**EMS Medicine Board Review**
**UCSF-SFGH EMS/Disaster Fellowship**
**John Brown, MD**
**Mary Mercer, MD**
**Katie Tataris, MD**
**Last Revised: October 2013**

# EMS / Disaster Fellowship Book Review
# Emergency Medical Services: Clinical Practice and Systems Oversight: Cone, O'Connor, Fowler 1st Ed. 2009

## Volume 1
## Clinical Oversight

Chapter 1: Altered Mental Status

- Ddx-Very broad differential should be remembered by providers--AEIOU TIPPS is useful.
- History not possible from patients, but clues from surroundings useful: bystanders, family, med-alert bracelets, medications, other sick residents or pets. Questions such as description of LOC or seizure like activity.
- Physical exam: AVPU classification for level of responsiveness. Head-trauma, pupils (toxidrome), odor of drug or toxic ingestion, tongue lac abrasion for seizure activity. Neck-stidor, obstruction as cause of hypoxia. Chest—RR pattern, trauma. Abdomen—pulsatile mass as cause of collapse. Neuro—focal signs, speech patterns, etc. Skin—temperature, dehydration, rash, track marks
- ABCs—including supplemental O2 as tolerated, adjunctive airways
- Medications: Past endorsement of empiric dextrose and naloxone but sufficient evidence that unnecessary dextrose could have significant consequences such as skn necrosis as well as poorer outcomes/tissue injury associated with hyperglycemia during myocardial ischemia etc. Naloxone over-dosing with theoretical risk of seizures but emergence phenomenon is frequent/real risk. Recommend against flumazenil for benzo Od in prehospital setting due to high risk of seizures. Supportive care sufficient for benzos.
- Direct medical oversight recommended in many systems if glucose OR naloxone given
- Intranasal use of naloxone may make it BLS delieverable.
- Treatment Challenges: differentiating intoxicated patients from more serious causes of ALOC (e.g. trauma, hepatic encephalopathy, sepsis, hypoglycemia, hypothermia, seizures, etc)
- Challenges of refusal of care after treatment for hypoglycemia and opiate overdose: For IDDM, generally ok to release if tolerating Pos, FSG normalized, no other e/o AMS and reliable. However, risk of recurrent hypoglycemia or sedation in long-acting oral hypoglycemics or long-acting opiates. Full risk assessment needed in these patients.

**Take Home Messages**: Education critical to prehospital management of AMS. Several useful tools and mneumonics

Chapter 2: Cardiac Arrest Part1-Systems of Cardiac Arrest Care

- Cardiac arrest is time-critical event, but much of the survival benefit patients receive is due to community based systems such as bystander CPR and AED deployment and use.
- Epidemiology: Incidence of SCA is estimated between 166k and 450k/yr. Survival to Hospital discharge for OOHCA is estimated between 5-10%. VF is initial rhythm in approx 30-60% of cases.
- Elements of Community Cardiac Arrest Care System (Chain of survival): Early recognition and calling for help, 911 dispatching and PAI, Bystander CPR, PAD, First responder BLS Care including defibrillation, ALS care, Post arrest care
- Bystander recognition of SCA has been variable due to agonal breathing etc.
- Role of EMD in recognizing SCA from calls that arrive with other chief complaints

- Bystander CPR rates and education efforts should be monitored by EMS MD and providers. Emphasis on compressions before ventilations
- Public Access Defibrillation: 70-80% of VF can be successfully converted to prefusing rhythm if shocked within 3 min of VF onset, but survival decresases 7-10% per minute for each minute delay. AEDs provide faster access to defibrillation. Need to be well placed in community with members knowing they are present and how to put them on. AEDs are very safe, but still some confusion about them. Newer studies (such as ROC) show survival doubles with AED +CPR compared to CPR alone.
- BLS Care of First responders: 1st goal: early defibrillation access OPALS study found that by increasing BLS response rate of <8 minutes from 77 to 92% improved survival to hospital discharge in SCA patients from 3.9 to 5.2%. 2nd goal: performing/continuing high quality chest compressions/CPR
- ALS Care: Despite traditional "cornerstone of cardiac arrest care" ALS now recognized as secondary in importance to overall survival when compared to BLS and bystander response.
- Role of Medical Director: Stewart quote: "Without dedicated medical leadership, the EMS system of a community flirts with mediocrity." MD is important in ensuring a system has adequate: training and equipment, optimal system design, hospital liaison and QI program.

**Take Home Messages**: Systems design and integration critical in success of first links in chain of survival

Chapter 3: Cardiac Arrest Part 2: Clinical Management of Cardiac Arrest

- Although detailed algorithms exist for ACLS-it's important to understand scientific rationale and practical considerations behind them
- Resuscitation protocols: Initial cardiac arrest care must be provided under standing protocols (not on-line direction). AHA ACLS is what most systems rely on. Protocols should also provide convenient medication dosing mixtures/information
- Direct medical oversight should be sought after initial exhausting of protocols with successful or unsuccessful resuscitative efforts. DMO should be prepared to provide appropriate direction for less common scenarios (eg initiating dopamine post ROSC etc)
- Chest compressions: emphasis on continuous chest compressions with few interruptions. Practical challenges in EMS setting (few staff, movement, scene, other interventions, etc). Some adjunct devices may help: feedback monitors, automatic compression devices
- Defibrillation: A critical and time sensitve intervention. Now most biphasic, but older monophasic devices require higher energy. Consideration about possible interface issues between ALS and BLS defib equipment. Some AEDs brought by BLS can be converted to manual, but others can't---time gets wasted in switching over. New recommendation to precede defib with chest compression and continue chest compressions following in order to better perfuse myocardium
- Airway management: changing landscape of now reducing time on airway and emphasizing compressions. More attempts halt CPR. Blind insertion supraglotic devices may be of use
- Ventilation: minimize ventilations to 8-10 bpm in order to prevent preload reduction. ITD is something to consider (though not borne out in completely)
- Medications: Vasopressors, Antiarrhythmics, and Atropine
- DNR and Termination of Resucitation efforts: Protocols in system are useful for addressing these situations. Medical Direction useful as well. Three primary situations of non-initiation or termination: 1. patient has DNR status; 2. Patient has clear signs of irreversible death; 3. Patient underwent initial resuscitative efforts and not responding (time and action limit)
- Post Arrest Care: Goals of post arrest care: 1. maintain hemodynamic stability; 2. Preserve the brain; 3. Correct metabolic derangements
- Features of post-arrest care: vasopressor titration, therapeutic hypothermia, appropriate cardiac cath, sedation, glucose and electrolyte management

**Take Home Messages**: Well thought out and evidence-based protocols are essential in an EMS system

Chapter 4: Choking

- Time sensitive nature- can progress from airway obstruction to LOC and cardiac arrest. Bystanders are optimal first responders and knowing maneuvers (Heimlich) to help dislodge FB is most useful
- Food most common object but other nonedible objects frequent in children
- Toddlers 1-4 yo are highest risk, then 4-9 year olds, then adults over 60.
- Maneuvers—for awake person Heimlich behind the person. Now ACLS recommends chest compressions. For Infants <1 year of age prone, head downward with backblows.
- EMS personnel arriving must be able to manage advanced stages of crisis—may have progressed to death
- May attempt Heimlich on patient. If ALS, may attempt direct visualization and attempt removal of FB with Magill forceps
- Intubation may be attempted to mainstem an object,. Cricothyrodotomy is last resort
- May need ENT intervention to remove object after hospitalizaton

**Take Home Messages**: Time sensitive. Basic procedures and public education needed.

Chapter 5: Drowning

- Epidemiology: Approx 4-7k cases non-fatal drowning per year. Fatal cases 3.2k-6k. Drowning of children generally result from lapses in adult supervision. Education and prevention programs important. CPR is an important skill for pool owners.
- Drowning: suffocation and death as a result of submersion in liquid. Wet drowning: aspiration of watery sand, other material>> pulmonary edema, pneumonitis, surfactant disfunction. Dry drowning: minimal aspiration due to laryngospasm
- Cerebral hypoxia—significant role in functional recovery of victim. 10% survivors have severe lasting effects. Secondary drowning: death from ARDS etc following drowning. Near drowning: immediate survival after submersion event
- Prearrival Instructions: important to guide bystanders through CPR (42% kids who drowned at home had no CPR until Ems arrival). AED use appropriate if available
- Scene and Crowd Control: for best CPR and also to prevent secondary drowning event
- Management of Drowning Victims in Cardiac Arrest- treatment algorithms do not require modification for drowning victims. Severe hypothermia should be a consideration for cause of cardiac arrest and active re-warming should take place where that is a consideration
- Management of near drowning—range of patients: those who never lost vital signs or were successfully resuscitated. EMS focus still on ABCs. Supplemental O2, monitoring etc. Many still require hospitalization. Should not be allowed to AMA
- Trauma is often a concurrent injury to drowning and near drowning patient (particularly cspine injury following submersion). While important to maximize immoblization, risk /benefit of maintaining cspine must be weighed in rescue efforts in which extraction may be difficult or hazardous to rescuers.
- Destination decisions: Consider transporting all arrests. Transport patients with perfusing rhythms to specialty centers (such as post arrest or trauma centers as indicated)

**Take Home Messages**: Drowning victims without VS, treat same as other cardiac arrest and add re-warming

Chapter 6: Electrocution and Electrical Injuries

- Electrical injuries have trimodal age distribution: toddlers-household sockets and cords, adolescents-risky behavior around electrical power lines, adults who work with electricity for living
- Most frequently, electrical injury is minor
- Electricity=flow of electrons from higher to lower concentration
- Direct Current (DC)=electrons flow constantly in one direction across voltage potential (battery)
- Alternating Current (AC)=direction of electron flow changes rapidly in cyclic fashion, in US standard household current flows at 60 Hz and 110 V
- Six factors determine outcome of human contact with electrical current: voltage, type of current, amount of current, resistance, pathway of current, duration of contact

- Low Voltage= less than 1,000 volts
- AC exposure to same voltage is 3x more dangerous than same voltage of DC current
- "Let-go current" (6-9 mA)= level above which muscular tetany prevents release of the current source, flexor tetany of fingers/forearms overpower extensors
- Vfib occurs at 50-100 mA
- Ohm's law, I=V/R or current = voltage/resistance
- Path of electricity flow determines tissues at risk (thorax vs cerebral)
- Tissue low resistance=nerve, blood vessels, high=skin, bone, fat
- Electrical energy->thermal energy conversion: massive internal/external burns
- SCENE SAFETY
  - Personnel should stay 10-30 feet away from source until utility company confirms off
  - Protective equipment: rubber gloves and boots
- MCC death electrical injury=cardiac arrythmia, resp. arrest (AC->VF, DC->asystole)
- MCC EKG abnl=sinus tach, NSST-Twave changes (transient)
- Treatment also includes trauma and burn evaluation
- Aggressive resuscitation (victims usually young, no CV disease)
- Lightning: unidirectional cloud-to-ground current resulting from static charges that develop when cold high-pressure front moves over a warm, moist low-pressure area
- Actual energy delivered is less than typical high-voltage injury due to short duration
- 70% lightning strikes not fatal, 30% strikes involve > 1 patient (hit shelter)

<u>5 Basic Mechanisms of Injury</u>

1. Direct Strike: hits person out in open, usually fatal
2. Splash Injury: lightning strikes object or person and 'splashes' to nearby victim
3. Contact Injury: victim in physical contact with person directly struck
4. Step voltage/ground current injury: lightning hits ground, spreads radial to human body as it offers less resistance than ground, travels one leg->other
5. Blunt trauma: victim thrown by concussive forces of shockwave->opisthotonic muscle contractions->fractures/trauma

-MCC death=immediate cardiorespiratory arrest

- "Resuscitate the Dead": significant potential for resus with early/sustained EMS tx
- Severe burns uncommon due to brevity of exposure
- Less important for burn care/aggressive IVF compared to high-voltage electrical inj.
- Victims struck during rain->"flashover effect"=decreasing current transit through body and also risk of severe internal injury
- Lichtenberg/feathering burns=pathognomonic for lightning injury, not true burn (extravasation of RBCs into superficial skin layers along current lines of flashover)
- Keraunoparalysis "lightning paraplegia"=immediate effect of lightning injury, paralysis of limbs with pallor, cool temp, absent pulses (result of severe arterial vasospasm from catecholamine release, resolves in few hours)
- Other injuries: neuro effects (LOC, confusion), TM injury, ARF
- ***Initial care to apparently dead victims first, change in typical MCI triage***

**Take Home Messages:**
SCENE SAFETY, significant resuscitation potential for these patients, combination trauma/burn injuries

<u>Chapter 7: Hypotension and Shock</u>

- Difficult to identify shock in prehospital setting, but early care is important
- Categorizing shock into 4 categories using pump-fluid-pipes model helps organization
- Clinical assessment of shock: vital signs, (often without/p), pulse ox (inaccurate), ETCO2
- Shock tx: isotonic crystalloid IVF (IO), hemostatic agents/tourniquets, pressors
- Lack of definitive studies on out-of-hospital shock treatment->controversies (PASG)
- Studies: no mortality benefit prehosp IVF in traumatic hemorrhage (short transport)

**Take Home Messages**: Shock is important in hard to identify, important to treat with IVF based on clinical situation

Chapter 8: Traumatic Injuries

- Injury related ED visits (36%) mostly 18-24 y/o male group and unintentional-MVCs
- Research is ongoing regarding best EMS system structure, ALS vs BLS interventions

Central EMS trauma concepts:

1. Consistent assessment algorithm that can be applied to any trauma patient
2. Time is of the essence, destination policies
3. Limit additional mortality (splint, fluid resuscitation, pain management)
4. Universal precautions/scene safety

- Scene assessment: photography, event data recorders in MVCs, telemedicine evals
- Airway management should be related to distance to trauma center, adequacy of BVM oxygenation, concern about use of prehospital RSI
- Hypotensive or hypoperfusing patients should receive IV/IO access and fluids
- Permissive hypotension: 80-90 mmHg systolic is the goal of therapy
- Blunt trauma pregnancy->usually MVCs->abruptio placentae
- Fetal viability at 24-26 weeks gestation may determine destination (neonatal)
- Perimortem c-section: maternal cardiac arrest < 5 minutes and fetal distress
- Pediatric fluid resuscitation usually underestimated, 20 ml/kg boluses
- Field guidelines: performing necessary interventions and rapid transpor to closest appropriate facility
- Isolated traumatic mechanism criteria has very low sensitivity and PPV->overtriage
- Field Triage Decision Scheme: revised 2006 approved by ACS, CDC, NHTSA
- Trauma scoring systems likely better for research than field patient care
- Revised Trauma Score (0-4)=RR, SBP, GCS
- Public health prevention: drunk driving, helmets, seat-belts, firearm storage

**Take Home Messages**: Well integrated out-of-hospital trauma management can have major positive impact on patient morbidity and mortality

Chapter 9: Vehicle Related Injuries

- Motor vehicle incidents account for a large percentage of requests for EMS
- Biomechanics: transferring physical energy to human body in predictable pattern with predictable results
- Morbidity and mortality occur when the body absorbs kinetic energy beyond tolerance
- Speed and stopping distance contribute to objects gravitational (G) force
- NHTSA estimates seat-belts reduce fatalities by 45%, with airbags up to 50%
- Motor Vehicle Incident types: frontal impact (32%), rear impact, lateral impact, rotational (38%), rear end, rollover
- Unique problems: traffic, glass/hazards, hazmats, extrication
- Haddon's matrix: host/agent/environment vs. pre-event, event, post-event
- Automatic Crash Notification (ACN) Systems: detect airbag deployment or rapid decel->notifies call center of vehicle GPS location, research to determine EMS integration

**Take Home Messages**: MVI->significant $ and resources, ACN in future may help improve care

Chapter 10: Penetrating Trauma

- Deaths have trimodal distribution: 50% occur within few minutes, 30% die in first few hours (EMS can make a difference), 20% occur days-weeks later (multi-organ failure)
- Kinetic Energy= ½ mass x velocity 2
- Law of Conservation of Energy: energy cannot be created or destroyed, only transferred from one form to another
- Ballistics=trajectory + how projectile acts when it hits its target
- Cavitation: high energy missiles create a shockwave and cavity in body tissues
- High velocity projectile injury=direct, pressure wave, cavitation
- Scene safety/law enforcement, PPE/blood-borne pathogens

- Conditions requiring rapid stabilization: open PTX (sucking chest wound->one way occlusive dressing), tension PTX (needle decompression), hemorrhage, hypotension-> IVF, impaled objects, airway obstruction
- "Scoop and Run" vs. "Stay and Play": reduced mortality when scene times shorter
- Golden Hour for Trauma: Best survival for patients requiring surgery is when the surgery was begun within one hour following the injury
- "Platinum 10 Minutes": for EMS, goal to begin transport of patient within 10 minutes of arriving on scene
- ACS Prehospital trauma triage criteria using physiologic, anatomic injury, mechanism, age, and comorbid conditions
- Trauma systems are designated to provide a coordinated response across a continuum of injury prevention strategies, emergency access (911), prehospital EMS, trauma triage, dedicated trauma centers, specialized trauma teams, rehab
- ACS Committee on Trauma: Level 1-4 trauma center criteria
- Penetrating chest trauma: PTX, pericardial tamponade, hemothorax
- Penetrating abdominal trauma: abdominal trauma has high mortality due to relative lack of skeletal protection and highly vascular structures, solid organ injury-> hemorrhagic shock, hollow organ injury->peritonitis
- Penetrating neck trauma: zone 1=high mortality, use occlusive dressing
- Penetrating extremity trauma: vascular injuries, bony injuries, amputations
- Medicolegal: documentation/PCR legal records, forensic evidence preservation
- Controversies: permissive hypotension, hypertonic saline, blood substitutes, prehospital termination of trauma resuscitation, US FAST exams

**Take Home Messages**: many controversial trauma treatments, keep up to date on new research

Chapter 11: Traumatic Brain Injury

- TBI accounts for 1/3 of traumatic deaths in US (firearms 40%, MVC 34%)
- Children account for 1/3 TBI, and 28% due to falls
- Brain injury from primary traumatic event + secondary insult hypotension/hypoxemia
- Airway assessment while maintaining c-spine precautions
- "Episodes of hypoxemia and hypotension worsen mortality"->oxygen and IVF
- Secondary assessment: pupils, GCS, etoh can complicate
- Mild TBI (GCS 14-15), moderate (GCS 9-13), severe (GCS 8 or less)
- Field differentiation of TBI impossible, important to reassess GCS, eval herniation
- IF clinical sx herniation->mild hyperventilation to ETCO2 30-35 mmHg
- Hyperventilation->cerebral vasoconstriction->reduction blood flow->lower ICP ->secondary brain injury

**Take Home Messages**: Use ETCO2, prevent spikes in ICP, need up to date research on TBI management

Chapter 12: Neck and Back Pain

Occupational back pain for EMS providers: Injury rate 34.6 incidents per 100 full time workers per year, with strains/sprains/tears highest category 36%, low back most frequent part of body injured. EMT's injury rate twice that of paramedics. Lifting patients causes 62% of low back injuries, majority at scene not at hospital. Injury prevention includes having sufficient personnel to lift a patient and using transfer devices such as slide boards. Patients with non-traumatic back pain: 80% of population has back pain at some point. Risk factors: heavy lifting, twisting, obesity, poor conditioning. Airway management may be difficult due to arthritis, consider narcan for chronic pain patients on opioids with respiratory compromise. Spinal immobilization unnecessary. Age over 50 or under 20, infectious symptoms, anticoagulation, persistent abnormal neurologic exam, immunocompromise. Beware medical legal risk cases of AMI, CVA, meningitis, and AAA--it is not within the provider's scope of practice to refuse care due to "faking" back pain. Documentation should include risk factors. Patients with traumatic back pain: spinal immobilization important in patients with head injury and AMS; all methods of ALS airway management cause some CS movement. Secondary survey should focus on ID of neuro deficits.

Selective CS stabilization important to minimize complications: respiratory compromise, chronic back pain and decubitii. Utilize NEXUS or southeastern MIchigan EMS spine injury assessment protocols to determine elligibility. NAEMSP says: AMS, intoxication, distracting injury, neuro deficits or midline TTP=immobilize. Recording of neuro assessment crucial especially in kids. Optimal care may be at spinal center or trauma center (hemodynamic instability, mechanism, specific anatomic injury or patient co-morbidity). CS injury cost $200K to $2M; missed CS malpractice average award $2.9M; err on the side of caution. However some countries have established treatment based on no demonstrated efficacy of CS immobilization. No clear evidence of advantage to helmet removal (MC or athletic).
**Take Home Messages**: Should we require stair slider chairs for 911 providers? Protocol for patients with no AMS once collar placed to self-extracate from vehicles?

Chapter 13: Ocular Trauma
Eye injuries are significant in 50% of facial trauma cases, mostly male and under 30. Beware distraction of eye injuries; facial injuries can include airway compromise and this must be assessed first. Do a visual acuity, even counting fingers or presence or movement of light is helpful (most helpful = pocket snellen chart with pinhole occluder if patient usually wears glasses). Check for penetrating/retained foreign bodies and use a cup over the eye if present--do not remove. Check eyelids for injury, EOM's esp. superior gaze for orbital blowout, cornea for hyphema, peri-orbital sensation for infraorbital nerve injury. If open globe injury suspected, protect eye with hard shield, elevate head of bed 30 to 45 degrees, pain control and anti-emetic meds. Same tx for traumatic hyphema. Chemical exposure of the eye=immediate, copious irrigation. Lots of eye examination description—can this be accomplished in the pre-hospital setting?
**Take Home Messages**: Add assessment of visual acuity (grossly) to head and neck trauma protocol if facial injury or eye pain is present.

Chapter 14: Intimate Partner Violence
Fear, isolation, entrapment are tools used to gain control in IPV. EMT's can theoretically detect IPV before injury on home EMS calls. Women account for more victims than men so chapter focuses on male-on-female violence. Intimate partners commit 30% of all female homicides and 5% of all male homicides. Higher risk groups include women of color, immigrants, the disabled, young and those separated or divorced. Testing period, starting with verbal abuse then escalating to physical or sexual abuse. The cycle of violence includes tension, then violence, then the honeymoon. It can be passed generationally. 33% of female trauma patients are victims of abuse; there is a role for universal screening in the ED. EMS providers need to be aware of reporting requirements in their jurisdiction. For safety they should avoid confronting the abuser, let the abuser get between them and their escape route, and not get physically between a couple who is arguing (scene safety first, liberal use of law enforcement). Physical assessment (e.g. for defensive arm and hand injuries) and behavioral assessment (e.g. the victim looking to the partner for guidance in answering questions) are both important. Instructions given on how to separate couples to ask about abuse (must be done--in the back of the ambulance if not possible elsewhere); if yes ask "are you safe now?", "do you want to talk about it?", "have you talked to anyone else about this?", "what do you need right now?". If victim answers "no", give resources and empower the patient however possible. EMT's can assist with safety planning and referrals. Document thoroughly, especially interventions like removing clothing, and use the principles of objective, accurate, specific, legible and complete.
**Take Home Messages**: Emphasize the "preserving evidence" aspect of reporting immediately to L.E. in our assault/abuse protocol.

Chapter 15: Sexual Assault
Vastly underreported, as much as 90% of rapes are not reported. Sexual assault is the acting out of power and control over another person with the intention of abusing and humiliating them. Sexual assault can affect anyone and is not necessarily accompanied by physical trauma. Support becomes the EMT's priority in dealing with SA victims including those that are Drug Facilitated; if alone ask if the patient would like a support person to be called. Do not examine the

genitalia unless life-threatening injury there is suspected. STI including HIV prophylaxis are time sensitive and should be considered. Preserve evidence, verbal as well as physical. Sexual assault care center is the appropriate destination, and EMT's should be aware of reporting requirements. Preservation of evidence includes chain of custody considerations such as labelling containers for clothing or bodily fluids with EMTs initials, date and time. Turn over ambulance gurney sheets to law enforcement.
**Take Home Messages**: Do we need to designate Sexual Assault treatment centers?

Chapter 16: Child Maltreatment
EMTs have access to home environment and similar to IPV can make valuable observations on child-caregiver interaction. Neglect is more prevalent than abuse. Assessment of the child's skin is extremely important. Multiple area of the child's skin being bruised or bruises of protected areas such as the genitals are suspicious for abuse. Developmental appropriateness of the explanation of injury by the caregiver is important. Rare for infants less than 18 months of age to sustain accidental fractures. Any child with suspicious injury should be transported to medical care. Delays to medical care by caregivers are suspicious. EMS responsibilities in sexual abuse of children cases are identification, crisis management and careful documentation. Child maltreatment more common in IPV settings.
**Take Home Messages**: None for our system (CA/CN awareness training/reporting in place)

Chapter 17: Animal Bites
Animal bites account for 1% of ED visits but are seldom encountered in EMS. Scene safety concerns are paramount, co-dispatch law enforcement and/or animal control and do not transport "dead" animals causing the patient's injuries in the ambulance. The EMS Medical Director should be aware of dangerous animal species in the area. All bites other than marine envenomations should be copiously irrigated after hemostatis is achieved, splint extremities if they are involved. Most mammalian bites are caused by dogs and cats and involve the upper extremities with high rates of infection and corresponding need for Abx. Reptile bites are mainly from Crotalid snakes (hemotoxic symptoms) and Elapid snakes (water environments, neurotoxic symptoms). Compression immobilization and positioning at or below the level of the heart are the only recommended prehospital therapies as antivenins are difficult to administer. For marine envenomations remove any remaining tentacles or nematocysts with gloved hands/instruments after stabilizing with a vinegar solution and use local heat application to degrade toxins and provide pain relief. Black widow spider bites should be treated with analgesics and benzodiazepines as needed for pain and muscle spasm. Rabies PEP recommended universally for bites from skunks, foxes, raccoons and bats (directly witnessed or suspected). Dogs, cats or ferrets who cause bites should be observed for 10 days in quarantine before deciding on RPEP if the animal is asymptomatic. Use the poison center as a resource when dealing with non indigenous animals/insects.
**Take Home Messages**: Do we need a snake bite protocol in SF? If so, do we need compression/immobilization added?

Chapter 18: Heat/Cold Exposure
- Providers need to protect themselves from the effect of extremes of temperature, and while treatment is more effective in systems with long transport times principles should be familiar to urban providers as well, since patients who are engaged in outdoor activities or homeless are also susceptible.
- Heat: conduction, convection, radiation and evaporation are the mechanisms of heat disapation. Volume depletion, decreased cardiac output and meds that cause anhydrosis contribute to heat injury (eg. psych). Spectrum of heat illness includes heat edema, heat syncope, heat cramps, heat exhaustion and heat stroke. Active cooling is the treatment, as well as replacement of fluid and electrolytes; transport if patient has AMS as heat stroke.
- Cold: Spectrum of cold injury shivering and mild agitation to ataxia and slurred speech then cessation of shivering and lowered mental status to coma and Vfib. Treatment is to remove the patient from the cold environment including removal of wet clothing, passive external rewarming if patient is still shivering, active external rewarming if shivering stopped, handle

gently to minimize the chance of inducing Vfib, active internal rewarming difficult in the field but perhaps warm IVF. Frostbite tissue damage caused by freezing/melting of intra cellular water therefore if refreezing is possible, rewarming should be delayed to post transport and meanwhile the affected tissue covered with a sterile dressing. Rewarming should be conducted by immersion into a warm water bath temp. 40 to 42 degrees C for 15 to 30 minutes and tissue is warm, red and painful. NSAIDS are of theoretical benefit but may not be in scope of practice.

**Take Home Messages**: Should we use chilled or warmed NS for environmental injury patients?

Chapter 19: Hemorrhage

Arterial hemorrhage will require pressure greater than SBP for :20 to control, venous and capillary bleeding may be amenable to hemostatic dressings. Traditional measures to diagnose hemorrhagic shock have limitations, e.g. AMS may also be due to hypoxia or hypoglycemia, but others have shown promise such as pulse pressure (SBP - DBP) and shock index (HR/SBP). Serum lactate and dynamic pulse oximetry still in development. Control hemorrhage with direct pressure, pressure dressing, splinting if appropriate and tourniquet application. Elevation and pressure points do not work. Advanced hemostatic agents (for dressings) all have drawbacks. Fibrin dressings (supply clotting factors directly into the wound) are very expensive and not approved by the FDA. Chitosan (mucoadhesive properties directly seal the leak) cheap but unproven. Zeolite (rapid absorption of water concentrating platelets) very cheap but produces an injurious hyperthermic reaction. Smectite (water absorption) but not exothermic and kaolin gauze (mechanism of action not listed) were the most recommended. Permissive hypotension (target SBP in the 60's), prevention of hypothermia, and special considerations such as use of replacement factor in hemophliaics (they may have supplies in their homes) and platelets for clopidogrel and FFP for liver disease patients discussed.

**Take Home Messages**: Is it time to institute pelvic binders? Time for TXA?

Chapter 20: Explosive and Burn Injury

Average number of bombings in the USA is 5/day. Explosives injury is caused by the blast wave generated by the transformation of a high explosive from solid to gas almost instantaneously. Spall (small particles of liquid and tissue thrown into the gas space at a liquid/gas interface) occurs in tissues such as lung and bowel--this is primary injury. Secondary injury occurs from projectiles dislodged by the blast striking the body. Tertiary injury comes from the patient being dislodged by the blast and contacting another object. Quaternary blast injury occurs due to additional components to the bomb, such as a Suicide Bomber who has hepatitis or a "dirty bomb" with radiologic contaminants. Regional burn treatment in MCI's important due to diminishing resources. Airway concerns mainly with burn patients-early ALS airway including potential extra-glottic devices with intubation capabilities. Don't use tape to secure ETT in burn patient due to potential slough of skin. Penetrating chest trauma may cause tension ptx, use a 14 g angiocath and a flutter valve, at least 3.5 cm long if possible. Use a chest seal dressing for open chest injuries. Suggestion re: loosening tourniquet to see if bleeding is controlled without it being tightened seems to contradict the previous chapter (once pressure applied to wound, don't recheck it for bleeding just keep the pressure on). Fluid resuscitate to normal mental status and palpable pulses (or SBP of around 80). For burns use the formula 2ml x %TBSA affected x weight (kg), giving 1/2 the volume in the first 8 hours; the rest in the next 16 hours. Use 3 ml instead of 2 for kids, and add D5W maintenance fluids in addition. Consider CS stabilization in blunt injury (not in penetrating), check disability and expose but keep burns covered with sterile dressing and remember to check for compartment syndrome (of the face?). Considerations for long-tranport interval systems include antibiotics-levoquin PO is given in the military if abdomen is unaffected. Control hypothermia and utilize advanced methods of pain management, including ketamine, transmucosal analgesia, peripheral nerve blocks.

**Take Home Messages**: None for our system

Chapter 21: Allergies/Stings

Pathophysiology:

4 Types of Hypersensitivity Rxns (table 21.1): Type I= Anaphylaxis

- Can rapidly progress to life threatening

- Causative agents broad: medications (ACE's), foods, addititives, latex, contrast dye, hymenoptera (bees), arthropod bites, marine envenomations, insect bites, mold

Assessment and Treatment Approach:

- Importance of scene safety (rescue/rx not possible if providers afflicted)
- Determine mechanism of sting or origin of allergy
- Query for specific sx: SOB, dysphagia, voice changes
- Exam: voice, airway edema, facial edema, lungs/wheeze, rash, hypotension
- Prehospital treatment: IV, O2, monitor, neb prn, Epi autoinjector if available, wound care/removal of stinger, antihistamines, Epi IV
- Caution in Epi >age 50
- Epi IM > SQ –if hemodynamically stable 0.3ml of 1:1000
- Epi IV 1ml of 1:10,000 if hemodynamically unstable

Special considerations

- Hymenoptera: greater chance of systemic reaction than other insects, particularly if multiple stings
- Consider allergic reaction as etiology of SOB calls
- Gila monster bites infrequent, but may still be attached to patient—remove by one of three methods: pry jaws apart, place flame under belly, submerge in cold water

**Take Home Messages**: Signs and symptoms very testable, IM > SC in less severe. Know doses of IM v IV Epi

Chapter 22: Shortness of Breath

- Two goals of assessment: 1-Assess severity; 2- Make provisional diagnosis to guide therapy
- Paramedics have moderate (not perfect) degree of accuracy in etiology diagnosis (agree with EM physician dx 81% of time)
- Disease severity assessment based on general observation, enhanced by VS, oxygen, CO2 monitoring
- If initial assessment includes possible progression to resp failure, need to assess airway for possible NIPPV
- Important to know upfront patient wishes regarding resuscitation interventions
- Possible life threatening etiologies: Asthma/COPD exacerbation, CHF, MI (not nec outward signs, but subjective dyspnea), PE (same but variable hypoxemia), PTX 2/2 metabolic derrangments or neuro impairment
- Panic attacks = diagnosis of exclusion but paper bag breathing may help as intervention
- Breath sounds: cornerstone of dx evaluation, but can be fooled
- General treatments: beta-agonists—safe to use in CHF (generally.. possible risk of worse ischemia, but chronotropic and ionotropic support); NiPPV versus ETI,

Specific Disease Processes

- Asthma; beta agonists
- COPD: beta agonists, nippv
- CHF: ntg, asa, nippv
- Infectious: O2 if needed, beta agonists if needed, PPE

**Take Home Messages**: Varied causes, EMS pretty good at identifying etiology, NIPPV useful as temporizing measure

Chapter 23: Chest Pain

- Epidemiology: An MI every 26 seconds, 10x mortality of MVAs, Pts arriving to ED via EMS with chest pain have higher pre-test probability of MI than general ED pop
- Apply monitor/ do EKGs early in evaluaton
- EMD not as accurate at predicting ACS versus Stroke (PPV 6% versus 42%)
- EKG interpretation—computerized interpretation misses up to 20% true STEMIs. Therefore, education also important
- Meds for ACS: ASA(give!), O2 (ok), NTG ("time honored" but falling out of favor due to RV), MS (reduced from class I to IIa), betablockers (limited/no EMS use)

- Prehospital Fibrinolysis: feasible safe effective, not necessary if PCI readily available
- Systems of care—Designated Centers for Destination; prehosptial notification (possible earlier activation), Air medical transport for PCI, Expanding role of BLS
- Other causes: Aortic dissection, Pericarditis, PTX, PE, Esophageal Perforation

**Take Home Messages**: Some archaic hold-overs in treatment (ntg v morphine), advantage of designated centers

Chapter 24: Heart Problems, Dysrrhythmias, Palpitations

- Focus on treating life-threats
- Focused hx/pe and Early 3 lead monitor +/- EKG to guide therapy
- Step One: Identify sx and how they relate to rhythm
- Step Two: Identify stable and unstable patients
  - Treat unstable, borderline stable can be evaluated further
  - Hypotension
  - Chest pain
  - ALOC
- Step Three Classify EKG findings
  - Rate
  - Regularity
  - Wide v narrow
- Step Four: Focus actions to evaluate stable but symptomatic and borderline patients

Controversies

- Rhythm strips v monitors: Strips are best whenever possible
- Synchronization and Sedation during countershock
- Prophylactic lidocaine for PVCs—no benefit
- Pediatric dysrrhythmias—Peds can have higher HR >225 in response to physiologic stress. 2 J/kg =unstable dosing
- Torsades: important to recognize and give Magnesium Sulfate 2G IV push, won't respond as well to shock, think of it with range of drugs ccb, bb, psychoactive drugs)
- Renal failure rhythm disturbances: most commonly hyperK—early CaCl2

**Take Home Messages**: Step-wise evaluation to focus on sick and pursue further dx when stable

Chapter 25: Fainting/Syncope

Syncope-loss of consciousness and postural tone caused by diminished cerebral blood flow. Must include both cerebral hemispheres simultaneously or reticular activating system in brainstem.

Four categories: cardiac, neurogenic, vascular, idiopathic.

1. Cardiac-transient lack of adequate cardiac output, ex) dysrhythmia, VT (in patients with CHF and low EF), SVT, sick sinus, afib with RVR, also AS, PE, long QT
2. Reflex mediated-most common, best prognosis. Body has an inappropriate autonomic response to a change in posture. Ex) vasovagal, orthostatic
3. Neurogenic-rare, ex) TIA, SAH, migraine, psychogenic
4. Idiopathic (35%)

Assessment: reassess all dispatch information with clinical evaluation. True syncope resolves on own, not with dextrose or after seizure. History is pivotal, but may need to get supporting details from bystanders. Complete physical exam is important although may be normal. Check glucose and EKG.

DDx: seizure, pseudosyncope, narcolepsy, cataplexy (no LOC, just postural tone)

**Take Home Messages**: EMS should do complete H&P and beware AMA requests.

Chapter 26: Headache

- Most headaches are benign, but not all

1. Primary headache=migraine, cluster, tension.
2. Secondary headache=caused from other than primary headache disorder, ex) infection, trauma, tumor

- EMS transport used more when cause of the headache was serious (ICH, meningitis)
- Concerning HA: recent trauma, AMS, fever, focal neuro deficit
- Exam: pupils, cranial nerves, mental status

**Take Home Messages**: Thorough physical exam, antiemetics might be better than narcotics

Chapter 27: Seizure

Seizure disorder is a common cause of frequent ambulance use.

Causes: electrolyte abnormalities, medications, medication withdrawl, toxins, hypoxia, CNS infections, systemic infections, trauma, sleep deprivation, pregnancy

- Important to determine if symptomatic seizure or unprovoked (epilepsy)
- Seizures originate from cerebral cortex or thalamus
- Excitation of susceptible groups of cerebral neurons
- Failure of inhibition by GABA system leads to prolongation of seizures (antiepileptics work here)

Ddx: convulsive syncope, convulsive concussions, pseudoseizures

Classification:

1. Partial seizure: seizure onset limited to one part of the brain (simple-normal consciousness, complex-consciousness clouded, can become generalized)
2. Generalized: cerebral cortex bilaterally involved at seizure onset

Febrile seizure: 3 mo-5yrs, no other cause found for seizure, due to maturing brain, simple=less than 10 min, generalized tonic-clonic, one in 24 hours

Status epilepticus: 5 min or without recovering to full consciousness between seizures

- Patients usually postical by time of EMS arrival
- Treatment: oxygen, check sugar, protect patient, benzos, spinal immobilization probably unnecessary unless significant trauma

**Take Home Messages**: Common condition, various benzo options

Chapter 28: Stroke

TPA useful for acute stroke if given in proper time frame, other options include inter-arterial tPA, mechanical embolus removal in cerebral ischemia (MERCI)

- "Primary stroke center" hospital in compliance with Joint Commission guidelines
- Essential to educate community regarding stroke symptoms
- Strokes are hemorrhagic or ischemic (80%), can't differentiate in prehospital setting
- Ischemic penumbra=area surrounding central ischemia, which has decreased blood supply but can be salvaged depending on severity and duration of ischemia.
- TIA=neurological deficit lasting few minutes (NINDS), to 60 min to 24 hours
- Patients with TIA have a 10-20% risk of stroke in next 90 days, half in next 24-48h
- Dispatchers correctly identify stroke 31-52% of time
- Paramedic/EMT education important to identify TIA/stroke and emergent nature
- Cincinnati and LAPSS are validated prehospital stroke scales that increase sensitivity, Melborne Ambulance Stroke Screen (MASS) is hybrid of both
- Treat reversible conditions (hypoglycemia) and ID stroke mimickers (Bells palsy, Todd's paralysis, complex migraine, conversion disorders, encephalopathy)
- Hx: when was pt last seen at baseline?? Tx: BP reduction only in hospital setting,
- Hospital prenotification to decrease door to CT, time to tPA 3 (+) hours

**Take Home Messages**: How do we determine stroke receiving centers? Improved community recognition of stroke symptoms

Chapter 29: Diabetic Emergencies

- 7% of total US population with DM, not all recognized. EMS is usually called for hypoglycemic emergencies. Glucometer use by EMS safe and accurate, but strips must be stored in stable temperature environment.

1. Hypoglycemia= glu < 70 mg/dL, tx-oral glucose, IV dextrose, IM glucagon. Giving 50 ml of D50->raises blood glucose 166 mg/dL but varies widely
2. Hyperglycemia=glu > 200 mg/dL, DKA or NKHS, need IVF

- Pediatric considerations: new diagnosis of DM
- Many IDDM patients refuse transport after initial paramedic contact, need to be back to baseline mental state, able to tolerate food by mouth, normal VS, no sulfonylureas

**Take Home Messages**: Most common endocrine emergency, EMS providers should be well versed in hypo/hyperglycemic patients.

Chapter 30: Abominal Pain

Abdominal pain patients represent approximately 5% of EMS calls, and are common causes of missed diagnoses in the ED (appendicitis and missed AAA causes of successful malpractice suits; 25 to 40 % of abdominal pain patients leave the ED without a definitive dx). Abdominal pain in the elderly, women of childbearing years, the immunocompromised and children are most difficult patients to diagnose. Undertriage is common (11 to 22% sensitivity) by EMS providers. Pain is caused by inflammatory, ischemic or infectious etiologies and diagnoses are commonly developed by quadrant location of the symptoms (remembering that significant systemic diseases, such as DM, ACS and porphryia can cause abdominal pain.) Pain mechanisms: visceral, e.g. from a hollow or solid organ, causing poorly localized pain. Somatic, e.g. from the peritoneal lining, e.g. from a late stage appendicitis, causing more severe and localized pain. Referred pain, e.g. diaphragmatic irritation from intra-peritoneal blood casusing shoulder pain. Adequate history includes AMPLE (allergies, meds, previous medical history, last meal and events leading up to the EMS call) and PQRST description of pain (Onset, Palliation/Provocation, Quality, Radiation, Severity and Time). Physical exam includes palpation of the abdomen in all 4 quadrants and eliciting peritoneal discomfort (e.g. tapping on the heel). Vital Signs are crucial to evaluate for signs of shock. Treatment includes IV fluid therapy to maintain a SBP of 90 to 100, small doses of IV opiod analgesics, cardiac monitoring and 12 lead EKG, O2 therapy. In elderly patients, have a low threshold to transport, consider AMI, mesenteric ischemia and ruptured AAA. For females of childbearing age consider ruptured ectopic pregnancy, ovarian torsion and TOA, all of which need transport to the hospital. For children consider pyloric stenosis and testicular torsion in infants, and intestinal intessuseption, volvulus and obstruction due to malrotation. In immunocompromised patients consider neutropenic enterocolitis, graft-vs-host disease, CMV perforation and tuberculosis peritonitis (transport to the hospital). In all cases, stabilize ABC's, assure hemodynamic stability and relieve pain.

**Take Home Messages:** Broad differential diagnosis category; should be transported.

Chapter 31 Obstetric and Gynecologic Emergencies

No recommendation for field pregnancy testing; treat all women of childbearing age as pregnant. VS, CP assessment, abd. exam mandatory. If vag bleeding present, IV, O2, Monitor, 500cc bolus (ectopic until proven otherwise). In known pregnancy, obtain relevant OB hx (especially important—trimester of pregnancy), if patient has urge to push or hx precipitous delivery, visualize the perineum (carefully protocolize this to protect EMS provider from medical legal liability). For 1$^{st}$ trimester pregnancies, recognize ectopic potential, be prepared to offer psych first aid if needed by pt. Preeclampsia signs (SBP greater than 160, DPB greater than 110, increasing pedal edema, headache or epigastria/RUQ pain), IV access desirable in these patients, give benzos for seizures, Mag Sulfate if available. Placenta previa or abruption: VISUAL inspection of the perineum only (no manual exams). Maximize chance for in-hospital delivery, but if field delivery is imminent, have enough personnel to care for infant as well as mother. Umbilical cord prolapse: place patient in knee-chest position during transport and keep presenting part of infant off pelvic brim with gloved hand. Nuchal cord: if cord cannot be gently lifted over the head, suction mouth and pharynx, double clamp and cut cord, deliver infant. Meconium: gently suction the oropharynx and/or intubate the infant after suctioning (not necessary if meconium is thin/watery). Breech delivery: support the presenting part, if needed EMS providers place 2 fingers forming a V in the vagina to allow infant to breathe until head delivers spontaneously. Never push the presenting part back into the vagina. Shoulder dystocia: utilize one of several maneuvers: hyperflex mother's hip against her abdomen while applying mild suprapubic pressure, gentle posterior traction on the head, rotate shoulders of infant while gentle suprpubic pressure applied, have mother go into the upright position on hands and knees. Care of the neonate is along PALS guidelines, if possible perform APGAR scoring at 1:00 and 5:00 post

delivery. Post-partum hemorrhage treated with IV boluses and O2. If placenta delivered prior to arrival at hospital, preserve for path exam. Pregnant trauma patients, even from minor trauma such as ground level falls, need eval for placental abruption. Transport on backboard tilted 15 degrees to the left to displace uterus. If patient more than 20 weeks gestation goes into cardiac arrest, immediate transport with chest compressions with a goal of C section within: 05 of cardiac arrest.
**Take Home Messages**: CE on OB problems a must for prehospital personnel due to low volume, high acuity situations. Role of Direct Medical Oversight potentially overstated in this chapter; should there be a link with the OB suite (delivery ward) for EMS for tough cases?

Chapter 32 Acute Poisoning Emergencies
Case fatality rate for self poisonings is 0.5%. Evaluation for non-poisoning etiologies, e.g. head trauma, and appropriate supportive care are the most important interventions. Obtain hx from friends/others at scene, and bring containers of involved substances (as well as any meds) with pt. Important foci of physical exam: VS, odors, presence of seizures, fasciculation (organophosphates), rigidity (strychnine), tremors (lithium, theophylline), dystonic posturing (neuroleptic agents), pupil size, diaphoresis (if present more likely sympathomimetic vs. anthicholinergic exposure), bites, erythema or bullae, and track marks. Toxidromes reviewed: opiod, anticholinergic, sedative hypnotic, sympathomimetic, cholinergic, and serotonin syndrome. Mixed ingestions can cloud the picture. Treat prolonged QRS complex ingestions (sodium channel blockade) with 1 to 2 meq/kg sodium bicarbonate. Potassium Efflux Channel blocking drugs can cause prolonged QI interval; tx recommended with magnesium sulfate. With AMS, consider CO poisoning, treat seizures with benzos, consider early intubation if patient is hypoventilating regardless of O2 sat. For dermal decontamination use PPE, irrigate with warm water including wounds, bag clothes. Perform ocular decon with ringer's lactate for 15 to 30", directing stream of water away from medial canthus. GI decon: no ipecac, contact poison center first, don't do for compromised airway, caustics or petroleum distillates. Prehospital antidotes recommended: atropine (organophosphates), flumazenil (!) (benzos), hydroxocobalamin (cyanide), naloxone (opiods), pralidoxime chloride (organophosphates and carbamates).
**Take Home Messages**: What toxidromes need dermal decon? Consider prior to transport.

Chapter 33 Toxic Inhalations
Hazmat National Fire Protection Agency training levels: awareness (minimum for EMS personnel), operations and technician. Intentional chemical releases control is law enforcement, accidental is fire. Suspicious incidents (approach from an uphill and upwind direction if possible): transportation incidents, industrial incidents, groupings of toxic syndromes from the same incident. If unknown toxic agent, use Level A PPE (encapsulated garment, self-contained air supply). For known toxic agents, use Level B (splash protection, chem-resistant clothing, self-contained air supply) or Level C (same as B but with a respirator/filter air supply). Level D is standard work uniform. For decon, set up zones (hot=potential life threat, warm=contamination reduction zone/decon, use copious amounts warm water, removal of clothing=90% decon, and cold=support zone). Various agents reviewed: vesicants, e.g. mustard gas=tissue damage, incapacitating agents, e.g. oleoresin capsicum=mucosal irritation, organophosphates, e.g. sarin=muscarinic and nicotinic effects, irritant gases, e.g. chlorine=mucosal and respiratory irritation, CO=intracellular hypoxia (role for HBO controversial, use for neurologic or cardiovascular symptoms), cyanide=uncoupling oxidative phosphorylation, use hydroxocobalamin for tx.
**Take Home Messages**: time to switch to hydroxocobalamin for CO tx, role of HBO in CO poisoning?

Chapter 34 Communicable Diseases
SARS outbreak in 2003 made infectious and communicable diseases an EMS priority, infectious vs. communicable diseases, host, agent, transmission mode, portal of entry into body, dispatch can start risk assessment, which includes fever, cough, chills, and antipyretic use. On a personal level, Cough etiologies: PNA, pertussis, influenza, avian influenza (A) e.g. H5N1, TB, SARS (coronavirus). Rash etiologies: MRSA, measles, rubella, varicella. Bite considerations: animal

bites, human bites, rabies, tetanus. Other diseases to consider: meningitis, diarrhea, jaundice (hepatitis A, B and C). Biologic weapons: anthrax (cipro, doxy, vanc, pen, amp, chloramphenicol, imipenem and clinda all effective), botulism (antitoxin, supportive care), plague (streptomycin, gentamicin, chloramphenicol), smallpox (vaccine), tularemia (streptomycin, cipro), viral hemorrhagic fevers (supportive care). On a systems basis, EMS planning, EMS surveillance (esp. dispatch systems) and mitigation, continuity of operations, legal authority, clinical standards/protocols, protecting the EMS workforce (and families), communication.
**Take Home Messages**: need for ongoing training/exercising in this area

Chapter 35 Behavioral Emergencies
These patients have "legitimate" medical issues. Common conditions: anxiety disorders, depression, schizophrenia, bipolar disorders. Tx: assess for medical problems, enlist patient cooperation (MD authority figure may be of help?), danger to self or others. Take suicidal ideation seriously, sedate prn with midaz/loraz, transport in (almost) all cases. Dealing with violent patients: verbal de-escalation, show of force, removing environmental dangers, physical and chemical restraints—haldol or benzos recommended, including IN route of administration (involve DMO). Elderly gravely disabled patients also discussed, with reporting requirements. Common mistakes are incomplete medical eval e.g. no blood sugar, "rushing" the patient without coordinated effort, no protection of crew safety, leaving a restrained patient unattended, not having inter-agency coordination.
**Take Home Messages**: evaluate use of chemical sedation, especially monitoring, positive effect of community paramedics on this problem?

Chapter 36 The Sick Person/Undifferentiated Patient
History taking (prioritize priority symptoms), history, and only those diagnostic tests relevant to patient's condition (e.g. EKG). For the truly undifferentiated patient, problem may occur at transfer to the ED personnel—review the hx, dx and diagnostic testing used to the point of transfer. The chapter then transfers into a discussion of errors in medical decision-making. Guillane-Barre syndrome used as the clinical vignette.
**Take Home Messages**: don't under-treat the undifferentiated patient or release on-scene without "double" checking. Do we need an "undifferentiated patient" protocol?

Chapter 37 Airway Management
Basic Airway Interventions, Invasive Airway Management, Alternative Airways: combitube, king tube, LMA, Surgical airways (rec: TTV effective 16G IV with 50LPM+20 BPM=TV 950 cc), airway placement confirmation (rec: waveform capnography), methods for securing ETI's and alternative airways, drug facilitated, CPAP. Controversies: PH ETI no proof it improves survival, Adverse effect of ETI is more "time off chest" in CPR, alternative airways in CPR may be better than ETI, ED's don't change alternative airways for ETT's until pt stabile, jury still out on pediatric ETI, no definitive advice on "successful PH airway program", limit ETI attempts to 3, yes on alternative airways.
**Take-Home Messages**: Keep TTV, lots of variation for successful airway programs, keep hands on chest.

Chapter 38 Procedures
Patient assessment, airway management, venous access, CV procedures, patient packaging, hemorrhage control. Table 38.1 summary.
**Take Home Messages**: Consider adding pericardiocentesis, removing traction splinting, keep spinal immobilization for penetrating trauma of the neck or back.

Chapter 39 Analgesia
Opioids (fentanyl, morphine, agonist-antagonists), Nitrous Oxide, Ketamine, NSAID's. Communications techniques, pitfalls: wait for hospital, standardized dosage of meds, pain can be gauged by facial expression, fail to distract.
**Take Home Messages**: none for our system

Chapter 40 Pediatrics
Evaluation (Pediatric Assessment Triangle, ABCDE's), Treatments, Respiratory Distress, Shock, Trauma and Trauma triage, Seizures, Controversies (airway management). Treatment should be no worse than the disease, O2 for all, IO instead of IV if unable to achieve (don't save for cardiac arrest), shock difficult to detect, transport to appropriate trauma receiving facility, transport after any seizure.
**Take Home Messages:** airway management a high priority for CE/skills maintenance

Chapter 41 Approach to Geriatric Patient
Changes of normal aging, Assessment, Medical conditions: cognitive impairment, depression, meds and drug toxicity, altered mental status, cardiac arrest. Social emergencies: medication and EtOH abuse, Elder abuse, caregiver distress, SNF's and ALF's, Public Health (screening e.g. falls and interventions, e.g. flu shots), research lacking. 50% admission rate!
**Take Home Messages**: screen for cognitive impairment, don't let elderly people sign out AMA.

Chapter 42 End-of-Life Issues
Ethical principles: patient autonomy, beneficence, nonmaleficence, justice.
Patient preferences: Advance directives, medical orders, POLST, grief support
**Take Home Messages**: Keep requiring grief-support training

Chapter 43 Termination of Resuscitation in the OOH Setting
Need for scientific data (although NAEMSP has 2 position papers: traumatic and non-traumatic cardiac arrest), defining acceptable criteria e.g. medical futility. When not to start (asystole+nopulse+no bystander CPR on EMS arrival), when to stop (no ROSC, no shock, no bCPR, and unwitnessed) resuscitation +/- 30" of ACLS. Peds arrest similar, with the addition of child involved/scene issues (social reason, not medical futility). Trauma: all blunt (unless vfib), penetrating with no signs of life on arrival or asystole. Grief support training a must
**Take Home Messages:** potential re-evaluation when STAR (post CA ROSC centers) come on line

Chapter 44 Patients in Police Custody
Medical illness manifested as criminal behavior: red flags are acute onset, delirium, prior psych hx, intoxication, DM and abnormal VS, Excited Delirium Syndrome—death may be caused by release of catecholamines and sudden drop in blood potassium levels when struggle against restraint stops, positional restraint asphyxia (don't hog-tie patients), irritant sprays (simple eye irrigation), kinetic impact munitions (bean bag rounds, plastic bullets—need full trauma eval), Conducted Electrical Weapons (TASERs)—controversy: who can remove the darts?, Noise Flash Diversionary Devices (ruptured TM's).
**Take Home Messages**: medical issues for both ED's (e.g. jail clearance) and EMS (e.g. TASER patient evals in the field)

Chapter 45 Managing Non-Patient Contacts
Differentiating patients and contacts, contact vs. patient documentation, changes in consent, third-party calls (with unwilling patients), EMS-Initiated refusals, non-traditional EMS (aka Community Paramedicine; utilizing the overcapacity of EMS to meet huge unmet needs such as uninsured care, screenings and minor illnesses and injury treatment).
**Take Home Messages**: important area—is there a difference between a contact and a patient non-transport?

## Volume 2
## Medical Oversight

Chapter 1 History

- Jean Dominique Larrey, Napoleanic surgeon flying ambulances. Civil war experience forbearer of US Cities (New York 1869). Hospital based services staffed with interns until WW II pulled them off ambulances. Poorly trained staff until 1960's with advent of CPR and defibrillation. 1966 NAS-NRC report with 24 recommendations dissed ED's as well. Led to 1966 Highway safety act and putting DOT in charge, put federal funds into EMS. 1973 the EMSS act designates the 15 core areas of EMS:

Manpower
Training
Communications
Transportation
Facilities
Critical care units
Public Safety Agencies
Consumer participation
Access to care
Patient transfer
Coordinated patient record keeping
Patient information and education
Review and evaluation
Disaster plan
Mutual aid

Increased federal funding until 1982 distributed on a regional basis (growth of rural EMS). EM becomes a specialty in 1979 and National Registry of EMTs founded in 1970. Universal 911 advocated in 1973. 1973 also saw the DHEW KKK-A 1822 standard for ambulance construction. 1978 DOT-DHEW MOU on EMS system development responsibilities, which quickly failed. American Society for Testing and Materials' 30 standards, all non-mandated. EMSC program funded in 1984. NAEMSP started 1985. Also COBRA/EMTALA. passed in 1985. EMS Agenda for the Future published 1996. NEMSIS MOU signed by all 50 states and 2 Territories in 2005. 4% of post-9/11 funding went to EMS. Advocates for EMS founded in 2002. 2006 initiation of the Federal Interagency Committee on EMS to ID state and local needs, recommend new EMS programs, and coordinate Federal programs interface with EMS systems. Medicare reimbursement for air ambulances change in 2002, resulting in an increase in programs, along with problems in regulation of these services due to the 1978 Airline Deregulation Act. 2006 institutes of Medicine report on The Future of Emergency Care in the US.

**Take Home Messages**: support standardization at a state level and funding at a national level?

Chapter 2 Medical Direction of EMS

Public Health emergencies now a part of EMS practice. Importance of mastering consensus and fiscal procurement processes. Pertinent discussion of medical vs. operational oversight of EMS services. Power of Medical Director over credentialing of personnel defended. Medical director should be well liked to be effective? The importance of sweat equity in projects. Medical oversight (assurance of day to day quality, demanded by local medical community) contrasted with oversight (long term vision involving research). The story of Seattle Fire Department's embrace of EMS. Development of paramedics as "accountable apprentices" to physicians, favored over current practice of training paramedics by professional educators? The "holy grail" of quality EMS medical supervision is 24 hour availability? **S** takeholder satisfaction, **C** ost effectiveness, **O** utcomes, **P** lanning/preparation, **E** mployee wellness. Texas empowers medical director to credential but protects him/her from liability if the EMS administrator does not support him/her. Besides credentialing, other functions include protocols, QI, medical community liaison and "5150" authority. The importance of research advocacy and awareness of most recent developments. Rural Medical Directors may eventually burn out. Justification of non-separation of

the provider and regulator EMS medical director roles. Base hospital as EMS resource center. The importance of on scene medical control (walking the patient to the stretcher and then cspining them example). Ride alongside as a back up to MD specific response vehicles, personal cars discouraged. MD specific dispatches (table 2.1), restraint from taking over a scene advocated. On scene functions advice seems a bit long and schizophrenic: don't stand back too far but also don't take over the scene completely. Scene etiquette similar to dealing with consultant, e.g. don't criticize in front of others. Can field medical supervision be provided by nophysician extenders? Chapter seems to imply yes. The medical director as Ulysses.
**Take Home Message**s: What type of Medical Direction does each system want? Likely differences from one system to another. Integration of in-field base physician capabilities takes time and effort.

Chapter 3 Education of the EMS Physician
Be an EM residency graduate. History of EMS fellowships included core curriculum published in 1980's by SAEM & NAEMSP and the funding of the SAEM Fellowship by EMS industry. Key components of EMS Fellowship are scene response, meetings, research, QI, air medical, regulatory, mass gathering medicine, tactical and disaster medicine. Have an EMS mentor, and get a "mini-me" medical director position, such as "QI Medical Director". Other accrediting agencies that have standardized EMS physician requirements: CAAS (ground ambulances), CAMTS (air medical services), CAAHEP (EMS/paramedic training programs) and ASTM International (EMS devices). IOM 2006 Report EMS at the Crossroads required reading for EMS physicians. Multiple education resources currently available (e.g. The NAEMSP Medical Directors Course) and local/state courses such as base hospital MD courses for direct medical control.
**Take Home Messages**: Work on standardizing courses, pick the most informative course to include in the fellowship curriculum.

Chapter 4 Leadership and Team Building
Need the 5 emotional competences: self-awareness, self-regulation, motivation, social awareness and social skills. Give useful feedback instead of constructive criticism. Use "I" statements (your emotional state, their action, your interpretation of their action and a request). Replace the word "but" with the word "and". Provide feedback in private. Effective leaders are the ones that get the bad news. Crew Resource Management is the science of effective communication between cockpit crew members. Levels of evaluation of effectiveness of training: participant satisfaction assessment, knowledge retention assessment, behavior change assessment, and clinical outcome assessment. Avoid writing a rule in reaction to a current situation. It is easy for managers to become distracted by economic or political concerns. The STAR CARE wallet card approach used by San Mateo County, p. 67. The "court of public opinion" test for evaluation of EMS calls.
**Take Home Messages**: How can we change the culture of QI interaction, e. g. Develop an ethos of self reporting and valuing increased education?

Chapter 5 Legal Issues
- Initial focus of legislation was immunity for the rescuer (volunteer). EMT's are the agents of EMS provider agencies and they are liable for the actions of the EMT under the doctrine of respondeat superior but are supervised by the EMS Medical Director (they don't practice "under the license of" the MD). Licensure is the permission to perform an act by a competent authority, as opposed to a certification, which is the formal assertion of some fact (EMT's would seem to be licensed).
- Federal laws and regulation providing MD accountability are Medicare fraud and abuse, HIPPA, civil rights/due process "1983 actions", protection from which is not found in malpractice insurance.
- State statutes and regulations often determine the scope of practice and require certification of the EMT by the Medical Director. MD is accountable to the state licensing board for his/her medical control functions. Immunity laws include sovereign immunity for government employees and Good Samaritan laws, which vary from state to state, excepting the Aviation

Medical Assistance act of 1998. Case law = common law, have been used against medical direction for lack of protocols for non-transport.

- Professional e.g. Practice vs. administrative e.g. Reimbursement areas of liability. Theories of liability: failure to perform responsibilities, negligent supervision, including failure to utilize lawful authority for supervision. Not meeting or knowing the patient is not an adequate defense (the Arizona curbside EKG consult example). Medial Directors need the ability to limit the actions of those that they supervise. Special duty exists on the part of dispatchers, especially problematic in directing responders to enter locked domiciles. Response must be appropriate and timely, volunteer status of responders is no defense. Importance of ICS and scene safety on scene management. EMTALA/COBRA issues include non-diversion of ambulances in route to a facility or on facility grounds and no "parking". MD's are responsible for non-transported patients. Fig 5.1 summary of principles: have a policy, train on the policy, do audits to hold accountable, have on-line medical control involved, be cautious with restraints, use a legally correct release form. Some discussion of ability to transport a patient against their will by virtue of a "qualified privilege". Ability to comprehend risks of refusing treatment better language to use than competency, which is a legal definition. Minimum provisions of contracts Fig. 5.3, include responsibilities, authorities, chain of command, terms of payment, insurance, and clear jurisdiction over aspects of practice that affect provision of care.

**Take Home Messages**: Review policy to eliminate "competency" language, is 100% audit of refusals that are not called in to the Base Hospital warranted?

Chapter 6 Due Process

Right to present reasons why the government should not deprive a person of life, liberty or property principle of constitutional law. Other relevant federal statues: Family Medical Leave Act, Age Discrimination in Employment Act, Americans With Disabilities Act, Title IX of the Civil Rights Act of 1966. All states have administrative procedures acts which provide due process procedures. State administrative law proceedings are a more flexible and expeditious forum for due process decisions than the courts. Substantive due process (more theoretical, protects against acts that shock the conscience) and Procedural due process, the fair restriction/removal of property rights. "Once it is determined that due process applies, the question remains what process is due." 3 elements considered: 1. The private interest that will be affected, 2. The risk of an erroneous action, and 3. The government's interest. Due process is only required of state entities, or private entities acting on a state mandate (e.g. Private ambulance services with EOA contracts?) Medical Review Committees and QI functions of Medical Directors have been interpreted to meet the state action requirement for due process, but not National Accrediting agencies. Examples given of what constitutes a fair opportunity to be heard were given, emphasizing those cases where a Medical Director made a credential revocation decision that resulted in a Fire Fighter termination of employment. Property due process rights include license actions down to, and potentially including, probation. Reporting a provider to the Healthcare Integrity and Protection Data Bank may rise to a liberty interest test, requiring due process protection. Communication of the hearing (notice) must include all incidents to be addressed and be timely utilizing registered mail or hand delivery with affidavit. Some situations rise to the level of threat to public health and safety, and immediate revocation of a property interest may be taken followed by a speedy hearing (CA example, state vs. local actions). Preponderance of evidence is the standard of proof. There is a right to have counsel present if desired and the accused can afford one, but no duty on the part of the state to provide one.

**Take Home Messages**: be sure probation/suspension actions include due process rights.

Chapter 7 Risk Management

- Internal components: safety, training, health, wellness, personnel and equipment management. External Components: prevention, public education, perception of the public. Monitor all high-frequency, high risk encounters, e.g. Non-transports, ETI's (?). Develop pre-loss (e.g. protocols) and post-loss (e.g. good investigations) strategies. Initial training and the liaison between training program medical director and system medical director emphasized. Robust system orientation prior to (local) accreditation emphasized. Aligning patient and prehospital crew expectations discussed. Incident investigation checklist Fig 7.1 p 112 emphasizing rapid

response and documentation of all complaints and discussions. Medical director must have final authority on the evaluation of the clinical aspects of the incident.
- Documentation of the prehospital encounter critical, especially for patient non-transports, and incident management. 5 Elements of a risk management program: 1. Identify risk exposure, 2. Evaluate risk potential, 3. Rank and prioritize risk, 4. Determine and implement control actions, 5. Evaluate and revise techniques as needed.
- Potential findings: environmental influences, safety factors, training, employee clinical performance or behavior, judgment error, equipment deficiency or failure, incomplete documentation, patient expectations, protocol or policy problems, actions of other providers, or direct medical oversight-use root cause analysis to determine which factors are involved (not always "human error") Remedial education actions may be warranted, and may include CE. EMS risk management systems should include literature reviews.

**Take Home Messages**: Use of CME to protect EMS systems from litigation and for remedial education purposes. EM resident education in EMS risk management.

Chapter 8 Ethical Issues
- Autonomy: the right to self-determination, including the right to harm oneself. Need these 5 criteria to be present:
- Patient has sufficient info about their condition
- Understands the risks and benefits of available options, including inaction
- Use the information to make a decision in keeping with their personal values
- Patient can communicate their choices
- Freedom of will to act without undue influence of other parties
- Beneficence: duty to act in the patient's best interest? Valid DNR required even in the presence of a person with Durable Medical Power of Attorney. Transport advised for family counseling following pronouncement. Paramedics should not change triage/destination decisions without on-line medical guidance. Truth telling should be couched in terms of what EMS providers directly know (which will be very limited) and they should not lie but defer most questions to hospital providers. No procedure practice on neomorts. Tx of minors without parental consent: emancipated minors, mental illness, substance abuse, pregnancy, STI's.

**Take Home Messages**: None.

Chapter 9 Political realities for the Medical Director

Technical expertise by itself is insufficient to create a workable system. The genesis of EMS systems not based on logic and rationality. Political community is swayed by power, money and personal connections. Physicians must resist the medical culture of “superiority” of the MD when dealing with the EMS environment. Political flashpoints include ambulance destination policies, trauma center designation, combined communications/dispatch center, hospital support of EM residency, medical helicopter service, etc. Denver FD adoption of a first responder requirement and Denver airport integration of paramedics on site cited as examples of political success. Power blocks identified, e.g. Firefighters, State Health Departments, etc. A pivotal mission for the physician adviser is to reframe, refocus and redefine the agendas of others. Visualize the migration of birds rather than the herding of cats. 5 political senses: Mission, Tradition, Position, Humor, Timing. Political Darwinism: Mutate or Die. Distinguish between a politician and one who is political. Systems evolve. Nurture your colleagues. Attempt to create win-win problem solutions. Be the source, become the force. Define quality in meaningful terms. Choose realistic mentors. Observe why others fail (don’t drive the jeep on the autobahn). Develop a shared paradigm with your staff. Strive to develop an appropriate demeanor. Respect the power of the bureaucracy. Every transport of a patient is a political statement. Principles of action: understand political judo, know where the last domino falls before pushing the first one, consider the movement of chess pieces, covet identified problems as “opportunities in drag”, identify relationships between people, become dispensable but not openly so, learn to swim with the sharks, stage a crisis on your own terms, be a political chameleon, identify all of the customers, understand the business you are really in, project academic passion and political neutrality, visible power is vulnerable power, never satisfy a bureaucratic need completely, control the key

factors, avoid the use of fear/embarrassment, survival alone merits respect, remain vigilant but not suspicious, practice OREO: Opportunities, Resources, Expectations, Obstructions. As often as possible, give credit to others for the success of the mission. Leverage your creativity to assist not only a limited population of patients but an entire community. Be a practice champion and choreographer—recognize those who are the best. Be substantive—figureheads become hood ornaments. Know when it is time to go.
**Take Home Messages**: Utilize the strategic planning process to improve collaboration and determine the current political landscape.

Chapter 10 The EMS Physician as Public Spokesperson
EMS MD's role in risk communication, first obtain clearance from the relevant Public Information Officer and the family of the patient where possible. Be the sincere patient advocate. To communicate effectively in the Sound Bite age be prepared to have 7 to 10 second comments from a 5:00 interview quoted (so stay "on message" the whole time), and keep any individual answer under 20 seconds. Think "bullet" format, and supply these materials to the media (suggested ppt format). In depth discussion of sound bite construction, with a 3 part format recommended: Definitive opener (Absolutely), short informational message (90% of head injuries are prevented by wearing bike helmets), and closing resolve (It's one of the best vaccinations against injury that we have). Don't repeat the negative part of any questions. Main difference with print media is the need to paraphrase the interviewee, and the potential for correction post-interview pre-publication. Press conference format: 10 to 15 total, MC, Expert Speaker, Counter-Argument person, How to do it person, I'm a good example person, and a demonstration. Aim for the mid week and send out press packets in advance. 10 rules: 1. Tell the truth in a 10 second sound bite, 2. Be accessible, 3. Be (and act and talk) like a human being, 4. Glass half-full on issues, half-empty on patients, 5. Make others look good, 6. Provide a good "hook"—a simple, valuable lesion, 7. Provide simple statistics and graphics, 8. Repetition, redundancy, reiteration, 9. Don't trust everyone (nothing off the record), 10. Anticipate the worst—and expect the mediocre. EMS and Trauma Systems are in the public domain.
**Take Home Messages**: need for training and practice in media relations. Not useful if you're not authorized to speak to the media. Someone will always take offense.

Chapter 11: System Design
"First-Hour Quintet": from European Resuscitation Council conference (2002), five diseases for which an EMS system can make a difference-out of hospital cardiac arrest, severe respiratory difficulties, severe trauma, chest pain including ACS, stroke. In 1973, EMS System Act put $300 million in federal dollars toward building 'systems' and proposed 15 components. This failed for 4 reasons: not developed for patient or consumer, lack of infrastructure for engineering of system, elements of a successful system could not be assembled into useful framework, too oversimplified. In 1991, AHA introduced chain of survival and 'early' approach to cardiac arrest. 1996, NHTSA 'EMS Agenda for the Future' gave a much better roadmap on how to build an effective EMS system. In 2003, IOM report from committee released 'Emergency Medical Services at the Crossroads' which recommended coordinated emergency and trauma care systems across the country. Challenges include tighter economic situations, increasing elderly population utilizing EMS, different types of systems. Common inputs-patients and money, common outputs-patient assessment, treatment, medical transportation. System design: geographical scope, standards setting and enforcement, division of functions, production strategies, market allocation, consequences on chronic failure to perform, business structure, management level required. Impacts of inferior system design: unequal socioeconomic service base, unequal response time performance, no incentive for growth, inability to match the right patient with the right resources, leaving the choice to the consumer. EMS System measurement-clinical sophistication, response time reliability, economic efficiency. ALS response time within 8 minutes (arbitrary from AHA), starts from first call to dispatch for help to when ALS arrives on scene. Important to understand response volume by time of day and day of week, geographical location of responses, use algorithm to locate resources. Unit hour is "fully equipped and staffed ambulance on response or waiting for a response for one hour" – poor predictor of clinical quality and cost of transport. Unit hour utilization is utilization/unit hours and used to measure

productivity of different actions in system. EMS System Design Factors: service area definition (high performance operation is service area population of 200K served by one ambulance provider), medical oversight, first response, ambulance service. High performance EMS system design: sole provider, control center operations, accountability, revenue maximization, flexible production strategy, status system management. System Assessment: Accreditation (CAAS, CAMTS, JCI). Using national EMS education and research agenda to guide policies and activities. Assessment System ex) Baldrige HealthCare Criteria for Performance Excellenct. Vision Documents and summary recommendations such as 'EMS at the Crossroads" help to describe desired future.
**Take Home Messages**: The EMS system is uniquely fit for location.

Chapter 12: Tiered EMS Systems
A tier is a temporal layer of response. Response can be single or multiple response tiered. Dispatch control can safely and reliably control BLS vs. ALS response. Risk vs. benefit of lights and sirens as well as multi-tiered response. Importance of performance reporting that show benefits of early response (police with AED). There are four tiers: dispatch and control of resources (no dispatch, nonemergency, emergency response), rapid response for extremely time-critical events (first response ALS intervention), transportation tier (all ALS staffed vs targeted ALS intervention), selective nontransport response (advanced practicioner on scene). Take-home messages: Medical directors should consider geography, population density, labor pool of BLS and ALS providers, available fiscal resources, and degree of command and control offered over each tier when influencing system design. Goals to be high performance and efficient EMS system.
**Take Home Messages**: none

Chapter 13: Fire Service Based EMS
Largest group of providers in the EMS system and medical response comprises the majority of emergency activity. First fire-fighters trained as paramedics in Miami 1967, "brought CCU to the field." Fire departments already had personnel and equipment to be medical first responders. In 1991, when AHA published chain of survival goals of scene response, BLS 4 min and ALS 8 min, fire and EMS integrated to provide care. 96% US fire depts provide first responder services. Combo FF/EMTP was better economically and medically to integrate care with response, higher paychecks and diverse career options. ICS/NIMS trained. CMS pays only for patient transport, not scene care rendered. Medical director not 'sworn' city official and may serve as technical advisor to IC, need to get out in the field and build this relationship. Sometimes sensitive relationship between medical director and fire chief, different in every system. System Status Management (SSM) predict need for EMS. Decline in fire suppression services and increase in EMS. Some fire-fighters don't want to provide EMS, saving burning buildings/performing rescues are better than good bedside care. Also importance of reduced costs of Firefighter-paramedic >> but can have problems with patient safety as have OT (>12 hrs, >24hrs) and performance issues.
**Take Home Messages**: Fire-based EMS is prevalent and integrated response provides time-critical medical care.

Chapter 14: Third-Service EMS Systems
Most prevalent in urban settings and where large geographic areas are under a single local government with the resources to fund EMS as a public safety agency (Boston, Denver, Pittsburgh). Unique public safety agency where chief reports to head of public health. Focus is on out-of-hospital care. Firefighters and EMS have distinct duties and career plans.
Disadvantages-compete for municipal funding and lack of combined political weight/funding of fire services. Recent trend of more EMS and less fire calls, merging of the two groups. SF, NYC, Washington DC recent switch to fire-based services.
**Take Home Messages**: TSEMS is focused only on providing prehospital medical care, but current mergers with fire and budget issues are threatening these systems.

Chapter 15: Private Sector EMS

Mid-1990s, big four: Rural/Metro, AMR, Careline, and MedTrans consolidated a lot of little companies, had large profit margin and shareholders. Different ventures of nurse triage/dispatch centers, EP contract management, joint 911 response with city fire units keeps the landscape changing. But difficult reimbursement climate, decreasing ambulance transports, rising fuel and personnel cost are stressors. Medical director should be outside appointed and not directly compensated by private company. Focus on prehospital care like TSEMS.
**Take home messages**: Important role in market, regional providers who invest in local infrastructure and integrate themselves in preparedness roles continue to thrive despite economic pressures

Chapter 16: Hospital-Based Systems
Community healthcare system revolves around hospital, so EMS is natural extension. Not a good nationwide model, but works for some urban cities like Atlanta or rural areas where community hospital provides expertise and funding for system. 800+ hospital based EMS providers. Streamlined medical direction and oversight, educational opportunities. EMTALA issues with hospital based system to provide medical screening exam and formally transfer them to another hospital if different destination was selected than own, updated to transport to closest appropriate facility (hospital property, not ambulance was first evaluation).
**Take home messages**: Small but important minority in EMS care, mostly for smaller cities.

Chapter 17: Urban EMS
System design depends on unique needs of a jurisdiction. Med Director with higher administrative function than rural system due to larger call volumes, # of providers, hospitals, variation, etc. One tiered (all ALS) v Two tiered (42% BLS+ALS) v many hybrid permutations. Fire plus third service often work together in hybrid scenario to provide 2 ALS providers per call. Dispatch needs also dependent on structure chosen (need better dispatch QI if allocating scarce ALS resources). Urban dispatch with unique issues including cellular phones (growing number): multiple calls for same event. Calls routed to local PSAP and/or regional call centers. Need for coordination. Response times vary on system goals and no set standard for "when the clock starts." General practice: <=4 minutes for first responders, <=8 minutes for ambulance arrival. 90% fractal response most commonly used to judge acceptability. Ambulance "cycle" times (call dispatch to back in service) are very similar despite rural or urban locales (60 min). Special business/ recreation/ geographic areas in cities may require dedicated or unique EMT response (e.g. Disney World Mobile Ambulance and San Diego bicycle EMTs). Traditional quality indicators 1) ROSC, 2) accuracy & consistency of dispatch, 3)successful intubation, 4)capnometry in advanced airway, 5) scene times in hypotensive penetrating trauma, 6) STEMI times EMS-to-door, 7) off-load delay, and 8) patient satisfaction and 9) "Bundle of condition-specific criteria." CME is important and should be designed for adult learning needs. Employee satisfaction and safety: unique stress-related issues in urban environment. Air medical: potential usefulness for time-critical issues (STEMI) and/or with building geography or traffic issues. Disaster Preparedness: EMS will be critical asset in urban disaster response and should coordinate accordingly with other public safety and planning agencies. EMS and Public Health: urban environment specific issues for vulnerable populations, system abuses (SF HOME team, SD SIP, NYC asthma outreach, etc).
**Take Home Messages**: One-plus-one tiered hybrid system works well for many urban systems; ALS response is believed to be of value; Robust dispatch and dispatch QI needed for tiered system; CQI critical, recommendations for QI buckets, Unique air medical, disaster prep and pub health—need to be tailored to community needs.

Chapter 18: Rural EMS
Definition of "rural" hard to pin down. Defined as "not urban"; ACS definition: limited access to definitive care due to geography, population density, availability of professional resources. 20% US pop lives in "medically underserved" areas. Also "frontier" definition: less than 6ppl/100sqmile. Access to care: Rural hospitals have limited qualifications, transport times are longer/wait times for ambulance longer, often limited fleet (one ambulance). Rural demographics: older patients, can be sicker> ambulance calls are more "urgent" than urban counterparts. However, due to lack

of access can have “high percentage” of non-urgent medical calls (beyond official EMT scope of practice). Opportunity for integration of rural health services and innovations such as community paramedicine (currently happening informally and in non-standardized way; legislation and Regulation can help with this). EMS research and QI>> rural systems should participate in NEMSIS for standardized data collection. Finance is unique in rural environment. High fixed costs. Challenging to maintain equipment. Many systems unpaid service (funded through taxes) or buy subscription, or both +/- fee for service; room for improvement. Human Resources challenges: volunteer corps, credentialing, training, CME. Medical oversight; large catchment, limited resources/unpaid, high risk. Use of physician extenders may be very beneficial in oversight, mgmt and QI. Failure of systems status management in populations<250K. Education systems: utilizing national standards, trainings, and now online systems very useful. Unique public health education/prevention services. Communication/Access; 911 not always in use in rural environment. Longer distances for radio communications—difficult to transport data such as EKGs. Use of satellite, cellular or telephone or internet technologies more efficacious. Transportation decision (i.e. to type of definitive care center) can be challenging: given underlying condition, specialty needs, transport time, patient stability. Recommend--volunteers train post shift

**Take Home Messages**: Unique challenges including patient population, expense of equipment and continuing education, limited workforce, communication systems, transport times (necessitating advanced protocols). Technological advancements may offer some solutions to many of these challenges.

Chapter 19: Wilderness EMS

Wilderness definition: again “not urban!” Some definitions “time” based. However, better definition: Wilderness EMS not just about transport time, but about the unique skills, expertise, and equipment needed to manage the patient and extrication process, or need to trasport specialized equipment to patient side (ex USARTs). Long history of wilderness medicine from different sources, starting with Nat Ski Patrol. 2000/2005: Scope of Practice more clearly defined with the following levels: 1)Wilderness First Aider 2) Wilderness First Responder (WFR): 50-80 hours training. Trained to recognize potentially life threatening illness/injury, basic first aid and splinting, possibly some medication administration (e.g. epinephrine, glucose), possibly some protocol application (e.g. CPR termination, dislocation reduction); 3) Wilderness EMT (WEMT): 150 hours of training, adds on to WFR plus all components of EMT-B; 4) Wilderness Intermediate/Paramedic: WFR+ EMT-I or-P, plus some other procedures (Foley catheters, etc); 5) Wilderness Physician: “necessary care within the limitations of surroundings”. Direct and indirect oversight: Direct difficult due to communications. Indirect more likely→need for protocols, training and importance of case review. Specific discussion of protocols: Wound care (including FB extraction); CPR termination after 30 minutes (unless hypothermic); Joint reductions (focus on dislocations from indirect trauma so as to reduce likelihood of manipulating fracture); Selective Spine immobilization (similar to NEXUS criteria, purpose is to figure out who can walk out even with potential spine injury. Having all on a backboard impractical in wilderness); Anaphylaxis and severe asthma mgmt. Parameters for Search and Rescue

**Take Home Messages**: The point of wilderness medicine is treating patients and conditions in austere environments. Need expanded protocols for WFRs because of this, but also recognizing dichotomy of also more limited capabilities. Knowing the different level of responder and training requirements as well as sample wilderness-specific common protocols.

Chapter 20: Volunteer EMS Systems

Volunteer EMS systems have unique challenges in nearly all areas of system design and management. It is estimated that 75% of all providers in rural and 30% of providers in urban EMS systems are volunteers. This is due to lack of funding to support a fulltime staff. Educational issues: Due to volunteer status (<40hr/week) and often low patient volumes in an area, individual volunteers have low annual patient volumes and similarly rare exposures to low frequency, high risk procedures like ETI. Difficult to motivate volunteers to pay for advanced training (1000 hrs for EMT-P) and difficult to maintain skill sets/continuing ED. Recommendation for volunteer corps is (hands on) knowledge/skill review Q6months (versus 24 months for general paid EMTs). Utilizing

on-line resources for CE as well as requiring maintenance of a portfolio/log of skills and cases are useful ways to keep volunteer learner engaged. Quality Management: Low call volumes → erosion of complex skills. Paper charting due to rural/low-funding and antiquated systems for dispatch and charting. Staffing ambulances may be challenging. Incentive programs could be used even for volunteers (opportunity to enroll in pension programs or educational scholarships can ensure accountability and quality/consistency. However, because quality of volunteer corps so difficult to ensure/enforce, trend towards decreasing volunteers. Funding: SO MUCH cheaper to pay for a volunteer ems agency as personnel is 75% of annual cost of EMS. Medical Oversight: Lack of funding and recruiting for adequate medical oversight (EM/EMS trained person in rural areas can be hard to find)
**Take Home Messages**: EMS is expensive to operate fully. However, designing a volunteer EMS system has challenges on all levels. Use of on-line resources, keeping portfolios, more frequent skills sessions, and understanding motivations of volunteers (in order to attract talent and design CE and incentive programs) are all important to maintain high level of functioning.

Chapter 21: Law Enforcement Medical Oversight
EMS and Law Enforcement have many interfaces in ensuring public safety. Medical personnel have been involved in assisting PD for decades and PD have been involved, especially recently in health emergency response: e.g. MVC, shooter, and cardiac arrest first responder. New developments recently: AED Programs, occupational medicine, integration of medical professionals in police units (tac). History: "police surgeons" collected forensic evidence, now consultation regarding MCI management. Current state: 9/11 added fodder to movement towards interdisciplinary collaboration. Now Law Enforcement Medical Director (LEMD) has a role in occupational health as well as disaster prep. Occupational Health: Wellness (fitness, smoking cessation, nutrition, health screening). LEMD should have leadership role in these programs. LEMD should have knowledge about how health affects LE performance. For SWAT responsibilities: fitness and sports nutrition knowledge are essential. Understanding of how to access and utilize resources for handling "psychologically stressful events" is also critical.
Education: Each officer, must have more than basic first aid knowledge. More specialized units should have more specialized skills, such as: (1) Self-aid/buddy –aid or SWAT operator—kit with tourniquets, bandages, NPA, IV catheter, gloves, (2) First-aid for patrol officer in riot/crowd—officers in crowds may have "loaded vests" (3)Tactical first aid for high-risk warrant office—buddy/self aid training needed (4)Self-aid/buddy-aid for patrol rifleman—buddy/self aid training needed. (5)Mental Health Officer/critical incident training—ex verbal resolution training, resources for identifying and assisting personnel with mental illness who are in crisis. Policy and Protocol: Education to staff about interactions with "patients in police custody" and specific subgroups such as "exited delerium" as well as knowledge of take down devices and consequences to help direct policy of use as well as respond to complaints. Special Programs: AED—different PAD programs, AED within PD offices and jails versus out in the community (squad cars), Mental Health Programs: help to guide identification of Mental Illness and direct towards treatment rather than jai, train officers in effective response techniques to minimize harm to officers and patients; Fitness health: different fitness health programs for LE—source of litigation? LEMD-Help address needs; Operational medical support: LEMD does not need to be an operator, but needs to be intimately aware of operations needs and assist with training of staff.
Good Tables 21.1 and 21.2
**Take Home Messages**: Broad range of public and internal issues facing responsibilities of LEMD

Chapter 22: Air Medical Services
- Primary goal: give patients not in vicinity of emergency care, chance of survival. Original medevac model for trauma during military ops. Current philosophy: "care is critical"—qualities of aircraft used to match highly-qualified personnel. History: Military evacuation of sick as early as 1915. Korea saw intro of helicopter-larger choppers in Vietnam. 1970s-Civilian AMS in US. Growth: By 1992-220 AMS in US. By 2007 312 AMS with >800choppers and 282 fixed wing. Currently ~3% all ambulance transports in US. HEMS distribution of services: Interfacility 54%; Scene runs 33%, Other mission 13%. Factors that have effected growth: closure of EDs, Reduction in Trauma Centers, Reduction in Specialist Availability, Continued concentration of

specialists in urban areas, Closure of rural hospitals, ED- Hosp - critical care bed overcrowding and diversion. Integration: AMS is relatively scarce resource with high costs. So, want to integrate well in HC system. Expensive in comparison with ground ambulance, so want to utilize AMS appropriately. NAEMSP consensus paper

- PRINCIPLES for how to integrate AMS into EMS: states must assume regulatory oversight, AMS are essential elements of modern EMS, EMS systems should strive to ensure every patient has timely access (including via AMS if nec), AMS and CCT represent particular expertise in emergency care, must be overseen by physicians, use of consensus guidelines, AMS should operate at level consistent with Commision for accreditation of medical transport systems CAMTS. Essential Elements of Oversight for AMS. Patient selection/dispatch criteria—appropriate AMS transports (Table 22.1).
- Communication/integration of AMS resurce within EMS system: clear and consistent method to request a helicopter; close coordination with 9-1-1. EMS provider training: AMS should educate EMS agencies re: AMS service, when/how to use/safety etc. Trauma scene versus interfacility transport: EMSMDs must be able to review and re-direct AMS traffic to appropriate use within system.
- Outcomes: Still much debate about HEMS in general, and particularly around whther it provides any benefit over ground transport. Outcomes data is inconsistent and inadequate. Research should compare outcomes as well as costs and safety/risks. Current literature review: HEMS utility for secondary transport of trauma patients presenting to non-Level 1 centers. HEMS has been used to extend the reach of hospitals to distant areas. HEMS may have role for stroke and stemi center transport to avoid “blind lytics” in rural systems, as well as investigating Prehospital EKG initiating HEMS and cath lab activation. Maybe a future for Sepsis with HEMS? Possible HEMS benefits to EMS system: 1. Extension of Advanced Level of Care throiught region, 2 Provision of ALS “Backup” for parts of an Ems system with limited coverage (eg, foothills?), 3. Minimization of Tranport times, 4. Direct Transport to Specialized Centers, 5. Transport Flexibility in Overloaded Hospitals, 6. Ability to Perform Unusual and Ad Hoc Activities.
- REGULATIONS: IOM rec that states assume regulatory oversight of all aspects of AMS. FAA oversight—FAR 135—commuter and on-demand aircraft. Govern things like pilot rest, training, rules to follow in different airspace, etc. Responsibility rests on certificate holder—operator /company of aircraft. Med directors need to understand that final say defaults to certificate holder (i.e. safety over medical mission). Federal Preemtion—“under federal preemption, AMS providers have overturned state regulatory efforts requiring aircraft specific equipment, hospital destinations, certificat of need requirement and CAMTS accreditation as requirement for licensing.” Industry Safety and Credentialing: states license AMS as ambulances, but no say over aviation aspects of programs. Rapid growth of AMS in 80s led to increase in accidents. CAAMS (now CAMTS) formed to devise voluntary standards. Now 14 participating orgs and 133 air and ground services.
- Finance and Organizing: Costs from $3-9M fixed costs, plus staff and flight crew and maintenance crew for variable costs. 60% of costs of AMS go to fixed/equipment (opposite of ground EMS breakdown). Must transport patient in order to bill for services. Different payment possibilities: Insurers/Medicare, “Membership Programs,” or through hospital or vendor total provision of service. Vendor-hospital issues revolving around 135 certificate can hold hospitals hostage. Even division between hospital and “community” providers. Crew configurations: most common = 2 medical providers (flight -nurse, -paramedic, -physician).
- Physiologic Issues: Patients with airemboli—should fly at lowest possible alt (800 feet above ground). Most flight at 1000-2000ft. However if weather bad, might need to climb to up to 5000 ft. Strong winds—motion sickness, use of anti-emetics to patients ?to crew?/supplemental crew?
- Aircraft issues: helicopters: shorter distances but more mobility. Fixed wing: longer distances but must land at airstrip—limited use in truly emergent/time-dependent cases, they can fly in more inclement weather and from more rural locales. Space: limited-most aircraft up to two patients and two caregivers. Weight of providers, patients and equipment taken into consideration (recent lawsuit re: pt weight). Hearing: loud—need headsets. Communication in

advance critical (history taking/allergies, etc). Lighting: in daytime-great with sun-sometimes too bright. At night difficult. To overlight in order to not effect pilot's vision. When added to space, adds to procedure difficulty. Special training for personnel. Electronic equipment—untoward effects on navigation systems. Patients with highlike lihood of pacing shouldn't be transported by air?? As not certified equipment?) Must test in advance. Operational challenges: Visibility, freezing precipitation, ambient temperature, landing zones, HAzMAT. Special capabilities: Difficult Access Areas, Aerial Rescue, Aerial Reconnaissance (incident scene), Search, Aerial lighting, MCI, Mass gatherings, Go Teams, Hi-Rise Aerial Teams.

- Research--safety lights and sirens v helicopters;

**Take Home Messages**: Expensive. Multi-factorial. Above some laws. Need for more research

Chapter 23: Interfacility Transport

Issue of choosing "closest" v "most appropriate" receiving facility is a challenge for EMS, necessitating interfacility transport for many reasons: medical home, level of care, specialty care, etc. Level of Care for IFT—BLS to ALS to CCT. Systems can choose what is allowed (private contracting v use of 9-1-1 system. Can also vary based on condition (i.e. hosp to SNF--private versus critical trauma-911). Also possibility of "specialized units"—like neonatal or obstetrical unit to go to transporting hospital. Good for anticipating potential needs of patients, bad for possible scarcity of resources and depending on level of training of the transporting personnel. Personnel: controversial issue. Type of provider not determined to be as important as skill sets and resources available. Usually don't include physicians. Often advanced providers—experiecned nurses with advanced CC skills or EMT-Ps. Vehicles: depends on area and need being addressed: ground and air. Weather considerations can delay. Hazards of Transfer: most associated with lights and sirens for ground versus weather and air traffic for air. Specific conditions: Trauma (most benefit), Cardiac (PCI), Stroke, Burns (wound healing, surgeries, and hyperbarics for inhalation), spinal trauma, obstetrical (most are for fetus—ie specialty neonate care, longer transport times à higher rate of delivery en route), Pediatric and neonatal (need special peds equipment and supplies), Poisoning (ICU or specific antidote needed, seizures can develop). Medical oversight. Advantage of multiple medical directors due to complexity of specialty care needs, direct medical oversight/control less common. Legal issues: EMTALA, which provider is responsible for patient during transport, ride-along risks, deaths en route.
**Take Home Messages**: Range of provider levels. Potential benefits of specialty care. Awareness of potential legal pitfalls.

Chapter 24: International EMS Systems

Goal to provide timely, quality access and care while respecting and navigating cultural and structural differences. Context: changing medical treatments, economic conditions, urbanization, aging population all factors contributing to strains and development of global EMS systems. Some natural scenarios opportunity to compare provider differences.
WESTERN EUROPE:

- France: 61 million people, highly specialized healthcare. Franco-German model of EMS with physicians on mobile ICU. "Stay and Play" –on scene stabilzation. Utilizes national emergency number. Physicians provide dispatch, determine response needs, destination hospital if transport required. Ambulance types: EMT ambulance, BLS fire with AEDs, general practitioner by private vehicle, physician in fly car to meet other providers, physician-staffed MICU. Use of physicians—pre-arrival instructions and requests for service can be denied (up to 35%). MICUs evenly/strategically distributed. No Emed, but SAMU physicians tend to be full time.
- Germany: HEMS is 16 states' responsibilities. Ground EMS is local cities/communities responsibilities. In Berlin- Primarily Fire-run-two tiered: 1st BLS +AED, 2nd MICU. Physicians don't play a role in dispatch. Employs Rendezvous system 87% time—physician meets ambulance if necessary. Physician requirements for involvement.
- Austria: Uses Physicians as well as EMTs. But philosophy is "Load and Go" more frequently in urban v "stay and play" in rural. Central numbers. Physicians at dispatch in large cities
- Netherlands: Paramedics=nurses with CC experience. Can treat and release. Central number.
- UK: EMS heavily utilized (5% pop). Does not utilize physicians for prehosp care. Emerency Care primarily under NHS. NHS phone service-advice nurses—can arrange ambulances. Minor

injury units around the country. Serious illness/injury can access Ambulances with central number>>MPDS used to prioritize calls. Ambulance technicians 1 yr training 30 weeks-5yrs. Ambulance care assistances few weeks. Doctors can meet teams in field. 12 regional air ambulance services.

NORDIC: Well known for social programs and high standards of living. EMS with higher training standards than in US or UK. Helicopter services and extra EMS funding paid for significantly through charitable program. Except in Finland, fire service does not play a major role in EMS. Regionalized dispatch is common.

CENTRAL EUROPE and RUSSIA: Ample supply of doctors + physician wages persistently low = extensive use of physicians in prehospital care. Physicians on ambulances plus GPs making house calls. Patients who are il are brought to specialized rooms in clinics and near ICU in hospital where anesthesia addresses care. Centralized nurse dispatch. Ambulances have basic or specialty care services. Physicians on board may treat and release (little litigation). Mostly govt run. Some private companies

SOUTHERN EUROPE: EMS relatively new. Started as transport service by untrained volunteers. Some with volunteer-based systems. Now all have EMTs. Most have two tiered response with physicians in second tier. Some employ nurses as well. Dispatch by nurses can redirect patient transport

AUSTRALASIA: Region characteristics--Old cultures and new countries, wealth and poverty, some of most densely populated areas in world ànd EMS still developing and changing. Japan: long history fire based services, but only recently has fire embraced the EMS mission. 1964 Olympics required devmt of ambulance system. Three levels of providers: First Aid Class 1, Standard First Aid Class, Emergency Life Saving Technician. Many hospitals, but specialized—few to take the very sick. Taraimawashi ("rotating around")=Japanese Diversion. Singapore: Civil defense system. Before 1996= nurses, Now paramedics. India: Very diverse land, cultures, poverty and wealth together. Diversity of EMS response. Many different private ambulance companies scattered throughout. Mostly untrained, but EMT programs developing in major cities/states. Private and Public/Private partnerships. Australia and New Zealand: heavy reliance on charitable and volunteer services.

LATINAMERICA: Co-existance of public system with private systems (often membership). Argentina: >200 private companies. Physicians and nurses staff ambulances with a driver. Fire helps with MVCs. Peru: fragmented because of different health regulating agencies. Topography varies, so access and transport varies by region/geography (less/none in rural). Ecuador: Fragmented like Peru due to high poverty rates. EMS and fire separate (fire volunteers). Physicians and nurses and drivers. No helicopters. Brazil: tiered ambulances. Physicians and nurses on MICU/ALS. Rescuer staff and nurses on others. Different geographies and receiving centers. Mexico: EM is a specialty. Access to EM in cities through mix of pubic and private ambulances. Very variable preshopital exerpeices elsewhere delivering to clinics/EDs staffed by different types of providers.

AFRICA: In most of Africa, EMS is in "infancy" and little is known. Details only on South Africa: Large, modernized country. Different types of locales, but Rapidly evolving EMS system x 30yrs. Centralized regulation and development divide by regions. Multi level EMS providers with varying degrees of training up to ACLS, PALS.

**Take Home Messages**: Large amount of variation in practice due to cultural needs and resources

Chapter 25: Military EMS Systems

History lesson regarding need for timely care of wounded soldiers, the invention of triage and the "flying ambulances" (Spain-Malaga, Napoleonic Wars and US Civil War). Training levels of military staff. All staff have basic first aid training and packs for "self-aid" and "buddy aid." In Army, selected members of units = "combat lifesaver" have additional 40 hours of training (IV, splinting and "more advanced first aid"). "Combat Medics" = trained to EMT-B plus additional advanced training (though not to EMT-P level). Some sergeants at EMT-I level. Medical direction by "unit surgeon" and physician extenders. Organized/levels of military care (Table 25.2 good summary): Level I (Unit): self/buddy and lifesaver—first aid, combat medic—EMT, battalion aid station—ATLS; Level II (Division): Medical Company (Clearing Station)—initial resuscitation;

Level III (Corps): Combat support Hospital, Fleet Hospitals—Resuscitative Surgery and Medical Care; Level IV (Echelons above Corps): Combat Support Hospitals, Host Nation Hospitals, Hosp Ships—Definitive Care; Level V (Out of Theater/Continental US): Fixed Med Facilities—Restorative and Rehab Care. Transportation: MEDEVAC (transport of casualties on specially outfitted vehicles) v CASEVAC (transport of casualties on vehicles of opportunity). Manual carries for initial transport from site of injury to point of safety. Litter carries some improvement (e.g. can transport intubated patients). Helicopters an integral part of transport to definitive care sites, but some fixed wing vehicles as well. Need for CCT teams to accompany peri-resuscititve patients. Equipment on battlefield and transport vehicles limited by weight. Communications networks are robust and redundant and play a role in medical oversight—telemedicine can bring experts closer to the patient sooner. Lessons learned/research—tourniquets, haemostatic agents. Military during peacetime working to create partnerships with civilian organizations to fill gaps in access to care for isolated communities, work towards preparedness for disaster response as well as international disaster relief.
**Take Home Messages**: Different levels of care from the field to definitive/rehab with system in place, with different levels of EMT training. Unique transportation needs. Multiple opportunities for synergy with civilian needs (disaster response etc)

Chapter 26: EMS Scope of Practice
EMS is a multi-billion dollar business in U.S. with >800,000 certified providers practicing in very different environments across the nation. Need to ensure core competencies and uplift the profession. Important emphasis on Scope of Practice v Standard of Care. Scope definition: deals with "what are you allowed to do"; act of commission by unlicensed person = criminal offense; may vary from level to level but does not vary based on circumstances; established by statute, rules and regulations or licensure board; difficult to regulate knowledge through scope of practice. (Standard of care deals with "did you do the right thing and do it properly?"). National Standard Curricula developed by DOT following EMS Systems Act ('73). Scope of practice models/ hierarchy in prehospital care: EMR, EMT-B, AEMT/EMT-I, EMT-P. Specific gradation (simple, fundamental, complex) in knowledge psychomotor skills authorized/expected at each level practitioner for airway/breathing, pharmaceutical interventions, medical care, trauma care (e.g. Oral airway >> non-tracheal airway/ventilation device>> endotracheal intubation). Appendices go through specifics of psychomotor skill sets described as well as medication authorization.
**Take Home Messages**: Defining scope of practice essential for ensuring safety, consistency, professionalism. 4 levels of scope of practice—know specific skill sets and requirements.

Chapter 27: Certification, Licensure and Credentialing of EMS Personnel
CL&C is difficult, politically challenging, but very important to ensure integrity and quality of care within a system. Purpose of occupational regulation is to protect the public. In US this happens at state level, though there are national guidelines accepted by majority of states as baseline, but then additional state and local regulations layered on top. *Licensure:* process by which governmental agency grants time-limited permission to an individual to engage in a given activity or occupation after verifying that he/she has met predetermined criteria. (The greatest form of public protection). *Certification*: process by which an agency grants time-limited recognition and use of credential to an individual (after verifying pre-determined criteria). Also a mechanism to identify specialty training and competency assurance part of licensing; Affirms knowledge and experience within a field. Neither grants independence of practice. NREMT cert process has been accepted by 46 states as part of baseline requirements. State licensure then includes other legal requirements. State reqs can establish entrance requirements.
Local credentialing offers means for tracking continued competence by enforcing further credentialing requirements. Three components of Local Credentialing: 1) Administrative (application, selection, hiring, etc); 2) Operational (incident reporting, vehicle ops, staffing, etc) and 3) Medical activities (procedures, protocols, QI, etc)
**Take Home Messages**: Like scope of practice, licensure, certification, and credentialing are present to support patient safety. NREMT provides centralized recommendations for baseline.

Re-credentialing at local level important for QI, but with many challenges.

Chapter 28: Education
Critical component of MD role—ensures high quality of care and professional standards. National in scope but allowing for regional/local flexibility. Medical Director should be involved in determining scope and delivering curricula, though may not be a primary instructor due to educational delivery experience. Delivery through community colleges an excellent model for training both for accreditation of curriculum, existing infrastructure, and for potential for college credit. Specific roles in education system: Educator (not necessarily physicians; need to remember audience: adult learners with varying educational background, not med students), Education manager, Preceptor (ensuring clinical experiences/mentor, not necessarily evaluative in same way as educator), Skill instructor (importance of visual aids and de-coupling of skills), Skill evaluator (techniques to allow students to perform best), Instructor evaluator (critical for ensuring quality). Education v training (practice of skills and application of knowledge acquired through education. Helpful appendices for program designing and adult learning
**Take Home Messages**: different stages of prehospital education, different skills/ knowledge need different instruction and testing techniques based on psychomotor requirements.

Chapter 29: Simulation
Important for training. Low fidelity (not mentioned in detail, high fidelity equipment, partial task trainers (automated feedback for specific skill e.g. CPR). Can be useful in providing higher volume of training (over broader period of time) than EMS students might otherwise have through clinical rotations or preceptorships (e.g. obstetrics, intubations). Research still being developed. Great amount of time, financial and administrative resources required to invest up front to plan and stage simulation-based training. Future of simulation is bright (bc of liability issues with ward rotations, need or more volume, improving technology).
**Take Home Messages**: Simulation is the future. Particular advantage for observing critical thinking/decision making skills as well as specific skill testing.

Chapter 30: Distance Learning
In the current technological age, distance learning more realistic mode of continuing education. Allows for sophisticated instruction and testing in real-time with real-time or fast feedback. Advantages: flexibility, cost, geographic challenges. Challenges: security, authenticity, difficulty/inability to test certain psychomotor skill sets. Medical direction required for credentialing process to ensure high quality curriculum, and if accepted in local EMS system, to test for adequate retention
**Take Home Messages**: When used in targeted ways with reliable testing, distance learning can be of use in many EMS systems.

Chapter 31: Provider Wellness
Question 1:
Who is responsible (leader) for agency wellness program and monitoring process
- Answer: EMS Medical Director

Question 2:
What are the components of provider response to stressful incident?
- Physical, Emotional, Cognitive, Behavioral (Tables 31.1 and 31.2).
- These can be acute or delayed
- What are some of the effects of poor response to the stressful event?
- Unhealthy Behavior
- Personal problems
- Long-term health issues
- Burnout

Question 3: Steps to be taken post event that can provide support
- Emotional Support
- One on one debriefing

Question 4: Factors associated with at risk individuals
- Old age, High experience levels
- Working for a commercial service
- Greater denial of hostility
- Higher levels of hostility

Question 5: Stressors in the prehospital setting
- Work hours - Long and Irregular
- Sleep deprvation and interruption
- Financial Stressor and salary pressures
- Personal safety from violence

Question 6: Wellness program components
- Regular exercise
- Proper rest between shift cycle
- Proper diet
- Continuing eduation on coping mechanisms and stress reduction techniques
- Better communication and organized collegial support
- Specific shift scheduling - rotating in a clockwise fashion with 48 hours off between night and day shifts
- Avoiding 24 hour shifts in areas where significant rest is not possible can help to mitigate shift work effects
- Conflict resolution concepts
- Violence reduction techniques
- Situational awareness
- De-escalation techniques
- Self-defense and personal protection measures

Question 7: Steps to be taken by MD/resources for EMS Medical directors for wellness programs
- Local resources on ongoing training and wellness programs and refer when necessary
- Familiarize with laws governing employee relations and fitness for duty
- Collaborate with ongoing surveillance and maintenance wellness programs and interventions

**Take Home Messages:** none

Chapter 32: Occupational Injuries

Q1. Prevalence of occupational fatalities in prehospital providers is 12.7/100,000 annually.
- National average is 5.0, law enforcement rate is 14.2 and firefighters is 16.5

Q2. common causes of death in EMS providers
- Ground transport crashes
- Air ambulance crashes
- Myocardial Infarction (more in fire fighters)

Q3. Common cause of occupational injury to prehospital providers are
- MSK injuries
- Infectious disease
- Injuries and illness associated with sleep deprivation and fatigue

Q4. Most common reported injury is
- Back Injury due to sprains and strains associated with lifting (42.5% of lost work injuries, 6.2 lost work injuries/100 FT providers)
- Factors associated with injury:
- Average BMI 30.7 +/- 7.2 in males and females 28 +/- 5.7
- Hamstring flexibility and low back extension strength was poor

Q5. How can back injuries be prevented or reduced?
- Ergonomic devices and interventions
- Call for assistance when lifting large or difficult to access patients
- Improved training in lifting techniques
- Safe lifting culture (push and pull strategy rather than lifting)

Q5. Common route of exposure for infectious disease in prehospital providers is accidental needle stick.
Q6. rate of needlestick injury/1000 employee years 4.2 -367
Q7 Drowsy driving is estimated to cause more than 100,000 motor vehicle crashes each year resulting in 76,000 injuries and 1500 deaths

- 18 hours no sleep = blood alcohol concentration of 0.05
- 24 hours without sleep results in impairment equal to BAC of 0.10

**Take Home Messages:** none

Chapter 33: Ambulance Safety and Crashes

- Introduction: Ambulance crashes cause 59% of all EMS occupational fatalities, the rate of transportation-related occupational injuries for EMS personnel is more than 30 times higher than the national average and crashes involving ambulances produce twice as many casualties as the national average. Most crashes occur during emergency use and most serious injuries are in patient compartment. Highest risk locations at intersections and traffic signals.
- Contributing Factors: Fatigue (sleep deprivation), poor driver training, passenger restraint (low seatbelt use in patient compartment), distractions (radios, computer, siren), ambulance structural design (few crash tests), diesel fumes (increased coronary, lung cancer risk).
- Haddon's Matrix for Emergency Vehicle (EV) Collisions: human/vehicle/environment
- Recommendations:
- Fatigue: shorter shifts, training on fatigue
- Driver Training: research is needed to determine recommendations
- Use of Red Lights and Sirens: Warning Lights and Sirens (WLS) are overused, implement tiered dispatch protocols to reduce WLS. But problems with implementation due to concern about not getting to critical patient quickly if information is inaccurate, need in congested areas, patient perception to not be taken seriously.
- Passenger Restraints: Seatbelt use is the law, but many personnel refuse to wear for patient care or other reasons, need better education
- Driving History: check driving record at start of employment and periodically recheck
- Vehicular Design: lack of standards to rear compartment of ambulance, most dangerous area and least regulated
- Vehicular Operations: black box-real time monitor of speed, acceleration, seatbelt use

**Take Home Messages:** no current universal ambulance safety standard, can we institute at a local level?

Chapter 34: Prevention and Intervention for Psychologically Stressful Events

- Intro: EMS work contains a significant amount of physical and emotional strain. Long hours, low pay, burn out and PTSD.
- Critical Incident Stress Management (CISM) and CISD (debriefing) are well received but little evidence that they make a difference with PTSD, may have paradoxical effect.
- Axiom: a well-managed, well-run organization will find its way through even the greatest challenges, more or less regardless of what is or is not done to assist.
- Healthy organization: management, command, supervision
- Psychological First Aid-contact and engagement, safety and comfort, stabilization, information-gathering, practical assistance, social supporter connection, coping information, collaborative services linkage
- NFPA 1500 (health and safety standard for fire service agencies) mandates all agencies provide an employee assistance program (EAP)-access to behavioral health assistance
- Absence of credible evidence that CISM interventions provide clinical benefits
- Current recommendations: 1. Immediate assistance (psych FA) 2. Early, reliable, nointrusive assessment (trauma screening questionnaire) 3. Stepped care (treatment matched on level of clinical need) 4. Evidence based treatment of clinical conditions (psych benefits of cognitive behavioral therapy

- Basic protocol to manage stressful situations: experience of PTE->supervisor hot wash (timeout)->TSQ screening(if > 6 positive then referral)->complete assessment->treatment by specialty clinician

**Take Home Messages:** review support for all provider agencies

Chapter 35 :Prehospital Exposure to Communicable Diseases and Postexposure Prophylaxis

Infection control is important part of medical oversight. CARE Act required Infection control role for emergency agencies. Universal Precautions should be encouraged. Notification of Infection control and Occ. health if exposed. Bloodborne Pathogens (BBP). HBV Vaccine now essential for HCPs. 3 doses then check titers. If nonresponder, needs boosters then check titers again. If still nonresponder, must be aware of status, as may need HBIG if exposed. HCV: not as infective as HBV and also many patients are asymptomatic—unaware of infected status but may lead to worse disease as well as more chronic states. No reliable PEP available. Some respond to interferon. HIV: Despite frequent contact with HIV+ pts, only 5% of HCP exposures are to HIV+ blood. Low transmission rate. Percutaneous: 0.3% rate of tansmission. Splatter: 0.09%. Rapid testing to assess status of HIV and HCV (and HBV if indicated) in exposed and in the source patient. Antiretroviral PEP given to all exposed to HIV+. Normally, give 2 drug PEP unless very high VL or known resistance to past meds, then give 3 drug PEP. If source will not consent to testing, give PEP. Tuberculosis: Universal Precautions. Since it is droplet transmission, additional resp precautions needed. EMS personnel should maintain high index of suspicion in patients with pulm symptoms and high risk factors. Reportable illness, therefore EMS should be notified by hospital if TB patient later identified and recognized to have arrived via EMS. CDC Recommends for HCP yearly TB screening via PPD. Varicella: Recommendation is for vaccination to prevent or diminish illness. If non-immune person is exposed, then vaccine can be given within 5 days of exposure. If the nonimmune person is pregnant or immune compromised, then VZIG should be given to prevent dissemiated VZV. Bacterial Meningitis: universal and droplet precautions when transported suspected patients. High case fatality for N. meningitides (10%). PEP should be administered when close unprotected contact occurs (mouth to mouth, intubation, vomiting, secretions, coughing). Simple proximity does not qualify as close contact unless the HCP was <3 feet from patient for >8hours. PEP should be given once a case is confirmed via CSF. HCP cannot work until 24 hours after PEP given. Recommended Immunizations: Childhood, HBV, MMR, VZV, TdaP boosters, TB skin testing. Report exposures to Occ Health.

**Take Home Messages**

Vaccines, Universal Precautions, Timely and accurate notification of providers and appropriate prophylaxis if warranted

Chapter 36 Career Personnel

What is wanted of Medical Director by prehospital personnel: 1.Support actions to the medical community; 2. Provide more feedback (realtime), 3.Be available to answer questions; 4. Tell providers how important they are; 5. Maintain perspective (ride alongs); 6. Clearly communicate expectations; 7. Compare notes (seek feedback); 8. Provide clinical leadership (caring/compassion); 9. New technology (and appropriate training); 10. Teach; 11. Keep an open mind when investigating complaints; 12. Evaluate performance regularly; 13. Create treatment protocols that focus on necessities; 14. Create treatment protocols that are simple/easy to read/remember; 15. Teach and guide rather than discipline.

Medical director expectations of career personnel: 1. Patient comes first, always; 2. Crews should do the right thing for the right reason (in the interest of patients, should keep in mind “what would MD want me to do”); 3. Providers will be team-players, recognize that efficiency in getting back in service is a service to other providers on the team. Professionalism breeds professionalism. Administrative support: management staff involved in equipment, HR, policy development and quality assurance are all part of the career team. Labor relations: Medical Director should stay out of labor issues. Unions can negotiate with management team. However, medical director = Patient Advocate, must keep interests of patients at forefront of concern. S/he can grant or remove clinical privleges for staff who are not fit to work with patients. Management deals with whether the person has a “nonclinical” job. Stimulate career growth through programs like the

Field Training Officer. Turnover: EMS has average or lower than average turnover for the healthcare industry. While there is some TO, it is better to invest in people's development since the vast majority will stay and build your system.
**Take Home Messages:** Expectations go both ways for MD and Career Personnel. Teach and be involved, and be the consumate Patient Advocate.

Chapter 37 Volunteer Personnel
Volunteer EMS while on the wane, are still involved in care. Most heavily in Northeast (volunteer rescue squads), otherwise usually in Rural(ish) areas (up to75%--80% are certified EMT-Bs). As rural areas become more suburban, volunteer corps negatively affected due to dwindling "discretionary free time". Recent study of rural volunteers noted 11 causes for decreasing volunteerism: time demands, training requirements, increasing call volume, changes in the nature of the business (abuse of EMS by public), changes in sociologic conditions, leadership problems, increasing use of combo departments, higher cost of housing, aging communities, internal conflict. Positive attributes of volunteer corps: Tenacity, desire, confidence; Flexibility; Acess to Private funds; Community Spirit. Challenges: Lack of clarity of goals and purpose; ineffective leadership; insufficient funds; public invisibility/lack of accountability. Key management issues: focus on motivation and pride, respect time for training; hold to same standards as paid personnel; reduction of turnover; creative compensation; educate versus testing; facilitate info dissemination; put the right person in the right job
**Take Home Messages:** Unique challenges and benefits. Unfortunartely, a dying profession.

Chapter 38 Nurses in EMS
Reasons RN's are a good match for EMS: 1. Continuum of care from prevention through rehab, 2. Largest (and potentially most powerful) provider group in the health care system, 3. Natural bridge to in-patient and post-acute-care settings for patients. Useful in air medical and rural settings; Houston uses them in ground EMS response. For education and training benefits are the global patient perspective, high tech device skills, entree into hospitals to facilitate clinical rotations and specialty RN skills, such as trauma. QI discussed as a function, but other than the need for the RN to have EMS experience not elaborated. In the patient care arena, only state boards of nursing can regulate the RN's scope of practice (not the EMs authority) regardless of location. The trauma nurse coordinator as the most highly evolved RN position today in EMS. RN's being used in ombudsman roles as they can move accross system and disciplines more easily than other professionals.
**Take Home Messages:** Is there a role for ombudsman in our system? Do we need an RN to EMS bridging or orientation program?

Chapter 39 Recruitment and Retention
Recruitment process outlined, including needs assessment and determination of skill set and how to recruit personnel for the position. Civil service process alluded to, includes protections against civil rights lawsuits. Diversity briefly discussed stating that encouraging persons of various ages and backgrounds important to the organization. Provide a motivating environment for workers rather than trying to motivate them directly. Other recruitment factors are finding a pool of potential recruits, and making the entry into the profession non-threatening. Retention principles: 1. Life cycle principle, matching retention to the phase of the career life cycle, e.g. maintaining technical skills in the "lead and mastery" phase, 2. Belonging principle, making the staff member feel needed and contributing to organizational success, 3. Success principle, helping the staff achieve success in important personal goals, and 4. Friends and family principle, retention increased when staff form strong personal relationships. Delegation of appropriate duties and sharing of power are excellent retention tools.
**Take Home Messages:** Should we require EMS providers to have retention programs? Should we have one at the EMSA?

Chapter 40 Medical Oversight and Management Interface
Look at state law and regulation to find the Medical Director's job description (and he/she may have to serve many masters). Maryland's regulations are quite specific on the duties of the

"operational program" medical directors. Contracts are essential to lay out the working relationships of the MD with the organization management. Challenges as follows: Volunteer systems: retention. Third service systems: promotion. Fire based systems: paramilitary structure and reporting relationships. Private industry: conflict with the business model. Unifying roles in CQI and education. Figure 40.1 QI process flow diagram; proper role of root cause analysis and siphoning off of credentialing/licensure actions. Medical Directions sources of liability include clinical practice (direct or by radio control) and employment practices (civil rights claims, e.g. the MD denied economic rights of EMS provider). Administrative functions detailed to the MD may include field orientation and oversight; any actions taken by the MD against a provider should be covered by policy and directly related to the relevant clinical behavior. Be sure to follow state law and regulation to ensure proper "overlap" from one jurisdiction to another. "Strive for the least adverse intervention for the field clinician that accomplishes the aim of the remediation and protects the public and system." Try to make dealings with unions a "win-win" basis.
**Take Home Messages:** none

Chapter 41 Interaction with EMS Providers in the Emergency Department
Keep radio communications concise, don't provide feedback for the radio report over the radio, treat EMS providers of all levels with respect. Turnover needs to include brief verbal and soon after the encounter more detailed written report, with respect shown to EMS personnel. Beware a temporary cessation of monitoring patients during transfer. Also, patient conditions can change en route. Feedback given directly and appropriately to the EMS crews is beneficial. ED observation by ALS EMS personnel recommended, as well as ED staff ride alongs. EMS break rooms are advocated. ED "holding the wall" time interval of less than 30" championed, and measured from arrival at hospital to departure of ambulance from hospital back in service.
**Take Home Messages:** Define and monitor wall times as a part of the system CQI process.

Chapter 42 Finance:
While initially federal funds provided resources to EMS after the EMS Act, this is no longer the case and each agency has to find its own funding. State government provides regulation, training, licensure but also have budget constraints, although some do provide limited funding opportunities. Three myths: price does not equal cost (cost of transport $364, but Medicaid reimbursement only $75), direct cost does not equal full cost, higher govt support does not guarantee superior performance. Most of the cost of EMS is the cost of labor.
Full Cost=direct(labor, medical supplies)+indirect(QI/admin)+shared (comm center)
Cost Per Capita=total system cost/total population served->indicates cost to community, not efficiency
Unit Hour Utilization=utilization (how frequently used)/unit hour (fully equipped and staffed ambulance on response or waiting for a response for one hour)
Cost Per Transport=Cost per Unit Hour/(U/UH)
EMS Revenue: tax subsidization, third-party reimbursement, patient payment
Sources of reimbursement: Medicaid, Medicare, private, commercial ins., contracts
-Medicare fee schedule->national RVU x natl conversion factor(NCF)+local base rate (after implementation, more losers than winners with this reimbursement)
-Difficulties of uncompensated care: moral and legal responsibility to respond, but little ability to shift costs
High-performance EMS systems: economic efficiency, response-time reliability, clinical performance, are directly interdependent
Additional subsidizations? Rare
Service Alternatives? EMT-B and medic instead of double medic, deferring capital purchases, non-transport (but then no payment)
**Take Home Messages**: Political backing can secure investments in the system, system can't run without reimbursement.

Chapter 43 Managed Care:
- Incentives in the form of "pay for performance"
- Unpredictable aspects of EMS care do not fit business efficiencies of managed care

- EMS systems designed with redundancy to accommodate fluctuations in call volume and some degree of preparedness for community disasters
- EMS=safety net for community
- MCO's reduce cost by retrospectively reviewing cases and denying payment
- EMS services getting retrospective denial of care should improve documentation
- MCO repatriation
- Culture changing->transition to managed care partners, interfacility transports

**Take Home Messages**: managed care reimburses, so data collection/outcome studies/QI help maximize these revenues

Chapter 44 Legislation, Regulation and Ordinance

EMS providers are permitted to carry out their various medical duties as "dependent practitioners" working within a state-licensed and authorized EMS Agency. They must be authorized by EMS physicians to apply their skills, limited to a scope of practice. EMS care rendered to the patient is a direct extension of the physician and must be maintained in accordance with the contract established between MD and patient. California MICN's involvement is authorized by the EMS medical director for the agency. Medical oversight MD is responsible for all assessment and management skills practiced by all levels of out-of-hospital providers (BLS or ALS). State legislatures create statutes, which are defined and explained by the state executive branch into rules and regulations, which can be modified through a hearing process as long as changes are not contradictory to the statute. EMS Law contains a Title (which must contain medical content), Rationale (related to protecting the public interest), State and Local Administration. The state EMS Director may or may not be a physician but if not they need a defined link to a physician for medical oversight. An EMS Council, Committee or Commission may be advisory (such as Georgia's) or granted approval authority (such as California's); they work with the state EMS Director. Regional EMS councils are also common and influence training, equipment purchasing and local system design (sometimes in conflict with state bodies). Local EMS issues such as awarding calls and response zones to various providers are crucial and differ from state to state in who has the authority. EMS vehicles are commonly licensed by the EMS systems they operate in. Medical oversight is generally provided by a licensed MD but with little subject matter expertise required. Medical record keeping requirements are found in state law. A brief discussion of "invalid cars" aka gurney cars is presented as not being regulated by EMS. Most EMS providers fall under the protection of Good Samaritan laws as long as they are not paid(!) Local ordinances can be used as a powerful tool to ensure MD oversight of the local system, and frequently cover such areas as response intervals and equipment but cannot contradict state statutes.

**Take Home Messages:** There will always be conflicts between state, regional and local interests.

Chapter 45 Federal EMS Programs

Enabling legislation/regulation: 1966 Highway Safety Act (stimulated EMS equipment purchases) 1971 EMT-Ambulance standard curriculum published by the Department of Transportation 1973 Emergency Medical Services System Act (provided substantial funding for EMS programs). 1984 Emergency Medical Services for Children program under HHS spurred improvements for kid's emergency care prehospital and hospital. 1990 Trauma System Planning and Development Act developed trauma system planning at state level. Since 2001 laws including the Pandemic and All-Hazards Preparedness Act require the Health and Human Services Assistant Secretary for Preparedness and Response to address EMS related issues. Federal EMS activity is primarily in policy, guidance, oversight and funding. Direct federal EMS providers are Indian Health Service, National Park Service, Customs and Border Protection, US Coast Guard, several Federal law enforcement agencies and the U.S. Military. Coordination is by the Federal Interagency Committee on EMS. The National Highway Traffic and Safegy Administration developed the EMS Agenda for the Future, establishes a consensus-based ong-term project strategy/vision and then funds national level projects to implement the vision. One of these is the NG 911 (next generation 911) project to allow the entire 911 network to data share. The Dept. of HHS provides the EMS-C program including safety, prevention and disaster preparedness. The Office of Rural Health Policy in HHS supports rural EMS and trauma service initiatives. The CDC's Injury Center provides several services, including the current trauma triage decision scheme and the surge

capacity after terrorist bombings proposed solutions for EMS. The CDC also funds state health programs in heart disease prevention such as stroke networks and the Cardiac Arrest Registry to Enhance Survival (CARES) that SF participates in. The National Institute for Occupational Safety and Health is also a part of the CDC. The ASPR office in HHS now has oversight of the National Disaster Medical System, which was transferred from 2003 through 2007 to the Department of Homeland Security but was returned after Katrina. Emergency Support Function #8 is Public Health and Medical Services and is the component of the National Response Framework that covers disaster medical care. ASPR has an Emergency Care Coordination Center that bridges all agencies involved in a disaster response. The Center for Medicare/Medicaid Services oversees the national fee schedule for ambulance services (always to the nearest appropriate facility; includes home to hospital, hospital to home, SNF to hospital and return, and home to dialysis center and return). CMS also oversees EMTALA. The Department of Homeland Security has an Office of Health Affairs to assist with overseeing terrorist event responses. The Federal Emergency Management Agency hosts the US Fire Administration, which has several EMS related duties, including EMS Health and Safety and the National Fire Incident Reporting System which has some EMS elements (a data base) and partners with NIOSH on ambulance safety.
**Take Home Messages**: Will somebody please develop a National, perhaps cabinet-level position, to coordinate all of the EMS regulation and federal projects in the US?

Chapter 46 State EMS Offices

Hwy Safety Act 1966 and EMS Systems Act 1973 established resources and structure for building EMS system—organized by the states. Each state oversees its own EMS standards, certification, vision etc. However, all states' EMS offices are members of NASEMSO (National Association of State EMS Officials). Vision, Mission, etc outlined on p513. Mission- to support members in developing EMS policy and oversight…Strategy by involving all states and territories as well as serving as national advocate. Ultimate goal of have orderly and coordinated EMS across the country and improve prehospital care of patients. 2005 Survey of State EMS Agencies asked about structure and function. Majority are overseen in state DPH, next greatest percent is in public safety, next (7.5%) as separate state agency. Depending on location, goals may be more or less health v safety oriented as well as different credentialing regulations. Table 46.1 describes varied functions (Highest: General admin, Personnel training or licensing, data and info systems etc). Staff volumes vary based on state. Lowest= 4 staff, highest=90. EMS medical directors should know their state regulatory offices—develop transparent communication processes, as two way communication may prove very significant going forward.
**Take Home Messages:** State offices try to bring a unified national agenda into context for each state

Chapter 47 Communication

- Necessary elements of an EMS Communications system: Service to persons reqring assistance, Mgmt information to EMS system leaders, medical oversight, Integration with Public Safety (law fire, etc) in day to day needs and in disasters, Collaboration with other organizations in health care, Service to community including quality service and accountability.
- Access and Service to community: May look different from community to community. Examples: Rural v urban, different geographic issues define capabilities by scenario. Comms does not just mean "911 dispatch" –could mean home phone access, community paramedicine, etc.
- Access—911 –mostly universal number in US. Improves access by improving awareness. Integrated all emergencies –health and pub safety. E911-system: landline calls automatically give location to dispatcher. Problem with cell phones—still need location discussion .
- Dispatch—evolution and more complex. Introduction of EMD protocols to help identify more urgent problems that need "lights and sirens" over other less urgent issues. Improve accuracy and safety for community. More research regarding pre-arrival instructions useful to patients. Centralized dispatch saves money
- Medical Oversight communications: Different depending on system and needs. Off-line v on-line medical control/consultation. Scope of oversight varies by system: treatment, destination,

AMA, medication recs. Med oversight and field providers can use variety of comms methods (radio, phone, cellular). Intro of video transmission is new

- Patient care records—Providers can share data of prehospital phase with hospitals. Different hardware and software technologies for crews to provide. PCRs should be kept with patient's hospital medical record. NEMSIS has helped to unify a "data dictionary" that most states have agreed to use. And licensed provders generally required to comply. Education re: PCR should stress one that is "accurate, precise, comprejensive, legible, objective and time-sequenced."
- Administrative Records—important for operations of EMS crews but also for tracking and responding to quality issues, customer complaints etc.
- Integration with Public Safety organizations—Three different structures for EMS comms centers: 1. A single center houses all staff for dispatch and comm. Of EMS, police and fire; 2. comms center is located in PD or FD with EMS dispatch responsibility; 3. Each Pub Safety has separate dispatch. Imortance of using an integrated comm. System/language and routine no matter what structure is chosen.
- Major Incident Communications—Emergency Communication is central to any major incident/disaster response. Robust system must be able to operate and coordinate with multi-agency response easily and under stress. Procedures should resemble day-to-day patterns for ease of use. Emergency system must be able to block or shut down non-essential communications. Redundancy is important. Use of incident command system for appropriate flow of information is useful.
- Collaborations with other Organizations in Helathcare—EMS systems must be able to communicate with local hospitals as well as other regional EMS systems. They must be able to have "interoperable" communications with other public safety. Interoperability overseen by DHS which also developed SCIP Statewide Communications Interoperability Plan to enhance local interop developments –enhanced local abilities 2008-2011. Radio frequency coordination is common problem locally and nationally. FCC regulates use of radiofrequencies by public safety organizations as well as others. FCC has designated separate Emergency Medical Radio Service for several frequencies including tradional Ems channels.
- Adapting Technology for the EMS Mission—Many advances in last 4 decades. Land Mobile Radio systems: include VHF (v high frequency) and UHF (ultrahigh frequency) dispatch to vehicle (mobile and portable radios), vehicle to vehicle, vehicle to hospital, hospital to hospital. Standard is now evolving from analog to digital (like cellphones). The Association for Public Safety Communications –working on data and broadband plans for future.
- VHF. Beneficial for rural, frontier, suburban. Range depends on power output, antenna height, repeater placement. Simplex: can only send messages one at a time.
- UHF Duplex: Allow for two-way conversation (at once). 463-468-MH. Good in urban environment because of penetrance. Need repeaters or microwave systems. Repeater: receives low level signal and retransmits it at higher level/ power --> covers longer distance. Repeater= base station.
- 700MHz & 800MHz Trunked Systems: Blend of two-way radio technology and computer controlled transmitters. Less interference: computer searches for open frequency when call is made. Compatibility difficulty: FCC allowed different equipment design. In some areas, vehicle repeaters are not allowed, limiting functionality. Many repeaters needed to increase transmission range. May significantly increase rural system cost. HEARnet System: VHF. Generally for emergent/disaster hospital to hospital communication. Hospitals, blood bank, dispatch, EMS offices. Should have independent power supply
- Other comms options:
  - Land and Mobile Phone. Superior clarity. Provides confidentiality. Capability of multi-media messaging. Provides alternate communication in radio 'dead zones'. Will not function in disaster situations. Difficult to efficiently coordinate users during and incident
  - 2.4-5.9-GHz Systems--"Hot Spot" wireless areas. Provides fast broadband voice and data transmission. Requires 'line-of-site' connection, making non-urban systems too expensive. Security and transfer speed issues abound at 2.4-GHz, whereas 4.9-GHz is secured for public safety
  - Fiber-optic

  - Satellite phones--Omni-directional antennae improved communication. Very expensive
- Future Directions: Cognitive or Software defined radio (SDR)
- Will scan channels to find which are in use when transmission is needed. Will change the channel or spectrum of channels (vhf, uhf, satellite, cellular) based on which has best strength/connection. Will consolidate all devices into one 'Smart Radio'. Overall increased situational awareness: Increased use of GPS, Enhanced 911 for cell & VoIP, More involvement of video and data 'pull' & 'push'. Picture, video, GIS mapping, real time. utilization, status automation.

**Take Home Messages**: Different communication models and technology vary depending on local EMS needs as well as situation (routine v disaster, high data complexity v low, etc)

Chapter 48 Information Systems

- At the enactment of EMS in 1973, there was no information systems component
- In 1996, NHTSA proposed 81 data elements important to an EMS information system
- This allowed EMS systems to benchmark themselves and contribute to larger data sets
- In 1996, NHTSA published 'EMS Agenda for the Future' and as part of an integrated health care system recommended improved information systems
- 1997 Data Elements for Emergency Department Systems (DEEDS), basic
- ED data set
- "The future of EMS will be based on information systems"
- In 1991 AHA published Utstein criteria, standard OHCA dataset **first major document to specifically address EMS system performance and outcome**
- Utstein=combined data from 911 dispatch, EMS system, hospital
- Formulation of NEMSIS (National EMS Information System) Project in 2006, national EMS database to document EMS service, establish electronic documentation, support state regulatory and disaster functions, support federal EMS needs.
- IOM Report in 2006 addressed the need for standardized EMS data and information systems
- State/national trauma registries capture some EMS data, but more linking to be done
- National Trauma Data Bank (NTDB) has standardized dataset as well
- NHTSA has Crash Outcomes Data Evaluation System (CODES) which matches data from police, EMS, ED to provide medical and financial outcomes of MVCs->use this information to make highway safety decisions
- National Hospital Available Beds for Emergencies and Disasters System (HAvBED) national bed tracking to monitor surge capacity in MCI
- Emergency System for Advance Registration of Volunteer Health Professionals
- Health Alert Network (HAN) funded by CDC provides information and emergent health information, messaging system
- Important to identify data points that will allow linkage between two datasets
- Improved information systems allows for complete billing and reimbursement
- EMS Systems vary, but ideal size for efficiency is just more than 1 million people
- Data should have clear definitions and provide real-time feedback to system and EMTs
- AEDs capture complex and sophisticated information on waveform and energy
- Three common types of software: front end (database), back end (report generators), web browser IS (enter, analyze, generate reports)
- Data entry->data use->performance improvements
- Good system must be user friendly and able to generate data

**Take Home Messages:**

- EMS data are needed for system and resource management, QI, injury or population surveillance, and reimbursement
- Fine balance between spending time on patient care vs. documentation

Chapter 49 Emergency Medical Dispatch and Prioritization

- Background: EMD = First link in chain of survival for true life threatening emergencies. Public needs to know who to call (911), and EMD needed to appropriately allocate/prioritize resources to range of "emergencies". EMS physicians help to create and oversee trained EMD response
- Items in an Emerg. Med Dispatch (Table 49.1): Systematized, scripted formal caller interrogation; systematized, scripted postdispatch and prearrival instructions; clinical/situational problem descriptors and codes,
- Myths about Medical Dispatch (Table 49.2): caller too upset, caller doesn't know right info, medical expertise of EMD not important, EMD is too busy to waste time asking questions and flipping cards, phone info from EMDs not useful and potentially harmful, more EMS personnel on scene=always better, it's dangerous to not maximally respond to all calls, only protocol training needed for EMD, home-gown protocols are easy and effective
- Figure 491. Example of MPDS 32-Man Down Unknown Problem (32-D: Life Status Questionable): good example of structure of interrogation and linguistic format of questions
- Emergency Medical Dispatcher Role and characteristics: multifaceted role requiring skills in - telephonic communication techniques, targeted medical knowledge, understanding of dispatch prioritization methods,
- Medical Oversight—required to educate re: methods of prioritizing calls with medical knowledge and to maintain quality of EMD
- Quality Management Objectives: Ensure dispatchers understand policy, Ensure compliance with policy, Ensure correct and effective application of policy, practice and protocol, Correct and improve any deficiencies identified
- QM Components:
  - Selection-ability to read transcripts, follow instructions, carry out multiple tasks, exercise good judgment
  - Orientation-must be incorporated ("inculcated") within EMS paradigm and system. Must be "help" oriented (as most 911 calls not life threatening)
  - Initial Training-focus on use of medically appropriate and approved dispatch protocols
  - Certification-attests to fact that EMD has been exposed to and demonstrated competence in defined body of knowledge
  - Continuing Dispatch Education-half-life of med knowledge is 5 years. EMD must have relevant updates as to practice
  - Medical Oversight-physician involvement and guidance essential in education, QM, policy
  - Data Generation-Random sampling of approx. 3% calls to drive review process
  - Performance evaluation or case review and feedback—Essential component of continuous improvement. Call reviewer must use active listening and be engaged in case. All parts of call should be reviewed: case entry, interrogation, instructions, dispatch priority assignment, etc
  - Recertification—necessary to maintain skills and "skin in the game"
  - Risk management—legal equivalent to preventive medicine. All elements of EMD QM pertain to this
  - Decertification, suspension, termination-formal policies of expectations and requirements and then formal documentation of deficiencies and corrective actions needed
- Supervision at Dispatch- On-site supervision to ID problems prospectively. All managers must be EMD trained as well, QM case review in part driven by on-site trends
- Prearrival Instructions—EMDs= "first first responders". Important to follow scripted PAIs and minimize ad lib. Designed to be clear and direct. Helpful for EMD to maintain control and a public expectation
- Dispatch Life Support –important component of PAIs- including things like CPR instruction, Relief of FBAO, use of AED. Important knowledge, procedures and skils used by EMD in providing care through PAI—BLS and ALS principles appropriate to each situation
- Compliance to Protocol- Only 5-10 provide completely correct PAIS from script in DLS. Medical director plays important role in maintaining compliance to formal PAIs
- Psychological components: Drives home point of stress experience d by caller and how EMD can mitigate. Phenomena: hysteria threshold of caller; "the repetitive persistence

methodology"- maintains control; bring the patient to the phone problem; re-freak event; nothings working phenom; paramedics aren't coming; relief reaction; gap theory

- Dispatcher Configurations: How dispatchers respond to calls-
  - Horizontal: team-based call-taker goes through protocol , radio dispatcher takes info and makes priority decision
  - Vertical- each EMD responsible for cachment area (less effective)
  - · Medical Dispatch Priorities: "Medical Urgency Science" Each question asked for
  - Gleaning info necessary for appropriate response assignment
  - Identify conditions requiring PAI
  - Obtain info required by response personnel to preplan and address scene and patient
  - Scene safety by minimizing hazards and risks to patients and personnel
  - · Priority Dispatch Responses
  - Symptom v diagnosis based MPD
  - Prioritzation provides logical framework to allocate resources based on info about pts
- Maximal Response Dilemma—you can't send maximal response to everything. Leaves resources unavailable for future calls. And it is not always needed. Need to use educated system to assign resources
- Emergency Medical Vehicle Collisions –can't send HOT responses to everything, as it endangers public safety. Therefore again use prioritization to make safe response time
- Tiered Response and Justification (See Figures 49.9 and 49.10)
  - Goal to get the right thing/people/skills to the right patient at the right time
  - Not really linear but prioritzation of time and skills needed Greatest urgency (HOT) >>> Least urgent (COLD)
  - Echo, Delta, Bravo (BLS), Charlie (ALS), Alpha, Omega
- Understanding Determinant Terminology: (Figure 49.11-12): provides ranking within chief complaint to direct level of response required as well as speed and priority
- Avoiding Response Code confusion – don't use duplicate names of things between MPDS and local protocols
- Response Theory and Local Development – need to incorporate local and political elements in termininng local response patterns to MPDS categories
- General Rules of the response Planning Process: Ask these questions: Will time make a difference in outcome? How much leeway exists for this problem? How much time saved by responding hot? What time constraints are present in system? When patient gets to hospital will time saved using lights-sirens be significant compared to time spent awaiting care?

**Take Home Messages:**

EMD is complex but useful component of EMS system
Medical direction in all aspects of EMD
Using well studied and organized system is more efficient and safer

Chapter 50: Regionalization and Designation of Medical Facilities

- Establishment of a regional system does not have definitive impact on patient outcomes (!) Emergency Medical Care system is 360 degrees/365 days a year that includes public education and prevention Definition of "Organizational Silos" within the EMCS response (e.g. EMS providers are one, in-hospital specialty transport teams are another). Time critical diagnoses concept = a way to avoid 3 separate systems (e.g. trauma, STEMI, stroke) and instead have 1 set of diagnoses with potential improved outcomes with regional designation of specialty care centers. Timely care with appropriate resources and good QI programs are the benefits of these systems. Explicit authority and authorized lead agency are two important factors to preclude legal challenges based on the creation of de facto monopolies. In the absence of federal $$ and legal authority plans for regionalization through facility designation usually fail. PL 101-590 (1990) Truama Care Systems Planning and Development Act--supports regionalization only $5 Million in 1992. Senate committee found mortality of severe injury in rural areas 3 to 4 times that of urban areas.HR 727 TCSP&D Actamendments passed in 2007 gave additional funding of $8-12 Million through year 2012. The chapter advocates for simultaneous, rather than sequential processing of EMS calls relevant to regionalized centers. Examples of system issues on p. 598 L column

include over-dispatch of air medical resources and over-use of regional resources by referral centers. West and Trunkey study 1979 SF vs. Orange County trauma systems showed much lower mortality (why was the SF trauma system allowed to end during the 1990's?). STEMI center direct transports decreasd time to treatment by :79 and mortality from 4.3% to 0%. p. 600 multiple system design components recommended (e.g. subcommittees of stakeholders to include medication oversight, funding, etc.) but no evidence presented that they are effective (!)
**Take Home Messages:** None

Chapter 51 Diversion and Bypass

- Diversion began in 80s as hospital capacity decreased and patient volumes stayed constant or increased in EMS and at hospital
- Initial goal was to ensure that patients did not have delay in care at "backed up" hospital
- Now at least 1/3 hospitals go on diversion at least once per year (12% between 5-19% of time, <3% hospitals >20% time)
- Diversion is worsening
- Studies have shown larger hospitals in more urban areas on divert more, with more older people diverted
- Increased diversion has been associated with longer ambulance transport times, increased time to thrombolysis in MI and lost hospital revenues
- Impact on EMS System: longer transport times, increased cost. Also theoretically decreased ambulance availability for calls (though no evidence to date)
- Causes of diversion: thought to be due to increased use for minor problems, but more data showing that inpatient capacity (all and for ICU) directly effects diversion rates
- Definitions and Criteria: NAEMSP and ACEP stress need for system-wide agreement to terms as well as documentation of frequency and duration of diversion events. Importance to define specialty triage criteria as well as override criteria. Communities should legislate immunity to protect EMS providers who make good faith effort for destination decisions
- EMS medical oversight should have specific guidelines regarding transport times and destination decisions to aid navigation of diversion
- ACEP v NAEMSP diversion criteria recommendations reflect different focus of the groups. ACEP more accepting of broader criteria
- Proximity effect of diversion: when one hospital diverts, nearby hospitals get more patients
- System-wide solutions to diversion: data tracking, multi-stakeholder forums to align community priorities, system-wide policies/rules re: diversion suspension
- EMS medical director is key player in helping to design diversion policies and direct success of these policies

**Take Home Messages:**
Diversion is used to increase pt safety and reduce wait times of EMS
Potential for goals of EMS and hospitals to be at odds
Multi-factorial, multi-stakeholder involvement key to aligning priorities

Chapter 52 Public Health

- EMS Agenda for the Future: EMS is the intersection of public safety, public health, health care systems
- Merging of fields: hurricane response, World Trade, avian influenza
- Public health relies on epidemiology to help organize the information through describing the occurrence, distribution, and control of disease in a population
- Bioterrorism syndromic surveillance
- Examples: SARS, immunizations, pandemic influenza
- Fire and police departments already work with prevention, EMS is a natural partner

**Take Home Messages:**
EMS providers are in an exclusive position to directly impact a community's health

Chapter 53 Injury Prevention

- Unintentional injuries leading cause of death age 1-44

- Injuries account for 1/3 of EMS transfers
- EMTs are appropriately qualified for injury prevention, they are directly exposed to the victim and location where the injury occurs
- Scene level intervention: counseling, CO detector, secure loose rug
- Analysis of computerized EMS data for community prevention programs
- Education: advising low salt to CHF patients before holidays
- Epidemiological triangle: host, agent, environment
- Haddon matrix-for each (host, agent, environment) evaluate pre-event, event, post-event
- Three E's of Intervention: Education (easiest, poor compliance), Enforcement (law support, punitive measures), Engineering (built into equipment, no active participation)
- Fire services focus on prevention, smoke detectors, stop drop and roll
- Example: preventing submersion injuries in Florida by home pool checks, education
- One survey showed 70% of EMS professionals believe that primary injury prevention should be a core mission of EMS systems, but only 33% routinely do it
- In 2002, NHTSA developed a program entitled Public Information, Education, and Relations for EMS Injury Prevention Modules (PIER) as a training guide to EMS providers to injury prevention knowledge and skills

**Take Home Messages:**

- The engine that will eventually empower EMS to become primary injury prevention leader will be economic
- Are EMS agencies too busy providing acute care to worry about prevention?

Chapter 54: Pediatrics Issues

- Children account for 5 to 10% of EMS patients (average PM has little peds experience; skills are hard to maintain). 4% of Emergency Department patients less than 14 years old use EMS to get to the ED (vs. 40% of patients over age 75). Training programs for EMS providers lack clinical content for evaluating pediatric patients (not so in CA which requires CoAEMSP accreditation, which requires pediatric clinical experience--pediatrics is now a part of the Department of Transportation curriculum). Trauma, especially preventable injury "the" leading public health problem for kids. The US has 2x the rate of these injuries than other industrialized countries. Pediatric tertiary prevention mentioned: EMS care and prevention of further injury incidents. EMS for Children (EMSC) program a part of EMS--funded in 1985; in 1993 had $10 Million. EMS is effective for peds in near drowning and foreign body aspiration--everything else unproven. Prevention and EMS access training for parents is important. Emergency Department Approved for Pediatrics program in CA touted as a success (!) Peds critical care systems only improved outcome in trauma patients. PALS (AHA), PEPP (American Academy of Pediatrics), and PEC (NAEMT) courses are modular standardize peds curricula. Long transports--call helicopter, not ground BLS (evidence?). Equipment: ACEP has a list, 48 states have minimum equipment list for peds. Controversies:
- Regionalization: all hospitals need baseline peds competence; specialized IFT teams (MD's + RN's with peds specialization) recommended for specialty centers
- Triage scores: pediatric trauma score vs. revised trauma score
- Airway: waffle on Peds ETI vs. BLS airway management
- Ventricular tachydysrhythmias: 20% of peds cardiac arrest cases: adaption of AED's for peds important (commotio cordis in young athletes mentioned)
- Safe transport: use child safety seats in ambulance
- Lack of pediatrics guidelines for disasters
- Legal issues: AMA's by parents (EMS providers should be able to over-rule) and abuse reporting
- Presumption of death--should EMS resuscitate everyone?
- Patient safety for peds--a big unknown at this time

**Take Home Message:** Evaluate Peds rescue airway. Need Peds disaster triage exercise

## Volume 3
## Evaluating and Improving Quality in EMS

Chapter 1: Quality in Perspective

- The shift in EMS from QA to CQI requires a clear definition of quality and dimensions
- AMA: "Quality of care is defined as the degree to which care services influence the probability of optimal patient outcome"
- How do we define quality, by the process or the outcome? By the customers, providers, or regulators?
- Donabedian's QA model: 1) structure-attributes of the setting in which the care is provided 2) process-what is actually done when giving or receiving care including patients and practitioners activities 3) outcome-effects of care on the health status of the patient and the population **patient satisfaction and changes in knowledge/behavior are included in broad definition of health-status outcome
- Joint Commission on Accreditation of Healthcare Organizations (JCAHO)=primary federally sanctioned health care QA organization for decades
- QA vs. CQI: quality can never be assured but it can be improved
- CQI emphasizes the processes involved in the provision of care rather than specifically reviewing care rendered by the individual
- Establishment of CQI goals must be established through a reasonable process and are best implement. Once the goals are established and acceptable thresholds set, performance should be measured.
- Data systems collection must be accurate "garbage in, garbage out"
- Deming principle of high quality: high quality is cost effective
- Quality EMS systems have developed from inspired leadership of physician medical directors and advisors

**Take Home Messages**: Need to "prove" the effectiveness of EMS interventions with respect to outcomes, key role of leadership, consensus from all participants on goals of system

Chapter 2: A Historical Review of Quality Concepts and Methods

- Ernest Codman "End Result System of Hospital Standardization" which was a proposal to track patient outcomes and identify attending and poor outcomes-originally viewed as antagonistic then adopted as founding objective of ACS
- ISO=International Organization for Standardization, technical standards
- Baldrige National Quality Program=internal organization self-assessment, performance improvement
- "Six Sigma"=the 0.27% that falls outside three standard deviations on each side of the true population mean, less than ¼ of a percent but 1/370 which is still important. System of pursuing quality solutions.
- Sequence of steps: define, measure, analyze, improve, control

**Take Home Messages**: QI process in EMS is in adolescence, six sigma first organized system of QI used with documented success in both the hospital and industrial sectors of the US

Chapter 3: Reconciling the pursuit of excellence: essentials of a quality EMS organization

- Quality organizations: strong and visionary leadership, knowing and meeting needs of customers, plan for future yet expect change
- EMS is similar to other industries that focus on quality. Manufacturing: reducing variability in product reduces defects and reduces production costs. Hospitality service: customer service attributes. High Reliability Organizations: failure leads to catastrophic consequences. Role of organizational culture: management maintains successful culture producing better outcomes, management culture is 'perhaps the single most influential predictor of a quality EMS organization. Robin Hood the Archer: accurate and precise tasks, 'serve above else'=interdependence of characteristics

**Take Home Messages**: Organizational culture and infrastructure must be in place in order to focus on structure, process, and outcomes measures of quality

Chapter 4: Data A-Z

- Essential to have data collection systems before starting any QI
- Need for timely, accurate, standardized measurement of EMS patient care and service delivery
- 1973 EMS Enactment: defined 15 components of an EMS system, required documentation of services in patient care record and formal review/eval process
- 1991 AHA published Utstein Style resuscitation data form, first major document to specifically address EMS systems and performance with respect to patient outcome, provides standardized approach across systems
- 1993 DOT NHTSA defined uniform prehospital data set, created standard definitions
- 1996 EMS Agenda for the Future-identified recommendations to improve information systems and to collaborate with other health care organizations to improve care
- National EMS Information System (NEMSIS): local->state->national database
- Other registries: National Trauma Databank (NTB), Crash Outcomes Data Evaluation System (CODES), hospital and ED databases, medical examiner
- Part of the challenge of implementing and EMS information system is the variability between systems and the unique system stressors each one faces-urban vs rural, $
- EMS information systems should be strategic and clearly defined
- Components of an EMS IS: predetermined purpose, user friendly, clearly defined data set definitions, appropriate hardware and software, reports that are quality and timely, connectivity balanced with security, administration and support
- Data integrity should have high quality and validity
- Linkage=electronic connection of databases or sources of information

**Take Home Messages**: need good leadership and good data

Chapter 5: Using Data in Quality Management

- Data necessary for effective decision making. Poor analysis>> lousy decisions
- Common problem in "quality management" is relying on individual bad outcomes or statistically unsound conclusions about "average" performance
- Structure+Processes è Outcomes. Need to examine all three phases of performance to assess gaps and areas for improvement
- Two types of variation in performance
  - "Special cause" variation – more rare occurrence, account for significant outlier in performance (eg. Switched brand of laryngoscope blades one month and ETI success dropped)
  - "Routine Cause" variation – common or inherent variation. Goal is to minimize or improve this level of variation, but need to assess entire process, inputs and outputs
- Statistical analysis: parametric v analytical studies
  - Analytical methods: take time sequence into consideration. Therefore can help identify special cause v common cause variation (see Fig 5.3 sim to First Watch reporting)
  - Control charts –set median as well as upper and lower limit of variation (set at 3 std). Point is to catch areas below lower limit
- Process Improvement Methods and Tools
- Seeking to identify and improve cause of common cause variation
- Process Diagram/Maps = Can help identify existing educational, operational or material gaps in existing process and incr safety
- Causes and Effects Diagram = visualize and stratify potential common causes of variation, then serve as model to evaluate individual processes (e.g. for ETI examples include lack of recent airway, suction failure, blade failure, difficult airway> then use this model to "code" individual complications)
- Pareto Analysis: Use categories developed in C/E Diagram to enumerate cause of error/variation, to better understand distribution of most common cause of error. Edict: "80% problems arise from 20% of causes"

- Control Charts –Process for how to calculate median, upper and lower limits
- Analysis of the means (p-charts): method for understanding differences in performance between two providers with different total attempts—helps you calculate the variation range for each (lower number of attempts, the wider the range and therefore less reliable conclusions to be drawn). See Table 5.6, Fig 5.9
- Matrix of Adverse Events: Another graphic illustration of events in attempt to categorize factors associated with increased adverse events
- Main Points: How to approach QI/PI with basic tools for understanding process improvement and implementing effective analysis. Underscores importance of well trained and dedicated personnel in QI/PI roles.

**Take Home Messages**: Important to have well trained and dedicated personnel in CQI/PI roles

Chapter 6: Quality – Art and Science

- Stepping away from the "technical tools" of CQI, and providing framework and exercises for understanding and defining quality individually and within an organization
- Organizational Development (defn): "A planned and sustainable process of change that focuses on human interaction, values, and beliefs and aims to self-create organizational or system solutions."
- Creating a quality culture: promoting quality from the "top" (not tucking the QI person low in the org chart), tackling issues of fear, small tests of change, define small scale goal and test skills of organization in tackling it, encourage inquisitiveness
- Group basics: Small group work, Flip Chart Paper, Reflection
- Sharing perspectives: Storytelling to support data for change, to engage individuals in process of improvement, to generate ideas
- Idea Generating Techniques: Brainstorming, Affinity Grouping, Multivoting, Nominal group technique
- Small to Large Group Methods:
    - World Café:
        - Guidelines
        - Logistics
        - Participants
        - Process
    - Appreciative inquiry
        - Discover
        - Dream
        - Design
        - Destiny
- Larger Group Methods
    - Open space technology
    - Future search

**Take Home Messages**: Many conceptual and facilitative tools to promote culture of positive change and CQI. EMS medical director and administrator, in addition to defining metrics, must choose small tests of change to test process of quality improvement within a system prior to larger scale overhaul.

Chapter 7: EMS Quality Improvement and the Law

- Two main legal issues presented by performing QI activities:
    - Confidentiality
    - Liability
- Approach to Confidentiality
    - Reasons for confidentiality: protect integrity of QI process, encourage candid engagement and review, separate systems issues from individual
    - Public "opposition" to confidentiality-desire for transparent process and appropriate access to info about quality of care

  - Understand existing confidentiality statutes in your practices area: (who conducts protected QI (single person, single agency, multiple agency)? what is the extent of confidentiality protections? “absolute v privilege that can be waived?”)
- Practical Steps to Enhance Confidentiality
  - What are the defined elements of QI?
  - By whom is QI data collected? (method of data collection and discovery; What are written policies of QI body?)
  - How are records maintained and distributed? (markings “confidential/peer review”; distribution in advance v on site, collect all copies of QI materials at end of meetings)
- Types of Potential Liability
  - Defamation
  - Antitrust claim/Tortuous interference
  - Claim on part of patient that QI was performed negligently
- Immunity Statutes: Persons covered (members of QI committee, investigators on behalf of committee, etc)’ Prerequisites to immunity (no malice, good faith that action was warranted); Types of claims protected against (monetary damages only, civil claims, all civil and criminal)
- Common Law Protection: beyond statutes, general principles that guide protection including “communication made in “good faith” and without monetary gain on pat of any member of QI. Common law privledges depend on facts of each case
- Practical Steps to Reduce Risk Of Liability: Follow QI body’s bylaws and procedures, Do not permit QI process to be misused (avoid conflicts of interests or perceptions of conflicts of interest), Preserve confidentiality of QI records.

**Take Home Messages**: Confidentiality and Liability = main concerns. Know local statutes; create and follow clear guidelines for QI process.

Chapter 8: Performance Measurement in EMS

- Increasing need for data-driven evaluations across healthcare industry in order to provide adequate consumer information
- EMS systems often need to justify expenditures to state/local governments and can use commonly quality standards and performance data to drive arguments
- A performance measurement instrument is necessary to
  - Allow provider organizations to determine where they are and establish a baseline performance level according to indicators
  - Establish goals based on current performance
  - Determine the gap between desired goals and current performance levels
  - Track progress toward achieving goals
  - Benchmark and compare performance between types of system providers
  - Monitor performance for control in certain boundaries
  - Identify problems and causes
  - Plan for the future
- No universally accepted indicators for quality performance in EMS. However, now developing a standardized lexicon of data elements necessary to facilitate EMS system performance measurement and improvement
- EMS System design and measurement—need to focus more on systems issues rather than individual error.
- Donebadian concept of error> Systems should be designed with the assumption that humans make errors and try to eliminate opportunities for these errors
- Framework evaluating Medical Care: Definitions of Structure, Processes and Outcomes by Donabedian
  - Structure: characteristics of providers, tools, resources at disposal
  - Process: set of activities that go on between providers and patients
  - Outcome: changes in health status of patient in terms of physical, social, and psychological functions that can be attributed to receipt of healthcare care (not just survival, time, but also satisfaction and changes in knowledge or behaviors)
- Measuring EMS systems performance using appropriate indicators is expected to

  - Provide continuous measurement of quality in the system
  - Identify areas of excellence
  - Highlight sentinel events
  - Verify effectiveness of a corrective action
  - Allow comparison to established standards
- Development of Measures (in part overseen by JCAHO, Research and other regulatory bodies)
- Field testing measurement Instruments—Agree on processes used to evaluate each measure—gave example of President's Health Care Quality Commission criteria (scientific soundness, importance of the quality concerned, relevance to users, potential to foster improvements, evidence based, interpretability, actionability, feasibility, ease/cost-effectiveness)
- JCAHO and State efforts at EMS performance measurements—many different PI/measuring entities several shared values criteria
- Chart at back of chapter goes through commonly accepted performance measures and if there is established standard by a national agency—very useful to see (ex: response times versus system user opinion/satisfaction)

**Take Home Messages**: Multi-faceted approach to performance measurement. Guiding principles of measurement helpful. Knowing national or state guidelines and requirements important. Need to assess integrity of data pre and post collection

Chapter 9: Performance Indicators (PI)

- Focus on technical skills in the design, implementation, analysis, and communication of performance indicators and their results
- Performance indicators: tell us how well and how efficiently our processes are performing
- Health care uses the: structure->process->outcome method but does not address cost efficiency
- Quality indicators reflect how well a process meets the needs of those who use or depend on the output of that process. Ex) survival rates, satisfaction scores
- Value quotient=quality/cost
- Everyone wants the highest quality at the lowest cost
- Important to balance high costs in numerator to improve value and cutting costs in denominator to increase value
- Process path=relationship between macro process, subprocess, customer, PI
- Open Source EMS Initiative (OSEMSI)=standardized performance indicator formatting
- For infrequent event indicators, calculate rate less frequently or use predefined number of most recent cases (in the last 25 crichs . . .)
- Reporting formats: trend or statistical process control chart reports, dashboards, comparative analysis reports
- National EMS Performance Measures Project indicator set-items that are either indicators or attributes to make comparisons between EMS systems
- Barriers to widespread utilization of PI: what are agreed definitions, time and effort needed for data collection, need to form comparative analysis.

**Take Home Messages**: regulatory agencies and payer incentives may be the ultimate driver in standardization and implementation of performance indicators, current trend into pay for performance

Chapter 10: Reducing Adverse Events in EMS

- 1999 IOM report: "To Err is Human" brought to light medical errors
- Health care should be safe, effective, patient-centered, timely, efficient, equitable
- Adverse event=injury caused by medical management rather than the underlying condition of the patient
- Minimal EMS data on adverse events, errors can occur in any stepof EMS care
- Error=failure of a planned action to be completed as intended or use of a wrong plan to achieve an aim

- Errors are inevitable and culture must be changed to eliminate current disincentive to reporting errors, near misses, and adverse events
- EMS providers must have three areas of expertise: procedural, cognitive, affective, but the high emotional stress of EMS makes it happen in a compressed time frame
- To understand the nature of error in EMS, must have event reporting systems-example is FAA near miss error reports
- Important to have immunity from punitive action toward the reporter, in medicine and EMS this will be a major culture change
- Goal of a root cause analysis (RCA) is to find out what happened, why it happened, and what can be done to prevent in the future. Performed for adverse events, near misses, sentinel events
- Systems approach in patient safety=design devices/systems that minimize error
- If someone administers narcan instead of epinephrine the response is not to educate or fire the EMS provider, it is to change the markings so the ampules look less similar
- What are the high-risk areas in EMS? 911 calls and EMS dispatch (interval data, pre-arrival instructions), medication errors (miscalculation of drug dosage or wrong drug), EMS access (delayed 911 access with not closest wireless PSAP access), ambulance crashes (hazardous, although downward trend), operator fatigue (affects traffic incidents and clinical care), airway management (incidence of out-of-hospital unrecognized misplaced ET tubes is high), hyperventilation during CPR (more likely with BVM), hypoglycemia (repeat hypoglycemia episodes less likely within 48 hours), refusal of transport and nontransport (should be conservative although no higher risk of death), diagnosis of AMI (appropriate interpretation and transport to PCI center), hospital diversion (potential to result in harm if transport delayed), data and EMS errors (national data set for errors)

**Take Home Messages**: Focus on patient safety and eliminating errors in EMS is important

Chapter 11: Traditional Benchmarking in EMS

- Benchmark=standard or point of reference in measuring or judging quality, value
- Standardization in the marketing process lead to increased efficiency
- Processes on accreditation to regulate compliance, ensure consistency on level of care
- Descriptive statistics allow each organization to compare themselves against others
- Best practices benchmarking=process of performance measurement, comparison, and analysis to a much higher level
- How to benchmark? First understand the company mission and goal, who are you and who do you serve? Identify and understand customers' needs. Establish common company and industry standards of performance. Identify star performers in EMS industry or divergent industries that have similar core functions
- Should a patient follow up survey be part of an EMS QI System?
- What to benchmark? Response times, ETI success, timeliness of cardiac treatment
- "High performance EMS systems": systems organized using public utility model. Benchmarks=unit/hour utilization, expenditures/capita, mean response time standards, cost/transport, cost/unit hour
- Three pitfalls=incomplete analysis of internal organizational functions, continued diversity in operational and clinical standards, unwillingness of organizations to share performance measures and best practices due to market pressures

**Take Home Messages**: standard benchmarking=best practices identified and disseminated, need common performance standards for apples to apples comparison, key is complete and accurate needs assessment of organization and customers. Less benchmarking in peds/trauma as less volume.

Chapter 12: Clinical Benchmarking in EMS

In order to measure performance, you need to have well established benchmarks. Benchmarks should be set by well organized research outcomes, and not by expert opinion alone. Since EMS research is still evolving, there is limited evidence for setting benchmarks in many areas of

prehospital care. This chapter discusses what exists, roughly divided into two categories, and summarized well in Table 12.1

Process of Care Benchmarks:

Acute Myocardial Infarction: Time to 12-lead, time to arrival at stemi center, time from hospital arrival to reperfusion

- Acute Stroke: Time to arrival at hospital that can provide definitive care, time to physician, CT scan and thrombolytic
- Trauma: On scene time less than 10 minutes for significantly injured trauma patients or with potential for significant injury, Compliance with trauma triage protocol at least 90%, overtriage and undertriage rates
- Endotracheal Intubation: intubation success rate (adjusted for patient status, use of paralytic agents, intubation method)

Outcomes Benchmarks:

- Cardiac arrest: use of standardized reporting mechanism (ie. Utstein template), population based incidence of survival, time from collapse to arrival of first defibrillator-capable EMS unit, cardiac arrest after EMS arrival
- Pain management: Routine pain assessment for all patients with pain, measurement of pain relief through documentation of change in pain scoring, administration of analgesia for patients in pain where potential side effects of medications will not adversely affect patient status (hypotension etc)

Key Points: Difficult to set national standards/benchmarks without sufficient data. Systems should focus on using benchmarks that have evidence to support them. The high impact conditions and procedures have been the most studied (Trauma, AMI, stroke, intubation).

**Take Home Messages**: Need to constantly update benchmarks

Chapter 13: Priorities in Developing a QI Program in EMS

- A QI program for a system is not just a list of metrics to evaluate or tasks to improve. Instead it must take into account the process of data collection as well as change management. This means understanding the existing system, policies, protocols, and participants.
- It's important to lay a strong foundation of understanding the components of the system including regulatory requirements and structure, political reach, participant profiles. Only after the system profile is complete, can you conduct a needs assessment for improvement.
- Once settling on metrics to track, be careful about inference/ causation statements. Associations found in data could be due to confounding factors.
- Quantitative analysis--start with benchmarks national or local for high impact areas. Sometimes system factors or experiences can drive QI activities (such as complaints). If seeking performance measures that will reflect performance of multiple agencies within the system, start small.
- Data reporting: define structure, define form data will take, define terms and metrics
- Table 13.2 very helpful as overview of potential quality activies and their definitions, methods of analysis etc.

**Take Home Messages**: step-wise approach to QI

Chapter 14: Preshospital Research: The Basics

EMS cannot do component research but must do systems research, drawing from the fields of engineering, public administration and social sciences. Why do EMS research? 1. better understanding of the area being studied, 2. foster expertise for the researchers/make EMS a better practice of medicine, 3. foster understanding of the scientific method among EMS providers, and 4. improve teamwork. Start the research by asking a clear, focused, simple question that passess the "so what" test. Next, decide if a hypothesis is warranted (not used in some observational research, such as OPALS trial looking at the effect of introducing ALS); the hypothesis is a simple declarative statement to be proved or disproved. The null hypothesis states there is no difference between two groups; the alternate hypothesis states that this is a difference between two groups. Review the current literature to determine if the question is appropriate and important. Perform a computer search of at least 2 databases (MEDLINE and

CINAHL are recommended). To select a study design, the researchers should ask the following questions:

1. Can they follow the participants over time?
2. Intervene vs. observe the participants?
3. Can they look at events that have already occurred or as they occur?

- The answer to the first question will point to a cross-sectional (one point in time) or a longitudinal (hard for EMS) study. The second question will determine observational vs. interventional study, and the third prospective vs. retrospective. In general, longitudinal, interventional and prospective studies are more useful in determining causation but are often preceded by other study designs of the same topic.
- Descriptive studies can be used to formulate hypotheses for other studies. Correlational studies can be useful but are subject to the ecologic fallacy; where patients experiencing the effect being studied (e.g. improved survival rates from traumatic injury in war) actually received the described beneficial treatment (e.g. faster air medical evacuation in recent conflicts). Case studies and case reports study individuals and can be used for education on the clinical scenario and hypothesis formulation for cause and effect. Another common design is the cross-sectional, or prevalence study which is frequently utilizes questionnaires--they are fast and inexpensive to conduct but do not establish causal relationships and are usually followed by further studies.
- Observational studies can be case-control (defined by their outcome) or cohort (defined by their exposure). Case-control studies are usually retrospective and useful for rare outcomes; however care must be taken to select the hypothesis before collecting the data, and to avoid sampling and measurement bias. Temporal sequence may also be difficult to determine. Cohort studies are usually prospective and temporal sequence is easy to observe; they are most useful for rare exposures with short latency periods. A before-after study design can also be observational as long as the researchers are not involved in implementing a change being studied.
- Experimental, or clinical, studies are similar to cohort observational studies except that participants are assigned the exposure status in an experimental design. Participants are usually assigned their exposure randomly (single blind--subject does not know which treatment received, double blind--subject and outcome assessor don't know, triple blind--subject, outcome assessor and care provider don't know). Randomization only ethical if the experimenter has clinical equipoise and is not sure which of the studied treatments is better; placebos only utilized where there is no accepted standard of care for the experimental treatment. Cross-over designs where each participant serves as their own controls may reduce bias error.

**Take Home Messages**: Every study needs a good start: question, hypothesis and literature search.

<u>Chapter 15 Statistical Methods</u>

- Effect size must be determined prior to selection of the statistical instrument
- p value is the probability that the null hypothesis is true; we try to prove that the null hypothesis (that there is no difference) false, rather than that the alternate hypothesis is true.
- Type 1 error-false positive-conclusion: there is a difference between 2 groups found but none exists. Risk is the p value, 0.05 by medical convention = alpha
- Type 2 error-false negative-conclusion: there is no difference between 2 groups found but one exists. Power of a trial is the chance of detecting a difference if one exists, usually aim for 0.80 to 0.95. Beta = (1-power) = risk of committing a Type 2 error
- Alpha (level of significance), power, magnitude of treatment effect all determine sample size. Choosing effect size is a clinical decision; the smaller the treatment effect, the larger the sample size needed.
- Statistical tests:
  - Differ according to the data to be tested: numical vs. categorical (measures of qualitative characteristics)

  - Best to use non-parametric methods if any doubt as to the underlying distribution of the data, e.g. Chi square test with null hypothesis no association between treatment and outcome. Parametric tests include student's t-test and one-way a nova.
- Confidence intervals-how precisely did this trial determine the true treatment difference.
- Point estimate-what is the size of the treatment diffence?
- p value-is there a statistically significant difference between the two treatments?
- Negative trials whose results are still c/w a clinically important difference usually occur because the sample size is too small resulting in inadequate power to detect a clinically treatment important difference.
- "Testwise risk" (Bonferroni correction) = alpha (0.05)/# of statistical tests performed, decreasing the type 1 error risk results in increasing the type 2 error risk (controversial)
- Consider interim data analyses but must be planned in advance as it is a type of multi variate comparison
- To use sub group analyses a priori identification of meaningful and properly defined subgroups must be done, limit the number and plan the sample size accordingly.
- Intention-to-treat analysis: patients are considered to be members of the treatment group to which they were originally assigned, regardless of whether the appropriate treatment was administered. Controls for efficacy and ability to administer treatments.
- Multivariate analysis: multi-variable logistic regression. What it shows: quantify the separate effect of each independent (predictor) variable on the dependent variable of interest. Multivariate logistic regression: hold all other variables constant to study the effect of the independent variable of interest on the outcome. Odds ratios are calculated for each predictor variable.
- Handling missing data: important to provide a plan prior to initiating the research project. The goal is for the missing data to be independent of both observed and unobserved variables "missing completely and at random".
- The benefit of interim analyses is for clinical conditions with significant morbidity or mortality.

**Take Home Messages:** none

Chapter 16: Protection of Human Subjects in Prehospital Research

Numremberg Code: post WWII statement of ethical standards for human research
Belmont report 1979 in US-respect for persons, beneficence and justice, the basis of all federal research regulations.

- Persons: 1. informed free choice to participate in research, 2. additional protection for those with diminished autonomy, e.g. Prisoners, kids, pregnant women, those with mental disorders
- Beneficence: risk/benefit ratio-minimize individual risks (including financial) while maximizing societal benefits
- Justice: risks not exclusive to the subject population, benefits not exclusive to another (e.g. Tuskegee syphilis study)
- Federal regulations provide 3 levels of protection: Federal (Institutional Assurance of compliance), institutional (IRB review) and investigator (informed consent). Federal Wide Assurance-for all the institution's studies, can be put at risk by any one study being out of compliance.
- Prehospital studies must determine which IRBs in a system have jurisdiction-usually one primary IRB and others are affiliated IRBs. Communicate with IRB support staff member before submitting.
- Various problems with having prehospital providers obtain consent: they may feel it will slow patient care down too much, or patients may feel that they will anger prehospital providers if they refuse
- Waivers are obtained if: no more than minimal risk of harm (medical and confidentiality), observational study with de-identified data, obtaining informed consent is not practicable. Waivers are granted by the IRB, not the investigator.

**Take Home Messages:** strict adherence to IRB process a must

Chapter 17: Exception from Informed Consent in Emergency Research: The EMS Perspective

- In 1993 there were a series of research misconduct incidents. Prior to this retrospective consent was obtained for resuscitation research from family members of patients. FDA halted Resus research for 4 years, then in 1996 released the Final Rule for prospective research in emergency situations.
- Conditions listed in Table 17.1 for Exception From Informed Consent include:
  - Life threatening situation exists
  - Available treatments are of unproven efficacy
  - Consent is not feasible due to the patient's condition
  - Treatment must begin before consent can be obtained from subject's legally authorized representative
  - No reasonable way to pre-identify subjects
  - Risks and benefits of the study are reasonable
- There is a requirement for community consultation and public disclosure-prior to first subject enrollment
  - Most investigators use town hall meetings
  - Some use population-based phone surveys
  - Public disclosure includes both in advance of, and at conclusion of the study (use press releases, classified ads)
- Include the cost of consultation and disclosure in study planning.

**Take Home Messages:** More difficult in some respects than obtaining consent

Chapter 18: Implementation of of Research in the Out-of-Hospital Setting

- Overall very important to integrate study into existing EMS practice within a system. A study should not radically redesign delivery of care practices
- Design of study should take into account existing system and practices with someone from the system involved in design phase. Need to engage providers for buy-in at early phase as well. Pilot study useful in testing design and feasibility
- Training prehospital providers: first decision= mandating training for all providers or only use those who voluntarily participate. Several problems/limitations to using only volunteers: selection bias and lower enrollment. Expensive and time consuming to train all but can take advantage of pre-existing meetings, trainings, etc.
- Maintaining provider participation: Need to constantly monitor participation, compliance with study protocol, enrollment, outcomes, and remember to “praise providers for enrolling patients and following protocol as well as informing them of protocol violations or problems
- Data collection: Outside Observer : If collecting prospectively, advantage to outside observer is that they are not distracted by patient care requirements. Better real-time data about protocll compliance as well. Disadvantages= cost
- Data Collection: Out-of-Hospital Provider: For “retrospective collection, the only choice, but also the most cost-effective for prospective studies. Disadvantages include: “distraction” by patient care, leading to incomplete data entry, especially if adding a separate data form to the medical record reduces likelihood of accurate or complete data collection given other clinical concerns. Electronic PCRs have helped collection and search processes. There is variation in PCRs from state to state, which could make using the pcr difficult for multi-system study. Computerized documentation does have advantage for large amounts of data collection facilitating larger complex databases. “Forced entry” is mechanism to ensure completeness-- can modify a field on a chat where the paramedic cannot complete/submit the form without entering a field.
- Linking field data with Outcome or Other Sources: Ideally prehospital studies will look at ultimate outcomes. HIPPA can be an issue with sharing data so all receiving hospitals must be part of study if outcomes to be used
- Key considerations for the EMS Agency: Must determine level of involvement in wants to have in research. Analysis of risks and benefits to patients and system. Potential benefits: training for prehospital providers, potential for more effective patient care, funding sources. Risks: burden of study admin conflicting with patient care, costs associated with training or study operations/ qi, bad publicity if bad outcome

- Key considerations for the Medical Director: If participating in a larger scale study, the medical director's role must be clearly defined (ie. simply approving the study versus a co-investigator). Must consider all aspects and possible effects on patient care, operations, or any political issues from the study.

**Take Home Messages**: Multiple factors to consider when engaging in prehospital research. Most importanly risk/benefits to patients and clinical care, but several operational, strategic issues as well.

Chapter 19: Essential Resources for Research: Mentors, Funding and Research Tools:

- Mentors very helpful to a researcher. come in variety of shapes, sizes, disciplines. Many definitions including: higher career level as well as expertise in particular field or research method. Help to develop ideas, form strategies, trouble-shoot problems
  - Many benefits from mentor/protege relationship for both parties.
  - Good mentor/protege relationships: mentors trust and respect their protege's demonstrate loyalty, directness, honesty, consistency, trong work ethic, desire to be a mentor. proteges have eagerness to learn, ability to learn from feedback, shared excitement in the work and willness to work hard.
- Statistical Support: should be inclued in all aspects of any serious research project including planning, execution analysis.
- Advanced Degrees/Training: Advanced degrees may be useful in fields such as pub health, epidemiology, biostats. Advanced training should be sought with a goal in mind
- Funding: funding is now increasingly available for EMS research. Researcher must identify a specific area of interest and find grants for that area. A previously unfunded researcher should not expect to get a large grant-- need to demonstrate success with previous grants and then move to larger/national grants.
- Collaborative Research: Interdisciplinary or interagency collaboration be very beneficial to advancing the science of EMS

**Take Home Messages**: Overview of key ingredients to research program--mentorship program, statistical support, advanced degree when appropriate, funding opportunities, and collaborative research.

Chapter 20: Writing for Publication in Biomedical Journals

- While research is many times initially exciting, writing it up is the hardest part
- Who should be an author? Must be involved in one of the following tasks: conception and development of the idea, execution of the study, collection analysis and interpretation of the data, writing and revising of manuscript
- Important for the authors to have consensus on the message of the manuscript before writing, if results are not worthy of publication look to redesign question
- IRB approval must be in place before investigation, should mention in cover letter and methods section
- Choose the most appropriate journal in terms of audience
- For career development it is important to write up the manuscripts of the presented abstracts
- "The key to publication in peer-reviewed journals is to have something to say, say it as briefly as possible, and quit when you have said it"
- Review journal manuscript requirements in terms of style and format, citations
- Sections: abstract, introduction, methods, results, discussion
- Introduction: concise review of the pertinent literature and enable a reader that is not familiar with the subject to comprehend the nature of the problem and the context in which it is important, usually concludes with statement of study objective or hypothesis
- Methods: sufficiently detailed so the reader understands how it was carried out, include information about human subject approval and statistical methods
- Results: present in a logical sequence, don't repeat in text information that is in tables or figures
- Discussion: allows reader to understand how the results can be interpreted and put into perspective, say how your results support or contrast prior work. Start with statement of

principal findings, then strengths and weaknesses, limitations. Don't overstate conclusions, but can include speculation if it is clearly labeled
- Review process usually starts with editor and then sent out for peer review, can respond to comments and revise for publication

**Take Home Messages**: How to produce a better manuscript? 1. Carefully consider target audience and adhere to the journal's instructions for authors 2. Manuscript must describe a well-designed and conscientiously conducted study 3. Write to inform rather than to impress using clear and purposeful prose that is accurate and concise

Chapter 21: Conducting Randomized Trials in the Prehospital Setting
- Randomized control trials (RCTs) are gold standard for research but difficult in the prehospital setting
- Consortium groups like ROC formed to perform multi-center prehospital RCTs
- Power of RCTs is strongest evidence of causation, also minimize bias and account for confounding factors
- Clinical equipoise must be upheld, in which the researcher is confident enough of the treatment to give it to patients but unsure enough of the treatment to withhold it
- Randomization can be done by placing patients into one of two treatment arms or by web-based randomizer, also can use same medication bottles, envelopes
- Pseudorandomization=using day of month, persons birthdate or medical record #, mostly used if immediate life-saving treatment is needed such as CPR
- Studies should be blinded so the biases of the caregiver doesn't influence outcome
- If there is a proven, effective treatment for a disease the use of a placebo is unethical and so new intervention should be compared to existing
- Collaboration is important to have a team build a good question and work together to produce final research product depending on background and strength of each member
- Data and safety monitoring board (DSMB)=group with experience with disease and/or statisticians to review study and results as it progresses
- Clinical follow up after patient reaches ED is difficult, helps to have on-call researcher

**Take Home Messages**: RCTs are difficult but feasible in prehospital setting and gold standard

Chapter 22: Conducting Retrospective EMS Research
- Secondary analysis=use of existing data set to answer questions other than why the data was originally collected, usually retrospective review. Pro=simpler to do, saves time and money. Con=researcher has no control over what or how data collected
- More than half of current EMS studies are retrospective, subject to bias or 'systematic errors in collecting or interpreting the data'
- Important to form good question first and not start by analyzing data to formulate question
- Data can be aggregate-provided for groups of people or individual
- "Ecological fallacy"=look at aggregate data for mean response times and also cardiac arrest survival, can say that they are related but since don't know that short times caused improved survival
- Important to understand which data is included, excluded and how it is coded
- Data abstractors must understand exactly what researcher is looking for to compile proper set of data, blinding if possible, inter-rater reliability of more than one (kappa score)

**Take Home Messages**: retrospective studies are not less valuable than prospective studies, but need to control for bias as best as possible

Chapter 23: Evaluating the Effectiveness of EMS Systems, Utilizing Outcomes Research
Methods to Identify the Impact of Prehospital Care
- Outcomes research is important for reimbursement as needed interventions
- Clinical trials determine if an intervention is works in a clinical setting (efficacy) while outcomes research determines if an intervention works in the real world (effectiveness)
- Lack of evidence behind most EMS interventions
- Six 'D's of outcome category: death, disease, disability, destitution, dissatisfaction, discomfort

- Three factors determine patient outcomes=random events (chance), patient factors, treatment effectiveness
- Risk adjustment measures (RAM)=quantifiable or categorical variables associated with greater or lesser severity of the condition or have an association with patient outcome (BP, LOC, age, gender), used to account for patient differences so effect of treatment can be accurately determined
- "Dimensions of risk" or "range of risk factors'=patient characteristics (demographic characteristics, SES factors) and healthcare events (health behaviors) that influence outcome
- EMS Outcomes Project (EMSOP) recommended several core outcome measures for prehospital research (vital signs, level of consciousness, mortality)
- One challenge for EMS outcomes research is the establishment of robust databases
- Need for integrated approach between basic science, clinical, epidemiological, and systems research for collaboration and improvement across the board

**Take Home Messages**: Paucity of prehospital research, we need to get to work!!

Chapter 24: Conducting Prehospital Cost-Analysis Research

- Once effectiveness has been established, the next question is if is cost-effective?
- Few economic research studies in EMS
- EMS Cost Analysis Project (EMSCAP)=proposed methodology for determining cost of EMS intervention to the community it serves
- Conducting a full economic evaluation-costs/consequences of 2+ interventions compared
- Four types of cost analysis:

1. Charges vs. costs-measures effect of the outcome in dollars. Ex) Cost of EMS system is $8.3 million and outcome for providing EMS care is $44.3 million savings to community
   -> Cost=resources consumed to provide good or service
   -> Charge=cost plus any taxes or profit from providing goods or service
2. Cost-effective analysis-measures a common effect, such as lives saved between two interventions and report the result in terms of effect/unit cost
3. Cost-utility analysis-effect measured in quality adjusted life years
4. Cost-minimization analysis-compares two equivalent treatments and determines which one has lowest cost. Example: air vs ground transport for burn patients

- Cost of a given service can be very different depending on the perspective of who is paying. Societal perspective=broadest view of cost, community perspective.
- All health economic evaluations should be conducted from societal perspective, which means any cost analysis should account for all costs regardless of who pays them or when they occur and include downstream costs/savings
- Framework for EMS costs. Important to include HR, communications, vehicles and exclude taxes and adverse event costs
- Cost of EMS system is combination of cost of actual response and cost of readiness

**Take Home Messages**: Difficult to calculate EMS system costs but need to use societal perspective

Chapter 25: Cardiac Arrest Research Methodology

- Very low nationwide survival rates for OHCA, and wide variation by region
- Standardized methodology for data collection since 1990, growing in usage: Utstein style research
- Utstein Style Methodology: Uniform definitions of OHCA, treatment and outcomes
- Studies should include the following:
- Standardized exclusion criteria: obvious death at scene, DNR orders, age younger than 18
- Population descriptions including not just race, gender, setting, initial rhythm (PEA v VT/VF), EMS system configuration, EMS interval times, time to defib
- Data collection and reporting: "Chain of Survival" helps outline data elements to report: witnessed/unwitnessed, bystander cpr or not, initial rhythm, time to defib, ems arrival, rosc
- Use of recording devices may assist in accurate time recording, use of compression measurement devices may assist in quality cpr assessment

- Outcomes: ROSC, survival to hosp discharge, neurologic status on d/c (modified Rankin score), quality of life
- Outcome sources: EMS records, hospital records, coroner's office, pt/family or primary md interview, community or federal registries
- Cost analysis: Cost-benefit, cost-effectiveness, cost-utility analyses

**Take Home Messages**: Increasing efforts to standardize are important

Chapter 26: Trauma Research Methodology

- Research methodologies can be any type: retrospective, prospective, RTC, or even case studies
- Design issues: Clear methodology, EMS system type, availability of data collection
- Inclusion and Exclusion Criteria: define patient population being studied. less uniformity given wide range of trauma research. may include: demographic, setting urban/rural, trauma mechanism, physiologic factors (VS, GCS)
- Randomization and blinding: as discussed in prior chapter
- Delivery of Study intervention: "Add-on" intervention to basic protocols. Need training for providers and medical oversight of compliance
- Outcome measure selection: Need for standardize outcome such as ISS or ASCOT
- EMS system issues: variability in EMS providers ALS/BLS and destinations: trauma centers (different levels of designation or no trauma centers)
- Informed Consent: Retrospective not possible. Most prospective and RTC studies require exception from informed consent given time and severity critical nature of incident

**Take Home Messages**: Multi-factorial issues in effective trauma research design

Chapter 27: Role of Prehospital Providers in the Advancement of Public Health

EMS providers can play a role as public health surveillance personnel in communities--a common example is fall prevention programs for elderly in their home environments. Early detection and prompt action/referral fit well with the EMS mission. EMS providers may recognize "pre-disease" or "close call" issues and reduce future morbidity/mortality. EMS providers may have a rare "window of opportunity" to give effective prevention education, especially for injury patients. EMS plays a crucial role in disaster preparation and response, and its effectiveness in response must go beyond regular measurements e.g. response intervals, to successful triage. The use of EMS to triage patients to appropriate regional referral centers, such as trauma centers, is stressed. The role of EMS in public health research, supporting legislative activity is also crucial. The use of NEMSIS-compliant data bases, and the use of EMS providers in down time between calls for public health activities is advocated.

**Take Home Messages**: This sounds like the groundwork for community EMS

Chapter 28: Pediatric Prehospital Research

Barriers to conducting pediatric prehospital research (recruitment, community exception to informed consent, obtaining parental/guardian consent) means few studies include children, despite being 25% of US population and 5-10% of EMS calls. OPALS showed pediatric CA commonly due to trauma, SIDS and respiratory disease, few received CPR. New federally funded research initiatives include the Pediatric Emergency Care Applied Research Network (PECARN) and the Resuscitation Outcomes Consortium (ROC). Age stratification for analyzing data helpful (Infant up to 12 mos, Toddler 12 to 36 mos, Preschool 3 to 5 yrs, School 5 to 12 yrs, Adolescent 12 to 18 yrs). Small sample size in a single EMS system is problematic; consortiums encouraged using standardized data sets such at the Pediatric Utstein Style. A child's assent must be obtained if old enough to understand purpose of research, in addition to parental/guardian consent. Research priorities include provider pediatric assessment and treatment skill maintenance, off-label medication use effectiveness, management of respiratory disease. Lists of organizations with pediatric research goals and resources provided as appendix to the chapter.

**Take Home Messages**: Evaluate adequacy of pediatric CE in a system, and effectiveness of assessments and treatments.

## Volume 4
## Special Operations Medical Support

Chapter 1: ICS and NIMS

ICS: key to interface between EMS and public safety entities. ICS as the “anti-bureaucracy” (bureaucracy being marked by formalization, specialization and hierarchy), capable of handling unstable situations with potentially catastrophic outcomes. ICS as a highly reliable, virtual organization. NIMS is designed to coordinate multi-agency, multiple jurisdictional responses to large scale emergencies. ICS developed in the mid-70’s by Firefighting Resources of California Organized for Potential Emergencies (FIRESCOPE) to deal better with multi-jurisdictional wildland fires. ICS is modular and scalable. All responsibility for every aspect of response to an incident belongs to the Incident Commander until it is specifically delegated. Unity of command important (each team member reports to only one person). Span of control dictates that no one supervises more that 3 to 7 other persons. Job Action Sheets should be available to each command team member to use as a documentation and decision-making reference (for the first few hours of the incident--JB emphasis). Unified Command utilized when multiple agencies with multiple jurisdictions respond to an incident but this does not overrule the IC’s command role). Orderly transfer of command are needed when discrete phases of a response are completed. Sections are organizational levels with responsibility for a major functional area of the incident, e.g. logistics.Branches are used when the number of divisions or groups exceed the recommended span of control, e.g. EMS branch. Divisions are used to divide an incident geographically, e.g. West division. Groups are established to divide the incident management structure into functional areas of operation. Units are organizational elements that have functional responsibility for a specific activity, e.g. supply unit. Single resources are defined as an individual piece of equipment with its personnel components (e.g. ALS ambulance) while Task Forces are combinations of mixed resources with a common communications capability and a leader. A Strike Team is a set number of similar resources with common communication and a leader. It is important to adhere to principles of ICS to avoid supervisor info overload and ambiguous reporting relationships. Command staff include Safety, Public Information and Liaison Officers. Joint Information Centers are usually established in large incidents to coordinate the efforts of the responding agency’s PIOs. The typical ICS sections are Plans, Operations, Logistics and Finance. Training crucial for leadership positions: ICS 100, 200 and NIMS 700, 800 recommended in the National Response Framework.

**Take Home Messages:** none

Chapter 2: Prehospital Triage for Mass Casualties

Linear relationship between over-triage and poor patient outcome. 5 categories: immediate (red), delayed (yellow), minimal (green), dead (black) or expectant (no color given). Minimal category defined as patients who will need medical care but can tolerate an extended delay in treatment without increasing their risk of mortality. Triage systems: START/JumpSTART (most common in the US) sorts by ability ambulate, breathing, perfusion and mental status. MASS (move, assess, sort, send) does not specify the individual patient assessment. SALT (Sort, Assess, Life-saving interventions, Treatment and/or transport) endorsed by ACEP; initial life-saving rapid interventions include hemorrhage control, airway opening, chest decompression and auto-injector antidotes. SALT uses 5 triage categories, ID-MED, with Expectant patients being triaged with the color grey. Triage tags should be used; and retriage emphasized.

**Take Home Messages**: Evaluate SALT triage vs. JumpSTART triage

Chapter 3: Mass Gathering Medical Management

Sports events coverage since 1965 Univ. of Nebraska football games cardiac arrests and antiwar protest coverage since Vietnam war 1971. Public health awareness since 1984 LA Olympics heat injuries. Demand for medical services quantified per 1K spectators, and adverse weather, spectator intoxication, inadequate H20 + heat, contaminated food, violent spectators and competition stress. Rock concerts longer than 6 hours with mobile spectators (mosh pits and crowd surfing) associated with more medical calls. Patient Presentation rate (PPR) per 1,000 is a

common metric. Challenges of care at MG's are large, including coordination of multiple agencies, densely clustered populations and the potential for MCI. Medical Director with responsibility for all care given is a must to maintain the standard of care at the event found in the surrounding community. May not need to be on site for smaller events. Event negotiations include compensation for medical personnel and provision of appropriate equipment. Pre-event reconnaisance emphasized, including reviewing prior iterations of the event's medical records. EMT level of care at a minimum; special attention to cardiac arrest possibility as potential for survival is 85%. Use of protocols by prehospital providers encouraged. Frequency of demand for medical care per attendee decreases as size of event increases. MDs should be on site if transport limited or long, large # of spectators or high risk of injury activities. RN's most valuable at fixed facilities and with medications. EMTs most valuable in mobile roles. Equipment and medications should match facilities and levels of care provided, e.g. bedpans for fixed facilities. Fixed on-site facilities must meet fire and other applicable building codes, locations announced to event participants, and have provisions for security. Some prep work is recommended for off-site facilities. Intravenue patient transport resources are needed if tx facilities are more than a :05 walk with pedestrian transport, e.g. gurney or wheelchair. Extra venue patient transport should include non-ambulance vehicles. Heat relief and the provision of potable water intertwined; at least 1 source of free potable water for every 1.5K participants. Ecological considerations in response are important as well e.g. poison ivy dermatitis. Techniques for Effective Alcohol Management (TEAM) instituted at all major league baseball stadiums in 1993. Delineation of egress/ingress routes for both medical casualties and equipment resupply encouraged. Communications discussed at length; the crucial interface between 911 dispatch and event medical response important in avoiding double response or no response to 911 calls. For mobile events multiple ambulances likely needed, as well as a system status management plan to "stack" calls near to the end of the event. Having a strategy to deal with the physician intervener important. One or more Tactical Emergency Medical Support personnel may need to be assigned to VIPs. Small section of the chapter devoted to MCIs--the importance of having casualty collection areas addressed. Medical Action Plan needs to be completed at least 30 days prior to the event, and malpractice issues must be addressed. Prospective QI (training), Concurrent QI (event medical records) and Retrospective QI (reviewing certain types of patient encounters specific to the event e.g. bites in a wilderness event) are all a part of the CQI plan. Predictive models include review of the 3 domains (biomedical, environmental and psychosocial) and these can have + or - effects on the PPR but review of past iterations of the event is most helpful. Communications capabilities are emphasized at all levels of response and command.
**Take Home Messages**: Every event needs a medical director. Communications plans need to be robust.

Chapter 4: Medical Support of Civil Disorder Operations
Tactical medics are there to support law enforcement ops; the main difference between force care in protests and other tactical operations are the potential geographic dispersal of casualties and their being surrounded by potentially hostile individuals. Humanitarian aid to protesters and bystanders can be rendered, but they should be transferred to the EMS system asap. These missions generate a lower casualty rate than other law enforcement activities, but a higher absolute number of casualties. Bandaging, splinting and wound treatment supplies are the most valuable for the officers and tactical medics to carry with them in these ops. Gathering intelligence on the protest group history of injury events, and even their medical plans may be useful in preparation, e.g. providing protective equipment for officers potentially exposed to blood being thrown at them. Also, plan separate care locations for law enforcement personnel from protesters, and anticipate the need for prolonged medical care at a "stronghold" field facility, as protesters can disrupt ambulance transport. Consider treatment in a crowd to be a "hot zone", with only life-and-limb saving care rendered until the casualty can be evacuated to a warm zone. Train for specific threats such as "officer burning" drills, as well as trip wires and Caltrops (star nails, used to disable officers, vehicles and working animals).
**Take Home Messages:** Need to develop specific tactical medicine protocols for EMS providers

Chapter 5: Radiologic and Nuclear Response For Emerency Medical Personnel

Ionizing radiation has the ability to cause gross surface and sub-surface damage to the body, including the immune system, by removing electrons from atoms and breaking inter-atomic and molecular bonds. Background radiation is present in everyday life; radiation exposure to materials such as weaponized agents or medical isotope sources are dangerous because they overwhelm natural repair capability of our body. Probabilistic exposure results in longer term effects, such as increased rates of cancer. Alpha and beta rays have low penetration ability; gamma and neutrons have higher penetration. Radiation safety officers are good sources of information for EMS/disaster planners. Radiation resources include REACTS, and should be consulted for responses. Exposure is divided into Irradiation, contamination and internal exposure. Defenses include decreasing exposure time, increasing distance and employing shielding. These (stochastic) radiation effects are linearly cumulative; 5 mSV or rem (Reontgen Equivalent in Man) is the accepted baseline of exposure with acceptable risk. (Use of your co-worker as shielding recommended!) Decontamination is by mechanical removal (washing), and prevention of ingestion preferable to trying to remove internal contamination due to bioconcentration (e.g. of iodine by the thyroid), so respiratory protection vital. Effects of radiation detailed in a chart; take home points are the sensitivity of the absolute lymphocyte count (less than 500 in under 24 hours) and the rapid development of nausea/vomiting are associated with the LD50 of radiation exposure (in the 200-300 REM area).The more rapid development of symptoms and the presence of CNS symptoms are associated with high lethality--JB emphasis. Radiation contamination easy to detect but logistically difficult with large numbers of potential victims, most of which are likely to be “worried well”--encourage showering at home, placing clothes in a plastic bag and self-presenting for screening. In nuclear detonations, most energy dispersed in light, thermal and mechanical energy with 5% left for immediate ionizing radiation and 10% in fallout--immediate fallout in the 24 to 48 hour range is highly radioactive and best protected for by sheltering in place. Bone marrow suppression is maximum at about 30 days post exposure. An Electro Magnetic Pulse is also generated, which knocks out uninsulated electronic equipment. The 3 myths of radiation injury treatment: contaminated patients are a threat to providers, decontamination takes priority over treatment, and special skills are needed to treat radiation casualties. Most important component of self protection is to prevent internal contamination. Use of radiation treatments are time dependent and need to be stockpiled. The biggest danger is the medical surge of the “worried well”.

**Take Home Messages**: radiation training important, as is maintenance of some cache supplies and training with radiation detectors at the provider level.

Chapter 6: International Deployment

- Preparation prior to any deployment is paramount
- Valid passport, country specific visa, personal affairs should be done in advance
- Individual preparation: extra prescription medication, eyeglasses, dental care
- International assistance: NGO’s=Red Cross, UN, private volunteer organizations
- Important to understand local nation’s culture, customs, medical system
- Each responder organization collaborates with host nation to provide medical care
- Important to know deployment details-nature and scope of mission
- Logistical support is the single greatest determination of the success or failure of the mission
- Medical translation used as word-for-word interpreting is better than interpreting a local language and paraphrasing answers to questions, interpretation may not provide level of detail needed
- Infectious disease in refugee camps have high case mortality rates, diarrheal or respiratory illness
- Responder team protection: jet lag, endemic disease-malaria, temperature, altitude
- Post deployment after action review: assess response and identify effective practices

**Take Home Messages**: International missions can be rewarding if the proper precautions are taken

Chapter 7: Federal Medical Response to Disasters

- Most EMS responders don't deal with disaster situations on daily basis although some have drills
- Disaster: event where the community and regional resources are not adequate to meet the needs of the response
- Laws and policies empower other states and the federal govt to provide assistance and cooperate with each other following a disaster
- Local jurisdiction responsible for organizing and managing the emergency response
- "Disaster Response Wheel" federal response to a request for assistance following a domestic disaster
- Stafford Act: provides funding and resource allocation mechanism through FEMA
- National Response Framework, 2008: guides the nation's all-hazard response
- NPF=Core document (who, what, how), 3 sets of annexes (Emergency Support Function, Support, Incident), partner guides
- Emergency Support and Function 8: Public Health and Medical Services, HHS coordinates
- National Disaster Medical System/DMATs are part of ESF 8
- Emergency Management Assistance Contracts: if a state's resources are overwhelmed, governor declares state of emergency detailing needs through EMACs, temporary licensure recognition in other states
- Economy Act: authorizes one federal agency to request support of another
- Posse Comitatus Act: prohibits military from being directly involved in domestic law enforcement, does not apply to National Guard or Coast Guard
- Homeland Security Presidential Directive (HSPD-5): federal govt will assist state and local authorities when their resources are overwhelmed or federal interests involved, work together using NIMS
- HSPD 8: established policies to strengthen all-hazards preparedness capabilities of US

**Take Home Messages**: Many improvements in the last 10 years toward coordination of disaster response

Chapter 8: Military Support of Civilian Authorities

- Distinction between homeland defense (external threats) and homeland security (securing the homeland, internal)
- Department of Defense has overlapping mission sets: homeland security, homeland defense, civil support
- Military operations use 'unified command plan' to guide commanders
- USNORTHCOM: provides command and control of DoD homeland defense efforts, some of these are: navy fleet, marine forces, army forces, air forces, joint task forces, reserve components, national guard
- Defense Coordinating Officer is single point of contact for DoD and domestic emergencies
- 4 Joint Regional Medical Planners that know military medical capabilities and match operational capabilities, link between regional interagency and DoD, "boots on the ground" providing tactical/operational link and critical info flow
- What are DoD's medical capabilities? Health service support to soldiers, military medical trained providers, specialized support (CBRNE, air evac, direct care/field hosp)
- Response structure-immediate response or national guard forces
- Civil requests for assistance can be through Stafford Act or not (Figure 8.10)

**Take Home Messages**: DoD plays significant role in homeland defense and support to civil authorities

Chapter 9: Mass Casualty Evacuation and Patient Movement

- How do you move large amounts of people when they are 1)aware of incident or 2)not aware of incident?
- Planning cycle: determine estimate, generate plan, execute plan
- Threat: most likely vs. most dangerous threats in community
- Easier to prepare for 'notice' events compared to 'no-notice' events

- 360 degree threat assessment: combined environmental, socioeconomic, structural perspectives
- Evaluate area characteristics: terrain, weather, environmental factors, population density and demographics, location and structural integrity of medical institutions, regional transportation
- Need for medical evacuation? Home-care/medically fragile patients, hospital
- Modes of transport: ambulances, paratransit, helicopter, train, bus, boat, ferries, military evacuation platforms
- Whenever possible, medical evacuation should be performed by standard medical transportation vehicles with dedicated medical staff onboard to move and provide care
- Execution-> casualty collection points (triage), ambulance exchange points (transport)
- Hospital evacuation->discharge all those safe to go home, shelter in place, or evacuate to another facility
- Using NDMS, patients normally on DoD aircraft after patient movement request (PMR) submitted

**Take Home Messages**: Prepare, plan, and exercise for large-scale patient evacuations

Chapter 10: Occupational Injury Prevention and Management

- A medical support team should be established for the operational team
- Need for regular diet and adequate hydration
- Rotate personnel working in severe cold or heat environments (sling psychrometer can measure dry temp and wet reading to incorporate humidity)
- Need emergency care plan in place prior to any incident
- In acute phase of injury response, different phases of management
- Most common injuries are sprains/strains-can use RICE or other rehab techniques
- Return-to-duty must be based on responders ability to perform tasks and not reinjure
- Physicial fitness and readiness are essential in law enforcement, should monitor levels
- Tactical teams have higher mental/physical standards
- Public safety employees should have WFRE (worker fit and risk exams)
- Unique risks such as violence, smoke, toxic substances to professionals
- Medical certification process (might be manipulated) and fitness-for-duty exams (FFD)
- Legal protections for age, race, gender, disability, pregnancy, religion
- ADA: unlawful to exclude a qualified applicant from employment unless this is a direct threat to health and safety of individual or others or unless there is undue hardship
- Must have emotional considerations in addition to physical

**Take Home Messages**: public safety employees perform some of the most physically hazardous and psychologically challenging jobs in the modern workplace

Chapter 11: Medical Surveillance of Emergency Response Personnel

- Greater and more varied dangers facing today's EMS workforce—threatening their health and lives. Examples: MCI/Active shooter to Epidemics, to Toxic Inhalation (eg World Trade Center). World Trade Center Medical Monitoring and Treatment Program
- Goals of a medical Surveillance program:
    - Early recognition of hazardous exposure-related occupational disease
    - Early intervention and treatment
    - Effective management of occupational disease process
    - Illness prevention
- Several federal regulations, agencies, documents provide guidance of design and operation of Medical Surveillance Program (OSHA, CFR, EPA, Natl Fire, etc
- Current OSHA Requirments for implentation of Medical Surveillance Programs:
    - For employees who may be exposed to haz-mat at or above Permissible Limits (PELs) for 30 days or more
    - In absence of PELs, for employees working at levels above published exposure levels for a substance
    - Employees who wear a respirator for more than 30 days/yr

    - Hazmat employees
    - All employees who are injured as a result of exposure to haz-mat
- EPA includes volunteers working for govt agency
- Success of surveillance program requires: clear definition of mission, components and procedures for surveillance before, during and after exposure.
- MSP require dedicated staff, medical screening, periodic exams and monitoring
- Must maintain employee records for minimum of 30 years post retirement/termination of employment
- Responders entitled to access records within 15 days of request
- Initial employment exam, depends on institution—in addition to health questionnaire, Immunizations, exam might included
    - VS including Ht, Wt, BP pulse, RR
    - CXR to screen for pre-existing abnlities
    - PFTs
    - EKG
    - Vision Test
    - Auditory
    - Blood (liver kidney), CBC, electrolytes, UA
    - Drug, pregnancy, etc
- Annual or Periodic Examination
- On-scene medical monitoring—may depend on incident
    - Rest requirements
    - PPE
    - Rehabilitation areas needed—different agencies might be primary host during incident, some variability
    - Periodic re-exams
    - Range of services—include mental health
- Exposure specific exam

**Take Home Messages**: Highly regulated process with significant med//legal implications

Chapter 12: EMS on the Fire Ground

- Four roles for EMS on firefighting ground: 1. standby for possible illness or injury of FF, 2. treatment and transport of ill/injured FF, 3. mgmt and staffing rehab area, 4. transport and treatment ill/injured civilians
- Stand-by regulated by federal regulations: Hazmat, PPE, etc> minimum of one ambulance deployed. If that one responds to patient, another should replace on stand-by function
- Physiology of Structured Firefighting:
    - Strenuous physical work at extreme heat, for variable periods of time.
    - PPE bulky but necessary pants, coat, hat, gloves, SCBA (self contained breathing apparatus)
    - HRs elevated, though does not directly correlate to level of work (elevation seen at initial alarm)
    - Live exercises increase CV demand more than mock exercises
    - Disproportionate upper body strength used due to axes
    - Exposure to CO and other toxins during exercise>> ST changes on EKG
    - Core temp rises even after work when suppressing in heat
    - § Conclusion>> Appropriate amt of required rest and rehab needed
- Treatment and transport of ill and injured: increased risk of Cardiac event, Si/Sx ACS/ SCA present
- Fire GroundRehabilitation:
    - Establish triage VS for initial and reassessment, include “general appearance”
    - Establish protocols to determine which FF require immediate transport from rehabs
    - Ensure medical providers in rehab have designated authority to detain FF in rehab or order transport as seen fit
    - Provide advice regarding rehydration

  - Provide advice/guidelies re: passive and active cooling
- Figure 12.1 Flow through Rehab Area: Registry/Accountability, SCBA storage and trade out, rest and refreshment, medical eval area, ambulance staging
- During rehab, assess for following: CP, SOB, Palpitations, irreg pulse, AMS, Skin changes, Temp changes, elevated pulse >150 or BP >200/130
- Rehydration and nutritional support: 1L loss in initial 20 min. 2L/ hr loss during intense FF.
- Considerations for fluids: avoid extremes of temp of liquids. Avoid high osmolality
- Solid foods often necessary for prolonged support. Have easily digestible foods: complex carbs, easy proteins and fats.

**Take Home Messages**: Multi-faceted considerations to fire support. MDs must know specific guidelines for removal from duty

Chapter 13: Flight Operation Support and Tactical Ops

- Helicopters as tactical tool: long history in military ops for medical evac
- Advantages include: accessibility, speed, trained personnel and sophisticated equipment, observation
- Risks- 183 fatalities in 30 years (2.75mill patients) US rotor wing transports in
- Use limitations – not every community has access, weather issues, weight limits, distance needed to travel
- Operating Cost determinants: single v twin engine design, flight crew configuration, flying weight, annual flights, total flight time, and fuel
- Flight crew configuration: RN/EMT-P, RN/RN, RN/MD, RN/Resp therapist
- Operational Roles
  - Airborne Law Enforcement Tool: birds-eye, insert SWAT teams etc,
  - Fire Department Tool; info for incident command personnel, rescue, etc
  - Medical Ops Support: civilian programs providing air medical transport, reduce time to definitive care, scene to hospital or interfacility transport
  - Special Transportation Assistance: programs to transport medications to Point-of-Delivery during medical emergencies—outbreak, chemical event etc.
- Safety Ops considerations: Specific rules/regs for Landing zone: 100 foot diameter for small vehicle. 200 foot ingress, egress; free of overhead wires; free of debris that could blow in the rotor wash; flat surface able to sustain weight of aircraft; secure perimeter
- Patient assessment and Loading: Handoff between air and ground personnel on each end. Usually load patient “cold”—rotors not turning. If loading while “hot” must secure all pt equipment securely.

**Take Home Messages**: Overview of regulations and considerations for helicopter transport

Chapter 14: Urban Search and Rescue

- History-Definition: “Science of responding, locating, reaching, medically treating, and safely extricating victims entrapped by collapsed structures”>> However USAR techniques can be applied in other scenarios floods, fires, etc
- Common injuries: fractures, lacs, CHI, polytrauma, dehydration, rhabdo, hazmat exposure, airway injury inhalation
- Delays in extrication>> need to begin treatment in field when scoop and run not possible
- Origin of US&R: Disaster Relief Act 1974, Stafford Act 1988 –established FEMA as lead agency; multiple disaster relied exp in Central South America, and Middle east> US&R 1989
- Operational Components: National US&R System has 28 nationally distributed Task forces: up to 70 members each to conduct S&R missions; Incident Support Teams, provide logistics support to Task Forces. All are mobilized by FEMA
- IST Advance—uses ICS to structure/support an incident/mission
- Operational Requirements for US&R:
  - Rapidly deployable
  - Completely self supporting (72hr)
  - Self sufficient medical capability
  - Integrate into existing disaster management structure

  - Establish predetermined financial responsibility
  - Establish logistics protocols
- Task Force capabilities:
  - Conduct physical, canine, electronic search in collapsed structure confined space
  - Provide emergency medical care and ALS to victims
  - Assess and control gas, electric and hazmat
  - Evaluate and stabilize damaged structures
  - Operate heavy equipment and rigging
  - Manage and coordinate public information
  - Acquire, acct for and maintain resources
  - Manage and coordinate taskforce operations
- Operational responsibilities of medical team Members
  - Treatment of task force personnel and staff, including canines
  - Treatment of victims directly encountered by TF during rescue
  - Treatment of other victims without jeopardizing priorities 1 or 2
  - · Preparation: Hours of training, medical fitness exam and re-exams, equipment training
  - Concept of Medical Team Leader (MTL)-usually a physician who will plan on medical care procedures, protocols of victims and personnel. Develop Medical Action plan once deployed
- Activation: system for alerting, easily deployable, assessment of worksite, medical action plan take into account environment and resources, procedures and protocols for transfer of care of injured victims as well as injured personnel
- On-scene: Unloading and organization of rescue and medical cache, food water etc at Base of Operations. Safety/Security. Interface with local authorities re: capabilities and Limitations. Communication with patients once reached. Frequent reassurance. DOCUMENTATION
- Post deployment: rehab of medical cache—often completely resupply. Debrief. After Action Report
- Local/Regional/State Response: Similar to federal but follow state/regional regs and support feds or incident specific for deployment
- Clinical Aspects of US&R
  - Confined Space Medicine
  - Dust Airway Impaction
  - Blast injury
  - Crush
  - Prolonged Care

**Take Home Messages**: Complex medical and logistical needs for patients/victims and personnel. Extensive preparation and training needed

Chapter 15: Water Rescue and Recovery

- Preparation and Planning: Essential to have extensive medical knowledge, planning and preparation for rescue programs and for any deployment. Problems arise when high sense of urgency of a mission compromises team safety by skipping necessary prep
- Important for medical director of a program to have extensive knowledge about diving physiology and pathophys. Do not need to be a diver, but must be expert on medical aspects
- Gas Law:
  - Diving injuries occur because of effects of pressure on gases and body tissues.
    - Basic science: Atmospheric pressure at sea level: 760mmHg (17.4lb/sqin)= 1 ATM
    - Moving above sea level>> less pressure; below sea level>> more pressure
    - Each 33 feet below sea level = 1 ATM additional (66 feet depth = 3 ATM)
    - Boyle's Law: Pressure ~ inverse to Volume (when temp constant)
    - Therefore as pressure increases with descent, the volume for gases in body decreases>>forces gases into fluids and tissues
    - As pressure decreases with ascent, volume expands, and gases must be expelled in controlled manner
  - Dalton's Law: The sum of partial pressures of gases = total pressure

- Henry's Law: quantity of gas dissolved in specific volume of liquid ~ proportional to pressure exerted above the gas.

- Diving Injuries and Disorders (4 types) – worst all involve ASCENT
  - Barotrauma: injuries that occur during DESCENT, due to increased pressure on body. "The squeeze":
    - Ex: Ruptured ear drums, GI and thoracic injuries
    - Divers must continually equalize pressures
  - Nitrogen Narcosis: Occurs at depths>100 feet
    - Nitrogen over-saturates tissues including brain: "Raptures of the Deep"
    - Similar to EtOH intoxication—concerns about diver judgement
    - Easily corrected
  - Decompression Injuries: During ASCENT, if too rapid
    - "The Bends"—
    - Sx appear within 12 hours—range of sx: fatigue, joint pains, paralysis, CNS
    - Require emergent recompression in Hyperbaric chamber
  - Pulmonary Over-inflation Syndrome and Arterial Gas Embolism: dur ASCENT
    - POIS- Holding one's breath while ascending (even at 3 feet). At depth, air in lungs compressed, then re-expands with decreased pressure>>rupture of alveoli >> leads to Ptx, pneumomediastinum, puts diver at risk of AGE
    - AGE= leading cause of death among divers. When alveoli rupture > air embolus can get into circulation and cause CVA or SCA (usually within first 10 minutes after ascent. Need CPR, ALS
- Dive Equipment
  - Wet suits vs. dry suits (more protection from elements, difficult to take off)
  - Contaminated waters: dry suits plus full face masks
- Administrative and Operational Practices
  - Utilizing ICS and NIMS during dive operations as framework for planning, safety and execution

**Take Home Messages**: very hazardous and complex environment requires high degree of planning and disciplined execution

Chapter 16: Medical Support for Hazardous Material Response

Planning needs to be multi-departmental, and include Standard Operating Procedures for each agency. Responsibility for the provision of EMS care in the hot, warm and cold zones is critical to identify. Conduct a comprehensive hazard vulnerability analysis; material safety data sheets (MSDS) are helpful for industrial compounds. Medical implications planning should include access to resources such as the American Association for Poison Control Centers hotline, and ability to medically monitor response personnel. Levels of respiratory protection include air-purifying respirators (APRs), self-contained breathing apparatus (SCBA), supplied air respirators (SARs) and N95/100 masks--all must be HIOSH-compliant. Training and exercising should be conducted, that include after-action reporting, and revision of plans, policies and procedures. Transport hazmat incidents are common: 4 to 8% of all transported materials are hazmat, combustible liquids and corrosive materials account for largest portion of releases. Title 49 of the Federal Code of Regulations requires hazmat placards but they may not be visible to first responders. Methamphetamine labs are contaminated with many kinds of hazardous chemicals as well as booby traps such as explosives--many first responder injuries from law enforcement operations. Workers exposed to this environment need gross and technical decon. WMD incidents can include biological as well as chemical agents. Toxins are natural biological substances produced by animals, plants or microbes that are not-volatile and nondermally active, but are more toxic by weight than chemicals. Variables that can influence the effectiveness of delivery include particle size, stability under dissemination and environmental/atmospheric conditions. Radiation dispersion devices "dirty bombs" are weapons of mass disruption vs. destruction. For a response, approach the incident from an uphill and upwind direction. Establishing a perimeter and incident command are two of the most important steps for responders. If the site is a potential terrorist attack site, beware secondary devices and consider evidence collection needs.

*Levels of PPE*: A Chemical Vapor Protection, B Liquid Chemical Splash Protection (with SCBA), C Liquid Chemical Splash Protection (with APRs), Level D Usual Work Attire (provides heat protection in the case of firefighters but not chemical). APR's have different cartridges for different threats and these have shelf lives. Powered Air Purifying Respirators are noisy but enable those with facial hair to have protection and are not seal-dependent. SCBAs are heavy and expensive, SARs are dependent on hose connections. Hand and foot protection are also required. PPE can induce injury especially heat stress and falls. Chemical agent types reviewed (neuro, blister, pulmonary and blood agents) along with detection methods, such as chemical paper. Biologic agent detectors require high selectivity; usual detection method is clinical diagnosis of affected individuals. Radiation exposure needs detectors, most practical for gamma rays is the pocket dosimeter which can be read in ambient light. Safe exposure levels are 0.1 Mr/hr with a survey meter, or total whole body exposure of less than 50 rem by dosimeter.
Decontamination: process of removing or deactivating harmful contaminants from the surfaces of persons or objects by dilution and physical measures. Primary contamination result of direct transfer from source; secondary contamination from contaminated person to person or object. Decontamination can be dry or wet (if it uses water). Deconatmination is best done outdoors due to multiple factors such as dispersion of contaminant but ideally use heated water. Fire apparatus can set up decon corridors with water hoses set at max 50 psi and exposure time of 3:00 minimum, protect airways on supine patients. For medical decon, use "gross" decon with shower prior to more detailed decon. If clothes need to be cut off supine patients, cut down center and roll to sides. All clothing should be bagged and tagged for evidence collection. 3 to 5" of washing for non-viscous and 5 to 8" of washing for viscous substances recommended. Need to prep for special needs patients such as kids. For supine patients do airway first, then open wounds, then front-to-back and head-to-toe. Pre-decon treatments should be limited to airway, hemorrhage and antidote administration. Technical decon refers to the process for responders to go through prior to removing their gear. After decon, responders should report to rehab. Special attention needs to be paid to decon of weapons. Emergency decon refers to an abridged technical decon process for responders who have had a PPE breach or medical emergency. NFPA1584 Standard on the Rehab Process for Members During Emergency Operations and Training Exercises should be consulted for Rehab standards to include a safe area with chairs, cots, access to medical eval, refreshments. Medical monitoring per local protocols but include weight as a vital measurement. Evidence collection and sampling will likely need to be performed by a reconnaissance team with a backup by a Rapid Intervention Team to rescue any providers injured in the warm zone.
**Take Home Messages**: are medical rehab protocols the pervue of EMS agencies or EMS providers?

<u>Chapter 17: Tactical Emergency Medical Support</u>
NAEMSP endorsed integrating EMS capability into tactical EMS teams in 2001. In 1995 most common form of support for tactical teams was a civilian ambulance on standby, 94% of whose personnel had no tactical training and 78% had no medical direction. Standard EMS protocols involve scene safety and do not allow tx until patients are in the cold zone, with subsequent preventable morbidity/mortality of delayed treatment. Waco example of operational security compromised by pre-alerting an EMS service with subsequent loss of surprise factor and death of 4 law enforcement officers. Zones of treatment: hot=hostile environment with patient extrication, opening of airway and control of life-threatening hemorrhage the only acceptable treatments. Cold zone=standard EMS care. Learning weapons safety important for TEMS personnel in order to render a weapon safe if necessary when removed from a patient's possession. Less Lethal Weapons (LLWs) include chemical incapacitating agents (OC and CS), rubber bullets and other projectiles, Noise/flash diversionary devices, Conducted Electrical Weapons (TASERs), which deliver 0.36J of energy at 50K volts over 5 seconds. Injury risks for these weapons include puncture wounds and blunt trauma from falls. 0.3% incident rate of significant injury with CEWs but safety is under active investigation after several in-custody deaths. Exposure to hazardous materials (including booby traps) must be considered in TEMS. Excited delirium patients may be encountered by TEMS personnel = acute onset bizarre behavior accompanied by incoherent shouting, hallucinations, hyperthermia, combativeness, extraordinary strength and paranoid delusions. Training is the key to a better approach to these patients. TEMS teams need dedicated

medical support in addition to the team's included provider, since event paramedics may not be able to provide ALS level care in the tactical environment. Services provided by the medical component of the tactical team include Medical Conscience, Medical Threat Assessment, Distance Physical Assessment (of the wounded), and Sensory Deprived/Sensory Overloaded Physical Assessment when close to the victims, Medicine over the Barricades assistance with hostage negotiations, and Hazardous Materials medical effects advice. Medical providers should be stationed close to, but protected from the action and should not carry a firearm unless they have the level of training and on-going proficiency to carry the firearm (difficult to maintain with medical requirements). Tensions that a Tactical Physician can face include the volunteer nature of the job, maintaining tactical training, and the need to deploy quickly for unknown periods of time. Tactical medicine core curriculum and CE is recommended. Training and QI involvement is essential. Direct medical oversight preferred over radio contact for operational security reasons. **Take Home Messages**: Need for a formal TEMS policy and protocol

Chapter 18: Explosive Ordnance Disposal Operations

- Bombings not all that rare (1,600 to 2,400 per year in US) and injuries are primarily caused by the blast: primary (due to blast wave, air-filled organs), secondary (caused by projectiles thrown by blast, eyes, neck, hands and feet most vulnerable), tertiary (body being thrown by blast wave and striking ground--blunt force injury such as C Spine fx). Contamination is also a consideration; biological if a suicide bomber, radiological (or "dirty bomb") more of a logistics issue than a direct threat from radiation (due to public concern, decontamination of large numbers of people/property, etc.)
- Explosions are mechanical (e.g. steam under pressure), chemical (two solids combining to form a gas with a larger volume than the solids, resulting in light, sound and pressure) or nuclear (atoms being split or fused together). The detonation velocity is the speed with which the chemical explosive reaction takes place, if very slow this is combustion, if instantaneous it is a detonation. Three effects of an explosion: Thermal (seen as a fireball) releasing heat, the least damaging of these components, Pressure (1st component: positive pressure wave with a visible shock front preceding it, disapates rapidly with distance, 2nd component: negative pressure wave, as air moves in to fill the vacuum caused by the positive pressure wave--slower than 1st component but powerful; "punch and pull" effect), Fragmentation: pieces of the device or debris that are pushed by the shock waves and cause injury when striking the body.
- Explosive classification based on detonation velocity: less than 1.005 meters per second are classified as "low explosives"; these are usually propellants that if not enclosed would burn not explode. Pipe bombs are an example of a device using low explosives. High explosives have a faster detonation velocity and are classified according to the degree of sensitivity", or the "insult" needed to make them detonate: Primary high explosives are very sensitive and are used for materials like blasting caps, Secondary high explosives need more insult to detonate and are often "boosted" by a small amount of more sensitive explosives. An example was the bomb that damaged the Murrah building in Oklahoma City: blasting cap (primary) plus small amount of TNT (booster) inside of an ANFO--ammonia, nitrate, fuel oil--explosive (secondary). Improvised Explosive Devices (meaning an explosive device that has not been manufactured) need an initiator and an explosive; important to determine as the EOD technician needs to know how the device functions in order to disarm it. There are victim-activated devices (e.g. car bomb with pressure sensor in seat) used to target specific individuals, time-activated devices (e.g. train bombs) that target classes of individuals, e.g. commuters, and command-activated devices that require the bomber to be surveilling the device. Secondary devices target responders to the primary device, and must be considered in any response. Booby traps are hidden hazards specifically placed to harm personnel.
- Bomb suits are protective but restrict movement and increase the likelihood of heat stress. The most important factors for the medical response is preparing the technician for response periods in the suit, monitoring him/her during their time in the response, and knowing how to rapidly remove the suit to provide medical care. Common blast injuries if the device detonates are tympanic membrane rupture, amputation, pnuemothorax, air embolis, GI tract and hand injury. Any response to an injured technician must include another EOD technician on the rescue party to scan for other devices, movement to a safe location, consideration for

decontamination and transport. Robots are being used more and more in this work; they often contain portable xray machines and safe distances are 10' behind, 36' on the sides and 100' in front.

**Take Home Messages:** see previous chapter (need for TEMS support protocols)

Chapter 19: Equestrian Veterinary Support

Horses are large, dangerous animals with a strong fight or flight response, so if you don't feel safe doing anything with/to them, don't do it. With that being said, approach a horse from a 45 degree angle on the left side, as this is what they are trained to be used to. Walk in a calm, confident manner and avoid direct eye contact, speaking softly to the animal. Pulses are hard to feel, but normal vital signs include respirations 10 to 16 per minute, HR 28 to 40 (if HR = RR this is known as thumps and is bad) hear best at the L elbow of the horse by listening to the chest, Cap Refill in the gums less than 2 seconds, + Bowel sounds and Temp measured rectally (watch out for the horses hooves and head when taking the temp with a large animal thermometer) 99 to 100.5 degrees F. Horses that are relaxed have their heads in neutral position or low, are slowly moving their tails swishing flies, and look calm. You should know how to place a leg wound dressing, which includes standard wound irrigation and cleaning, telfa dressing, lots of padding, and an outer layer that is very wide (over 6"). Among many illnesses/injuries affecting the horse over which you can do nothing but get the animal to a veterinarian (the strangles, concussion, laiminits, rabies, dryland dystemper and colic to name a few) if the horse sustains a rattlesnake bite to the face, swelling may ensue which can close the airway. Insert two sawed off lengths of garden hose into the nostrils to keep the airway open (avoiding the head, legs and bite of the animal, which can transmit rabies if infected). If working with horses, having a first aid kit specific to their needs would be helpful. Many human medications, such as corticosteroids and benzodiazepines are commonly used in horse, although there are horse-specific tranquilizers.

**Take Home Messages**: have a large animal vet on your team if deploying with/using horses.

Chapter 20: Basic Veterinary Care for Working Dogs

Canine triage similar to START with the addition of a blue category for animals that have been decontaminated. Normal vital signs are P 60 - 140, RR 10 - 30, Temp 101 to 102.5 degrees F. Perform CPR with animal on its side; 1:1 compression/ventilation ratio, survival rates 3% CPR, 25% for respiratory support. 02 by nasal cannula with flow rates 50 to 100 ml/kg/min--if cyanosis and decompensation persist, consider intubation or euthanasia. Use cephalic or saphenous veins for IV access. Overt signs of dehydration are lethargy, tacky or dry mucous membranes, oliguria, panting, and increase in heart rate and weakness. Fluids can be given subcutaneously if IV access can't be established (IO works as well). Shock crystalloid fluid volume is 90 ml/kg/hr, given 25% at a time every :15. Once stabilized give daily requirements (66 ml/kg water for dogs). First generation cephalosporins can be given for wound infections. Wounds can be irrigated and closed if tended to within 8 hours of injury. Use pneumatic cuffs instead of tourniquets for hemostasis. Utilize 3 layer Robert-Jones dressings for extremity wounds. Velpeau slings can be used to immobilize the shoulder joint and the Ehmer sling for the reduction of a craniodorsal coxofemoral luxation. Pad and paw injuries should be cleaned, closed if appropriate, dressed and bootied. Bite wounds can be more severe due to slashing forces in the bite than first apparent. Spinal injury no treatment other than extremity splinting. DMSO suggested for head trauma. Burn injuries look for shock, administer crystalloids based on TBSA affected. Dogs cool themselves by panting and convection; they will seek shade when overheated. Treat with ice packs and fans/a/c. No ice water baths. Treatment of hypothermia, frostbite, near drowning and allergic reactions similar to humans. Tick borne illnesses include tick paralysis and RMSF; treat with doxy. Use antivenin and shock treatment in all cases of snakebite with envenomation. Treatment of ocular injuries, respiratory syndromes and anthrax similar to humans; use Panacur to treat for giardia, NSAIDS and opioids for pain.

**Take Home Messages**: Handlers are the best protection for canines; don't travel without a canine first aid kit and veterinary backup.