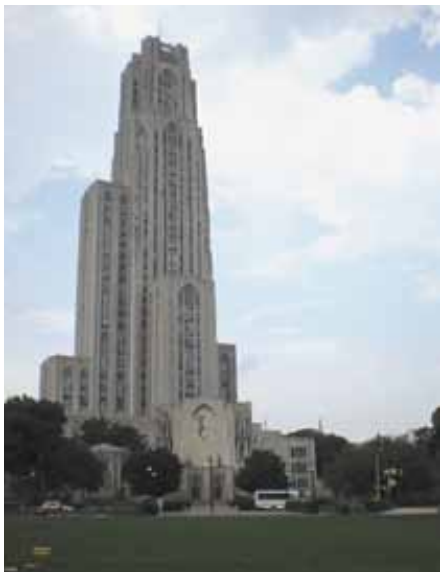
University of Pittsburgh Medical Centre (UPMC) "Presby" (Presbyterian) has about a 700 bed capacity and the local EMS in the city is generally quite close, so "scoop and run" is well adhered to maxim for the city-based paramedics.

EMS in Pittsburgh and Pennsylvania

In Pittsburgh proper there are approximately 350,000 people, with 1.2 million people in the greater Allegheny County. The county has 68 ambulance service providers over 130 municipalities, and many of these outside Pittsburgh proper are small, independent services who are often intensely loyal and proud of their local ambulance service.

Some of them may only operate between two and six ambulances and run on a shoe-string budget. There are a mix of career and volunteer paramedics in these services, depending on where you go.

Chris Cotton with UPMC in background



The Cathedral of Learning, part of UPMC

Emergency Department at UPMC Presby

Restocking drugs at UPMC Presby

Inside a Pittsburgh Ambulance

Neurosurgical ICU handover at UPMC Presby

Some paramedics contracted to smaller services work at multiple stations to make more money so they can support their families. Some of the agencies operate a subscription scheme to give ambulance coverage to their community.

Focussing on the city of Pittsburgh, there are roughly 60,000 ambulance calls per annum, and these are spread over the 13 ambulances in the confines of Pittsburgh, and are staffed by approximately 150 career road paramedics, supported by 15-20 admin and support staff, including medical directors and supervisors. There are two ALS trained staff on each ambulance. In the greater county of Allegheny outside of the city there is usually at least one ALS qualified paramedic on each ambulance.

Some of the smaller independent services find it difficult to stay afloat, so the University of Pittsburgh Medical Centre (UPMC), where some of the dispatches are coordinated from try to help them out where possible by offering them advanced notice of a particular day in a given time period (eg one month) where they will be responsible for all inter-hospital transfers. This helps them to plan some predictability ahead, especially with rostering.

Pre-hospital QI Program

Flight and road crews are provided a free copy of EMSCharts.com software for patient care record (PCR) documentation. Most crews outside the city of Pittsburgh use this electronic system. The inner city Pittsburgh paramedic system bought their own e-PCR program just prior to when the UPMC version was released. Either way there is an obligation by all services to ensure their PCR's are submitted electronically (pdf) within 24 hours of attending an ED, whence they become part of the patient's notes. Many crews therefore only verbally handover a patient at the time they drop a patient off, and then go back to their base to write up their ePCRs. These forms have a number of data fields built in to their software so that data can be filtered, searched and cross-matched as necessary.

All PCR's are reviewed in order of escalation by:

1). Peer review
2). Base manager review
3). MD review

This way 100% of cases are guaranteed to be audited in many systems and the opportunity exists for comments by any of the above along the way as feedback. Where a protocol violation has occurred, it is up to the individual clinician to own up before it is discovered by peers or upliners. If a paramedic commits a protocol violation and they don't own up immediately the penalties for being found out later are severe. Once identified as a violation the PCR is automatically reviewed by a medical command doctor who makes comment regarding whether there is grounds for remedial training or whether no further action is required. It is this latter which usually occurs, as most violations are not significant.

Medical Dispatch System

They operate a similar dispatch system to that previously used by SAAS in that they assign a numerical value to cases. 0 = known, or suspected fail of primary survey (eg CPR in progress), 1 = unknown emergencies or potential for life threat (ie bronchospasm). 2 is for "get there as quickly as possible but no lights and/or sirens" and 3 is non-urgent.

Paramedic Education

Most paramedics in Pittsburgh do a two year certificate course to become a paramedic. UPMC's health and rehabilitation sciences department offers a bachelor of emergency medicine degree to paramedics over four years, and includes a critical care and management class component.

On the helipad at UPMC Presby

On duty in Pittsburgh

Certification is provided by the state of Pennsylvania and paramedics must keep up this certification by "ConEd" or continuing education which is done by spending a certain number of hours on continuing education activities and some time with one of the four doctors who help administer the protocols. The bachelor of emergency medicine is gaining in popularity, but the majority of current paramedics did not start out in that system and most don't currently have it.

National Registration

National registration is available to all paramedics, but is not a requirement for practice. It is most relevant for those who wish to transfer from one jurisdiction to another. Once transferred, the paramedic still has to comply with state protocols for the state they will be working in and satisfy their state's requirements for practice, such as the ability to use particular equipment, etc..,. These requirements may be different to those set out under their national registration requirements.

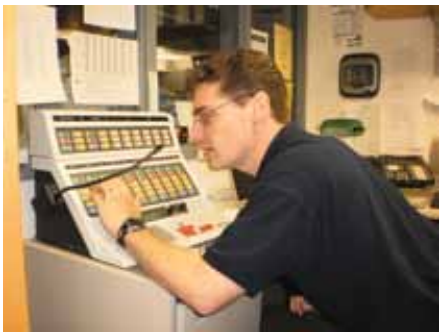
Stat Medevac helicopter retrieval/transport service

Flight paramedic Troy Morrissey drawing up labetolol

I spent a day working at the Medevac Three base in an area known as Cranberry, about 20 miles north of Pittsburgh, operated by Stat Medevac, who fly 23 helicopters and have 17 operational helicopter medivac sites in four neighbouring states, with the vast majority based in Pennsylvania. The crew of pilot Ken Ott, flight nurse Jim Pratt and flight paramedic Troy Morrissey are very professional to work with, are very polite/helpful to their patients and staff, they interact with and really know their craft.

Protocols

They operate under protocols; and there are plenty of them. They know them well and basically can operate "above the line" on their protocols without any need for consult with medical command. Their level of care would mirror most intensive care paramedic systems in Australia, and If they believe a patient needs care beyond their regular scope of "above the line" protocols they can go "below the line", which means they have to radio through to their Medical Command room at UPMC Presby for consultation and permission to do so. This system appears to work well and the Medical Command structure is first rate, and staffed 24/7 by experienced emergency physicians such as Dr Frank Guyette, a 35 YO emergency physician whose passion for pre-hospital care started when he was a young volunteer ambo in his local county growing up. The medical command room at Presby is dedicated almost entirely to supporting their operations.



Dr Frank Guyette taking a medical consult

Sub Arachnoid Haemorrhage case

We attended a call to a hospital approximately 20 miles north of the base to fly an elderly lady with a sub arachnoid haemhorrage back to Presby. The local hospital had already performed a CT scan and the diagnosis was confirmed. En route her MAP was remaining too high so the crew consulted to Medical Command for permission to give her labetolol, which was approved. Dilantin was also drawn up but not administered.

Equipment and shifts

These critical care flight paramedics usually work 24 hour shifts and can sleep anytime they have downtime. They have venous lactate monitors on board, can RSI and they are currently using the CMAC device to view airways live on a computer screen when they are intubating someone. They love this device. Flight paramedic Troy Morrissey says he has not failed a single intubation since it was implemented. They also have the EZ IO drill and use it almost routinely for adult cardiac arrest, and of course for paediatric cases as well. They are currently trialling portable tissue (StO2) monitoring.

Stat MD Medical Command

Stat MD is a not-for-profit organisation run by the UPMC and provides clinical advice to the rotor wing, Stat Medevac and ground ambulance crews. Four emergency physicians rotate through the 24/7 control room. This room, on the 13th floor of UPMC Presbyterian hospital, is the hub of medical command for all air operations, and also advises local hospitals of impending arrivals by road or rotary wing aircraft.

Medjet airline Medical Advice service

Stat MD also is contracted by a number of US and Canadian airlines to provide in-flight medical advice and direction to crews in the event of a medical emergency during flight. They are one of two companies in the USA who do this; the other is Phoenix, AZ based. All airlines contracted with Medjet have kits comparable to any doctor's bag, and have a rage of IM and IV medications, airway management adjuncts and a portable defibrillator on board. Radio communication with the planes can allow Stat MD to talk directly with anyone tasked with treating a patient. They also provide advice on whether a plane needs to be re-routed if a patient needs urgent medical treatment outside the scope of what can be provided on board the aircraft. The profit from providing this service pays for the staff in the medical command centre.

Med Assist Service

In addition to the airline consult service Stat MD also coordinate an insurance-style service called "Medjet Assist". Airlines and passengers can contact them and check on requirements for upcoming flights for people with significant medical problems where problems could arise during the flight. They liaise with the patient's family medicine practitioner and with the airlines to get the "right fit" for the flight. They can provide someone to accompany them on the plane also.

Safar Symposium

This was held over two days; 01 and 02 June at the Starzl Biomedical Sciences tower in Pittsburgh. The symposium is held in honour of the late Dr Peter Safar, who is greatly revered in Pittsburgh for the development of modern methods of resuscitation, setting up intensive/critical care units and starting the "Freedom House" Ambulance project in Pittsburgh in the 1960's.

Professor Pat Kochanek, director of the Safar centre with the Morris Water Maze

His development of current methods of CPR and his work with the late Asmund Laerdal, a toy and doll manufacturer to produce a life-size doll capable of having CPR performed on it was radical for its time and enabled widespread dissemination of teaching of CPR, and has saved thousands of lives worldwide. The first iteration of the doll produced by the two for resuscitation is housed behind glass in the Safar Centre at UPMC.

The symposium traditionally is held over just one day, but this year they opened it up to two days in order to showcase the latest research being done by trainees from different departments in the hospitals and research centres. There were over 100 poster and oral presentations by trainees from different disciplines, most of whom are doing research in the field of emergency preservation and resuscitation or related fields. Most of the research is targeting neurological damage in anoxic brain injury and is looking at novel therapies designed to limit chemically-mediated inflammation that occurs in response to anoxia. Most still involve rat studies and are a way off clinical trials in humans, but importantly this ground work needs to be laid in order for this research to progress to humans.

This inter-departmental research trainee's day was a chance for like-minded people to share their research projects with other researchers who may not otherwise realise what other research is being carried out that they might be able to tap in to. It is also a chance to celebrate and acknowledge their work. It culminated with the presentations being assesed by a panel of judges who awarded the Nancy Caroline Fellowship Award for excellence in research. Nancy Caroline was a close associate of Peter Safar's and was heavily tied up with EMS in Pittsburgh and wrote the well known "Emergency Care in the Streets", which for many years guided paramedic practice in the USA and was also popular in Australian paramedic circles.

Day two of the symposium started with a presentation by the centre's director professor Pat Kochanek on the remarkable life of Dr Safar, and this was followed up by associate professor of medicine, Thomas Rea from King County Seattle with his talk "the resuscitation grail: innovation, translation or tall tales". This talk focussed on the fact that resuscitation, critical ischaemia and subsequent reperfusion issues are a complex series of events that are not as yet fully understood and there appears to be no one single treatment that is effective globally. Different therapies are targeting different issues but there appears to be an interdependence of therapies, especially in relation to timing, sequencing and doses of medications in the victim suffering cardiac arrest. Chain of survival links and post resuscitation care certainly appear to influence survival.

Physiology-specific therapies are certainly gaining momentum, such as VF waveform analysis and CPR and defibrillation timing to where on the scale the fibrillating ventricles are at the time.

Resuscitation Outcomes Consortium (ROC)

This group are collecting systemic and uniform data across multiple sites on cardiac arrest and outcomes. Australia is uniquely positioned to help out here because we only have a handful of providers of pre-hospital care, whereas in the USA there are approximately 3000 agencies. The idea is to gather as much demographic data on resuscitation cases as possible, and from there join the dots to get a big picture from the data of what is working and what isn't.

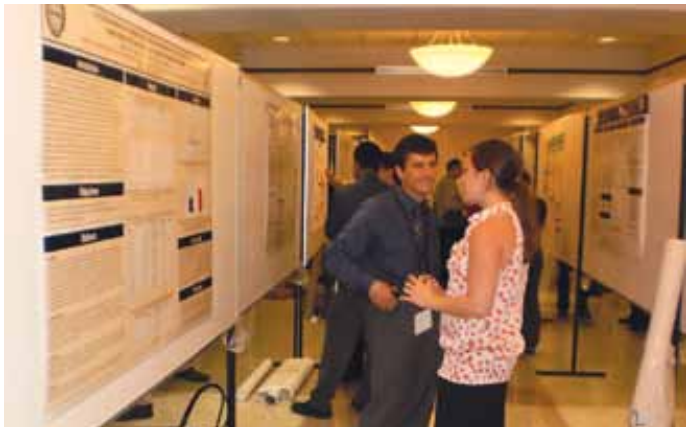
Novel studies using a rat model of VF cardiac arrest

Studies are being undertaken in rat models at the Safar centre. In anaesthetised rats they induce VF and measure multiple parameters such as Overall Performance Category (OPC) after return of spontaneous circulation (ROSC). Neurological recovery in these rats is measured by the Morris Water test, where resuscitated rats are placed in to a round and featureless water tank with a lone platform somewhere in the tank just below the surface of the water. There are symbol markers on the wall in the room where the tank is, and if the rats can see these and are able to recognise and remember a symbol they can eventually find the platform and when they are subsequently removed from the platform they can fairly easily find their way back to it. Those rats that perform poorly in these tests are usually because they have sustained some kind of anoxic brain insult from the resuscitation efforts. This is one of the only ways they measure neurological recovery effectively in rats.

Looking at the data from the work with rats, it is apparent that inflammation after cardiac arrest in long term non-survivors shows higher levels of inflammatory mediators, especially TNF alpha in the striatum of the brain.

Journal Club meeting

I was fortunate to attend one of the weekly journal club meetings held in the Safar centre. Hosted by Safar Centre director, Professor Pat Kochanek it involved about



Poster presentation at the Safar Symposium trainees research day

Safar Centre for Resuscitation research attached to UPMC Presby

Firefighter undergoing platelet function and physiological testing in heat stress

Testing the blood of a firefighter for platelet function in response to heat stress

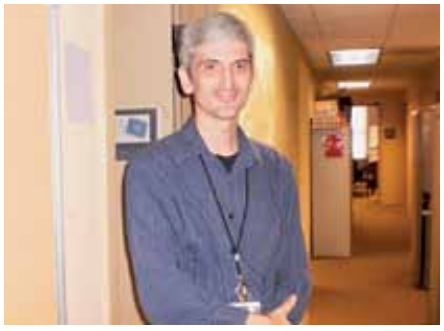
The first resuscitation doll used for demonstrating CPR developed by Laerdal and Safar

15 participants, mostly researchers, medical students and some MDs. The two presentations were presented by those with an interest in a particular topic.

Prof Kochanek says they look at lots of different articles ranging from effectiveness of CPR to mitochondrial DNA, and everything in between.

The two topics presented in the meeting were one on PPAR-y which inhibits oxidative stress and is thought to be neuroprotective (by inhibiting ROS) and for which the potential exists to improve outcomes by increasing its presence, and one on HSP60 which is released from dying cells and is implicated in the release of neurotoxic nitric oxide. Preventing this could reduce the cellular penumbra of death in neuronal damage.

Research Champions in Pre-hospital care



Dr Cliff Callaway

Dr Cliff Callaway is the Associate Professor and Vice Chair of Emergency Medicine at UPMC, as well as working for the "post cardiac arrest service" UPMC provides. Cliff works out of an office with anywhere between 6 and 20 people there at one time and oversees most of the research for UPMC in pre-hospital care. These people are co-researchers, doctors, biomed scientists, etc..,. They do a number of different things in the way of research, but there is a large focus on cardiac arrest and CPR. They have a lady (Melissa) who works with the electronic PCR forms and maintains a cardiac arrest registry. She often meets the crews at the hospitals and interviews them about the case. Her co-worker Joe's role is to examine the data from MRx's and link it to the e-PCR's.

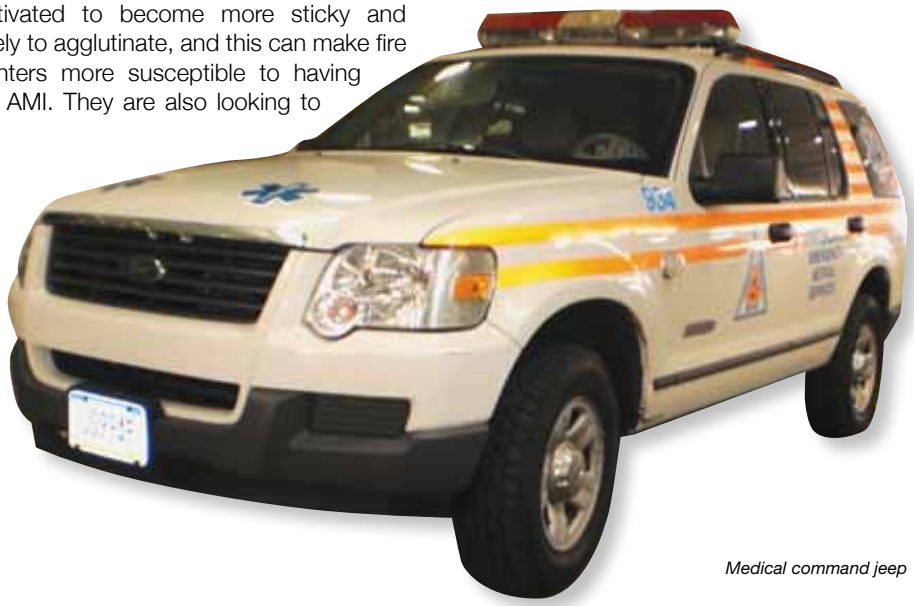
The data gathered from the MRx includes waveform characteristics and other analyses such as thoracic impedance, rate, depth of compressions and ventilations. It also records the amount of time with no CPR, and records the audio from the scene. At first local crews were a bit worried/sceptical about this, but they have now realised that the tool is not designed as a policing measure, rather as a data gathering tool. Some of the crews are now so comfortable with it that they even joke on the audio file when they are at a call "are you ready Joe? We're about to defib". In Cliff's office, it is Joe who records all this data in a way that is linked to the e-PCR and then enters the monitor data with it.

Dr David Hostler is an Associate Professor of Emergency Medicine and the director of the Emergency Responder Human Performance lab which was active the day I was there. His staff had a fire fighter who they made hot by getting him to exercise in their "hot" lab (up to 100 F) and then took blood from him to measure his platelet number and quality. In Increased temperature environments platelets are activated to become more sticky and likely to agglutinate, and this can make fire fighters more susceptible to having an AMI. They are also looking to measure what happens when they are given aspirin weekly.

I spent a day with one of the paramedic system medical officers, 35 YO Dr Frank Guyette. Frank started out as an EMS volunteer at the age of 16 and initially did a bachelor's degree in biology and then his masters in cellular biology, followed by medical school in New Orleans. He shifted to Pittsburgh to work at UPMC for his residency in emergency medicine and decided to stay on to do his fellowship in EMS and then a master's in public health and disaster medicine.

His interest in emergency medicine stemmed from his early days as a volunteer paramedic with a small county service, and then through exposure to emergency cases in his work rotating through medical command, either in the control room where he takes calls from road crews wishing to vary from a protocol or "riding the jeep" where the ambulance service MD's drive around backing up road crews to serious cases.

Along with Cliff and David, Frank is part of the Resuscitation Outcomes Consortium (ROC), a group of 10 universities across the USA and Canada that looks at trauma and cardiac arrest data via interconnected registries.



Medical command jeep