

## Medical Oversight

- 1966 Accidental Death and Disability - EMS sucks; blueprint for EMS development
- 1966 Highway Safety Act - Money for EMS systems to start up
- 1973 Emergency Medical Services System Act - Grant funds; emphasizes regional systems, trauma orientation; "15 essential components" of an EMS system
- 1996 EMS Agenda for the Future - 14 attributes of the EMS system
- EMS Education Agenda for the Future
  - National EMS Core Content, scope of practice, education standards, education program accreditation, certification

## Legal Issues

- Aviation Medical Assistance Act is the only federal good samaritan law; all others are state-based (and vary state-by-state)
- EMS personnel are licensed
- A license is a property right subject to due process protection
- Due Process has 2 parts:
  - Notified of charges
  - Hearing to rebut charges - provider has fair opportunity to challenge the basis of the action and present their own evidence
- Federal Civil Rights Statute - Can sue in federal instead of state court, so you lose state immunity (if present) and good samaritan protection (which are state laws)
- Respondent Superior - Applies to EMS agency, not medical director
- Negligent Supervision - Applies to the medical director
- Public Duty - duty of public safety is to the public at large, not to the individual patient
- Special Duty - this is to the individual; can occur if the EMS agency has a relationship with the patient, such as responding to multiple calls for one patient.
- Federal Laws:
  - Medical directors in employment hierarchy may be named in employment disputes
  - Sexual harassment
  - Fraud (Medicare and Medicaid; medical necessity)
  - HIPAA violations
  - Civil rights violations - case law on withdrawing oversight, termination, denial of due process
- State Laws & Regulations:
  - Licensure (which is a "property interest")
  - Medical director attestation that provider is qualified to receive state certification
- Elements of Informed Consent:
  - Ability to understand the information
  - Communication of decision that is apparently consistent with patient's own values
  - Freedom from undue influence
- Common Law – based on previous rulings. Not binding in other States.
- Relation ship is supervision
- An agent acts for another, a supervisor oversees.
- Not vicarious liability master responsible for the harm caused
- License – permission from a gov authority
- Certification a formal assertion
- Medical directors are not subject to ADA claims unless they employ
- Negligence
  - Treatment 42%
  - Accidents 40%
  - Dispatch 27%
  - Training 2%

## Ethics in EMS

- Autonomy - Right to self-determination, even if decision will result in harm/death
- Beneficence - Doing what the providers thinks is best; Do no harm
- Criteria to allow patient autonomy:
  - Sufficient information about medical condition
  - Understand the risks, benefits, and options
  - Ability to make a decision
  - Ability to communicate

- No undue influence
- TOR Guidelines:
  - Non-Traumatic adult:
    - No ROSC after 20-25 min
    - ETCO<sub>2</sub> <10
    - Not in persistent VF/VT
  - Blunt trauma adult
    - An appropriate mechanism
    - Evaluation for reversible blocked airway
    - Evaluation for VF/VT
  - Penetrating trauma adult
    - Intact airway
    - Evaluation for VF/VT
- Exceptions to patient confidentiality, by law:
  - Criminal investigations
  - Suicidal or homicidal patients
  - Suspected elder or child abuse
  - Patients who pose a public health threat
  - Child/Elder abuse
- Emancipation:
  - Married
  - Legally separated from parents
  - Pregnant or have a child
  - Served in armed forces
- Special circumstances (can treat without parent)
  - Care for mental illness / substance abuse
  - Sexually transmitted diseases / pregnancy

#### Public Safety Answering Points

- Goals of EMD
  - Right resources
  - Right person
  - Right time
  - Right way (e.g. L&S)
  - Right things (e.g. pre-arrival instructions)
- Key components of EMD protocol:
  - Chief complaint identification
  - Key question interrogation (i.e. HPI/PE)
  - Dispatch Life Support / prearrival instructions
  - Prehospital dispatch coding and response configuration
- Prearrival Instructions
  - Failure to provide = "dispatcher abandonment"
  - Dispatcher Life Support requires adherence to written protocol
  - Prearrival Instructions = formal, medically approved, written
  - Telephone Aid = Ad lib advice based on dispatcher experience
  - Vertical Dispatch - Done by one provider, serial process
  - Horizontal Dispatch - Done by team; parallel processes; partner can dispatch while primary dispatcher provides prearrival instructions
  - Prioritization of Response:
    - Determinant codes are static, allows for comparison among locales
    - Response assignment to code varies based upon model of EMS
    - Determinant codes are not linear determinations of severity, they are stepwise differences in priority

#### System Design

- Influences on EMS System Design:
  - 1966 Accidental Death and Disability -- "EMS stinks"
  - 1973 EMS Systems Act -- We'll fix it with a lot of money; focus on system, not patient
  - 1996 Agenda for the Future -- More patient-focused / medical directors; introduced clinical care and integration of EMS into the healthcare system

- 2006 Emergency Medical Services at the Crossroads -- EMS is the gatekeeper of the health system and does save lives
- EMS System Cost -- 75% labor, 25% infrastructure
- Response Times:
  - Standards -- 4 min for BLS FR and defibrillation; 8 min ALS and transport unit
  - Average time delivers poorer service
  - Fractile times better meets patient needs (e.g. 90% of cases meeting XX goal)
  - Best to identify response time intervals (better able to identify steps with delays)
- Unit Hour Utilization = U (Utilization) / UH (Unit Hours)
  - Optimal .55-.45
  - Average .35-.25
  - Poor predictor of quality and cost per transport
- Effective Medical Oversight -- best if:
  - External (vs Internal)
  - Authoritative (vs Advisory)
  - Broad (vs. Narrow) scope of authority
  - Funded (vs Volunteer)
- System Status Management - An ambulance deployment model based on anticipation of need
  - No fixed base stations
  - Posting locations based on temporal and geographical patterns of demand
  - Intends to provide most timely transport
  - Manages deployment of resources to meet response time requirements
- System Status Plan
  - Protocol for deployment of system's unit hours
  - Statistical basis for protocol utilizing historical call volume for each hour of each day of the week
  - Considers geographical barriers (e.g. rivers, traffic, time of day)

#### Delivery Systems with Special Considerations

- Wilderness EMS Systems
  - Better defined by the situation and circumstance, rather than geography and transport distances
  - EMT-B may perform interventions usually reserved for higher scope of practice
  - CPR termination:
    - Must consider risk to rescuer vs chance of survival of victim
    - Special cases: hypothermia, cold water drowning
  - Often best to perform procedures that allow victim to assist in self extrication (e.g. joint reductions, victim rehab)
- Military EMS Systems
  - Organization:
    - "Buddy or Self aid"; combat medic
    - Level I: Aid station, first medical contact
    - Level II: Forward surgical team (physicians, nurses and medics), blood, stabilization
    - Level III: First true medical facility, combat support hospital, comprehensive resuscitative surgery and medical care
    - Level IV: Comprehensive intermediate hospital with definitive medical and surgical care
    - Level V: Fixed hospitals in the US

#### Scope of Practice

- National scope for EMT -- Positive pressure ventilation devices (automated and manual)
- National scope for paramedic -- percutaneous cric, not surgical cric

#### Education and EMS Personnel

- National EMS Education and Practice Blueprint -- Foundational document that identified the EMS curriculum, including content of all levels of EMS. There has been no revision.
- National EMS Scope of Practice Model
  - Defines the national levels of EMS providers
  - Version 1: EMT-A, EMT-B, etc
  - Version 2: EMR, EMT, AEMT, Paramedic
  - Defines the national scope of practice of the levels; but local scope is up to the states
- Medical Directors of EMS programs must verify competency prior to testing
- Developing Curricula -- composed of 5 aspects:
  - Needs assessment

- Formulation of objectives
- Course development
- Methods of instruction
- Program delivery

### Occupational Health

- Emergency Vehicle Operations Course
  - National curriculum
  - Locally taught course
  - May or may not be required based on local/state requirements
- National Fire Protection Association (NFPA) 1582
  - Requires fire departments designate a department physician to provide medical oversight
  - Requires fire departments establish a comprehensive medical program to address worker health and safety, and include reimbursement to workers for basic medical evaluations and vaccinations
- Ryan White Act 1990
  - Provides framework for Emergency Response Employees to be informed by a receiving facility (e.g. ED) that they may have been exposed to infectious disease
  - Mechanism: Employee can initiate an inquiry, or facility may provide routine notification
- Occupational Health and Safety Administration (OSHA) Blood borne Pathogen Standard 1910
  - All employers of at risk occupations must have written exposure control plan
  - Must have PPE at no cost to employee
  - Employers shall provide testing for TB and resources for protection against exposure (e.g. face masks)
- OSHA 1904
  - Requires employers to keep records and report on work-related fatalities, injuries, and illnesses
  - States may supersede OSHA whereby organizations may be required to report to local, regional, or state governing bodies instead of OSHA
- Injuries
  - 65% Of work loss due to back injuries
  - Death is due to crashes

### Provider Health and Wellness (Rehab)

- Hazardous Waste Operations and Emergency Response (HAZWOPER) Regulations - Governs any incident requiring PPE to work in an immediate dangerous to life and health environment
- HAZWOPER and NFA 1500 Standard require a transport capable EMS unit at all fireground and hazmat incidents
- Emergency Incident Rehabilitation - Should be initiated any time work is performed for 20+ minutes in fire suppression or hazmat protective clothing
- NFPA 1584
  - 5-10 min rest after consuming one 30-min SCBA cylinder or 20 min of heavy exertion
  - 20 min formal rehab after consuming two 30-min SCBA cylinders or 45 min heavy exertion
- Minimum 8 oz drink at every rehab period
- Active cooling required when rehab done in hot/humid conditions

### Service Delivery Models

- Ambulance Types:
  - Type I - Truck, cab-chassis with modular ambulance body (Truck + box)
  - Type II - Van, integral cab-body ambulance (Van style)
  - Type III - Van, cab-chassis with integrated modular ambulance body (Van + box)
- FLSA Overtime 7 (k) Exemption - Firefighters only get overtime after 53 hours (not 40 hours) per week, even for FF doing EMS

### Special Populations

- N/A

### System Finance

- Cost Per Capita - (Total EMS costs) / (Population served)
- Unit Hour Utilization
  - Basic measurement of efficiency in EMS
  - Unit hour is a staffed apparatus in/ready for service
  - Utilization is the activity per unit hour (e.g. transports)
- Cost per Patient Transport = (Cost per unit hour) / (Unit Hour Utilization)

## Public Health

- Triage types (NEED TO REVIEW)
  - START
  - JUMP START (Peds)
  - SALT
- 3 Components of Public Health:
  - Assessment
  - Policy development
  - Assurance

## QI and Evidence Based Practice

- Claims arising from QI:
  - Defamation - Provider claims the performance improvement review was slanderous or created libel
  - Antitrust/Tortious Interference with Business - the loss of employment or business practice as a result of discipline
  - Patient Claim of Negligent Supervision - they were harmed because of improper protocols or allowing provider to continue to practice
- NFPA 1790
  - Call Processing - <90 seconds, 90%
  - Turnout time - <60 seconds, 90% of time
  - Response time - BLS 4min, ALS 8min, Transport 8min; 90% of time
- Value Quotient - (Performance Indicator) / (Cost)
- Level of Evidence:
  - Level I - RCT
  - Level IIa - Controlled, not randomized
  - Level IIb - Case control/cohort
  - Level IIc - Multiple or overwhelming data from less well-designed trials
  - Level III - Expert opinion
- Class of Recommendations
  - Level A - Good evidence, benefits >> risks
  - Level B - Fair evidence, benefits > risks
  - Level C - Fair evidence, benefits ~ risks
  - Level D - Fair evidence, benefits < risks
  - Level I - Insufficient evidence
- Most EMS evidence is LOE III, COR C

## Data Collection, Management and Analysis

- Clinical/Enumerative - use traditional statistical methods
- Performance/Analytical - use non-traditional methods, such as control charts

## Research and Informed Consent

- Belmont Report (1997) - Three primary ethical principles:
  - Respect for persons
  - Beneficence
  - Justice
- "The Common Rule" - Uniform federal regulations on conduct of human subjects research. 3 levels of protection:
  - Federal (Institutional Assurance of Compliance, Federal Wide Assurance)
  - Institutional (Institutional Review Board)
  - Investigator (Informed Consent)
- Waiver of Informed Consent - May be obtained for low risk studies.
- "The Final Rule" (1996) - Established mechanism for emergency research.
  - "Exception from Informed Consent" -- not a waiver of informed consent. Done for extraordinary or exceptional studies where consent is not possible. Must obtain community consultation and public disclosure.
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## Biostatistics and Epidemiology

Type of Data	2 Groups	3+ Groups
Continuous Data	Student's T-test	ANOVA
Ordinal Data	Wilcoxon Rank-Sum Test	Kruskall-Wallis Test
Categorical or Binary Data	Chi-Square	Chi-Square

## Tests

- Parametric tests normal distribution
  - T test 2 samples
  - ANOVA > 2
- Regression analysis draw conclusions about correlations
- Enumerative sample obs over time
- Control charts
  - Mean and limits
  - Decrease alpha error by looking beyond 3 STD
- Special cause variation In January intubation success was 50% - why? Cold ETT tubes, new medics
- Common cause variation Ave intubation success id 75% look at process
- Nonparametric testing
  - Not nl distribution
  - Wilcox Kruskal Walls
- Each “sneak peak” adds a 5% risk

## Studies

- Types
  - Cross sectional 1 period of time – snapshot Fast, cheap, cannot correlate cause ->effect, identifies prevalence of Dz not incidence (# of new case)
  - Longitudinal look over time
  - Observational – blood draw
  - Interventional MS vs fentanyl administration
  - Descriptive
  - Correlational – can not assign cause. i.e., solders in Iraq had a shorter time to care vs. Korea. Better survival in Iraq. Can say it was time
  - Case control survive vs non survive good for rare dz need to know outcome
  - Cohort – follow groups and compare outcome look at exposure intubated vs not, Can have sampling and recall bias (Cohort- all march together)
  - Before/after study
  - Randomized control –
    - gold standard not good for delayed outcome, often not practical, often background studies must be done first. Strong evidence for correlation, accounts for confounders,
    - Ethics – researchers must believe that the 2 Rx arms have equipose
- P value
  - If P is < a pre defined value (alpha – often 0.05 1:20) then null is rejected 95% chance findings were not random
- Errors
  - Alpha error False + thinking there is a difference but there is not, pi is signif but...
  - Beta error False - thinking there is no difference but there is, pi is not signif but...
    - P is > 0.05
    - Can be caused by inadequate sampling size

- Power Chance of detecting a treatment effect typically set 0.8-0.95
  - Beta = 1-power chance of missing a true effect
  - Influenced by sampling size, effect size, variability between pts, and alpha
  - Small treatment effect requires a large sample size
- Bad to categorize continuous data i.e., BP 80-90 in 1 group
- Confidence intervals
  - If they don't cross 0 then significant
- **Bonferroni correction** is a method used to counteract the problem of **multiple comparisons**. It is considered the simplest and most conservative method to control the **familywise error rate**

For example, a researcher is testing 20 hypotheses simultaneously, with a critical P value of 0.05. In this case, the following would be true:

- $P(\text{at least one significant result}) = 1 - P(\text{no significant results})$
- $P(\text{at least one significant result}) = 1 - (1 - 0.05)^{20}$ 
  - $P(\text{at least one significant result}) = 0.64.$

#### Cardiac Arrest: General Management

- ~ 30% of prehospital cardiac arrests are in VF upon EMS arrival
- 70-80% of VF converted to perfusing rhythm if shock delivered within first 3 min
- PAD Trial - Survival doubled at sites with AEDs
- Termination of Resuscitation - BLS:
  - 3 periods of high quality CPR
  - 3 AED analyses without shock
  - No ROSC
- Termination of Resuscitation - ALS:
  - Airway management
  - Vascular access
  - Persistent asystole for >20-30 min
  - Persistently low ETCO<sub>2</sub>
- Compression fraction goal is >90%

#### Hypotension and Shock

- $BP = CO \times PVR$
- $CO = SV \times HR$

#### CBRNE

- Levels of PPE:
  - A - Vapor resistant suit, self-contained supplied air
  - B - Splash resistant suit, supplied air
  - C - Splash resistant suit, filtered air
  - D - Normal clothing (e.g. bunker gear)
- Primary versus secondary contamination
  - Primary contamination - Direct transfer from source to person
  - Secondary contamination - Transfer of agent from person to person
- Most medical care should be deferred until after decontamination. Manual airway maneuvers may bridge victims until treatment can be provided.
- "Immediate Danger to Life and Health (IDLH) Environments" -- exposure to airborne contaminants that is "likely to cause death or immediate or delayed permanent adverse health effects or prevent escape from such an environment."
- Blast Injuries:
  - Primary - From shock wave
  - Secondary - From shrapnel
  - Tertiary - From patient being thrown
  - Quaternary - Downstream complications (e.g. compartment syndrome, ARDS, pneumonia)

- Types of gas agents:
  - Vesicants - potent alkylating agents
  - Incapacitating agents - riot control agents such as CS and OC
  - Organophosphates and Nerve Agents - military grade or civilian pesticide
  - Irritant gases:
    - Chlorine - Moderately water soluble, lung irritant
    - Ammonia - Very water soluble, notice irritation immediately
    - Phosgene - Minimally water soluble, goes to alveoli, turns to acid and after time causes ARDS

### Poisoning and Clinical Management

Odor	Agent
Fruity	Isopropanolol, Acetone
Garlic	Organophosphates, Mustard gas
Mothballs	Naphthalene, Camphor
Freshly mown hay	Phosgene

- Titratable Reserve - How much acid/base is required to neutralize an acid or alkali
- Alkalis
  - Injury by liquefaction necrosis or saponification
  - Injury by first contact - oropharynx, hypopharynx, esophagus (most common)
  - Tissue edema occurs immediately
- Acids
  - Injury by coagulation necrosis; eschar formation may prevent injury to deeper tissues
  - Stomach is most commonly involved organ -- pyloric and antral spasm
  - Higher mortality compared to strong alkali ingestion
- Hydrofluoric acid
  - Majority of deaths from cardiac dysrhythmias secondary to hypocalcemia, hypomagnesemia, hyperkalemia, acidosis
  - Lower concentrations = more severe burns
  - Pain out of proportion to tissue injury
  - Treatment: Calcium or magnesium gels; calcium gluconate IV for QT prolongation
- Cyanide
  - Antidote Kit - Contraindicated in combined CO & CN poisoning due to tissue hypoxia
    - Amyl nitrite - forms methemoglobin
    - Sodium nitrite - forms methemoglobin
    - Sodium thiosulfate - Forms thiocyanate (less toxic and removed by kidneys)
  - Hydroxocobalamin - combines with CN to form cyanocobalamin (B12; excreted by kidneys)
- Carbon Monoxide
  - Shifts oxy-hgb curve to left, preventing release of O<sub>2</sub>
  - Binds to iron-containing proteins: Myoglobin (dysrhythmias, cardiac dysfunction), Cytochrome oxidase (metabolic acidosis)
  - Direct injury to endothelium releases nitric oxide -- peripheral vasodilation and hypotension, inflammatory response, increased free radical injury
  - Delayed Neurologic Syndrome - More likely in patients who are more symptomatic initially; more common with LOC in acute poisoning
  - Pregnant women -- Fetal Hgb has higher affinity for CO; mother may have milder symptoms with high fetal toxicity
  - Methylene chloride (in paint thinner/stripper) -- metabolized to CO; Carboxyhemoglobin levels may continue to rise due to continued metabolism/absorptions
  - Indications for HBO therapy -- Mostly symptom-based; CO-Hb >25%; pregnant & CO-Hb >15% or fetal distress
- Organophosphates
  - Bind to ACh-ase, resulting in stimulation of parasympathetic nervous system, neuromuscular junction, and CNS



- Muscarinic receptors - Smooth muscles, glands → SLUDGE, DUMBELSS (bronchorrhea and bronchospasm are killer Bs) Rx atropine
    - Nicotinic receptors - Skeletal muscles, ganglia → Fasciculations, weakness, flaccid paralysis, tachycardia, hypertension Rx 2PAM
    - Brain → Anxiety, HA, slurred speech, tremors/seizure, coma, respiratory arrest, delirium/hallucinations Rx Benzos
  - Nerve Agents
    - G-agents -- Volatile, non-persistent, vapor and liquid threat. Tabun (GA), Sarin (GB; 4-6 hours), Soman (GD; 2 minutes).
    - VX -- Non-volatile, persistent, liquid threat; increased exposure. Aging - 60 hours.
  - Vapor exposure is immediate, liquids may be delayed
  - Avoid succinylcholine -- prolonged effects
  - Antidotes:
    - Atropine - Muscarinic effects does not reverse miosis
    - 2-PAM - Nicotinic effects (removes agent from AChase). 600 mg IM or 1 gram IV slowly (HTN if rapid infusion)
    - Diazepam - CNS effects; administer to severely intoxicated individuals whether seizing or not
  - Observe for:
    - Vapor - 1 hour
    - Liquid - up to 18 hours
- Blistering Agents (including Mustard)
  - Alkylating agent affects macromolecules and DNA. Vapor and liquid threat. Latent period between exposure and effects. Damage through direct contact (eyes, skin, lungs) and systemic toxicity (neoplasm and marrow suppression, increased risk of infection). Treatment is symptomatic
  - Mustard Gas
    - Chemical cell damage (1-2 min); clinical effects (2-48 hours); usually not fatal
    - Blistering of skin and mucous membranes in 4-8 hours
    - DNA damage in 3-5 days
    - Mustard effects -- Eye injury (esp with vapor exposure), Pulmonary (upper airway necrosis, alveolar injury, pulmonary edema), GI (within 24 hours; N/V/D, abdominal pain)
    - Treatment -- Rapid decon 1-2 min after exposure. Do not over-hydrate (not a thermal burn)
  - Lewisite & Phosgene Oxime
    - Causes IMMEDIATE reaction (unlike Mustard and other vesicants that have delayed effects)
    - Effects similar to Mustard, but no marrow effects
    - Hypotension or "Lewisite shock"
    - Treatment -- Decon; British anti-Lewisite (BAL) -- chelating agent (Dimercaprol) only for pts with signs of shock or significant pulmonary injury
- Pulmonary Agents (Phosgene, Chlorine, Ammonia) -- irritant gases; treatment largely supportive
  - Phosgene
    - White cloud / colorless gas; smells like freshly mown hay; 4x heavier than air
    - Low solubility → Minimal early symptoms (symptom-free period for 2-48 hours)
    - Initial symptoms similar to riot agents
    - Attacks alveolar-capillary membranes; leakage of fluid into alveoli (up to 1 L/hr); non-cardiogenic pulmonary edema; hypotension
  - Chlorine
    - Greenish-yellow gas - pungent odor
    - Highly soluble → immediate irritation to eyes, nose, upper respiratory tract
    - Early involvement of upper airway and mucous membranes (burning/lacrimation, rhinorrhea, hoarseness, bronchospasm/dyspnea). Later involvement with greater exposure causes pulmonary edema.
  - Ammonia
    - Colorless, alkaline gas - pungent odor
    - Highly soluble → immediate irritation to eyes, nose, upper respiratory tract
    - Same effects as Chlorine
  - Hydrocarbons
    - Toxicity dependent on viscosity (most important property for aspiration risk), surface tension (low surface tension = increased risk of aspiration), volatility (high volatility = increased risk of aspiration)
    - Pulmonary injury / chemical pneumonitis -- Due to parenchymal injury and loss of surfactant (increased vascular permeability and edema)
    - GI - N/V; Centrilobular necrosis (similar to APAP with delayed presentation)
    - CNS - Slurred speech, ataxia, HA, lethargy, AMS, coma; transient euphoria

- Cardiovascular - Dysrhythmias (VF/VT) and syncope. Sudden sniffing death syndrome (Halogenated hydrocarbons are increased risk; Catecholamine sensitization - caution with Epi in cardiac arrest)
  - Special Toxicities:
    - Chloral Hydrate -- Polymorphic V-Tach
    - Toluene -- Renal tubular acidosis; severe hypokalemia
    - Methylene Chloride -- CO toxicity (unlike inhaled, CO increases over time)
  - Treatment - Decon; No gastric emptying except if <1 hour for: Camphor, Halogenated (carbon tet, PVC, vinyl chloride), Aromatic (benzene, toluene, xylene), Metals (lead/gas), Pesticides
- Radiation
  - Types: Non-ionizing (causes excitement of atoms/molecules; radio/microwave); Ionizing (removes electrons, breaks bonds; alpha/beta/gamma/x-ray; damages DNA and other rapidly dividing cells)
  - Means of exposure
    - Contamination - radioactive materials on clothing
    - Ingestion - MOST dangerous; radioactive materials concentrated by tissues
    - Irradiation - radiation passing through body
  - Irradiation protection principles -- Limit Time (linearly cumulative), Distance (inverse square law), Shielding (Alpha stopped by paper/clothing/skin, Beta stopped by turnout gear)
  - Radiation Sickness -- Prodromal stage (N/V/D, anorexia), Latent stage (hrs to wks), Manifest Illness stage (ARS syndromes), Recovery or death
  - ARS Syndromes -- Bone marrow syndrome (hematopoietic), Gastrointestinal syndrome, Cardiovascular/CNS syndrome
  - Dose Limits
    - 5 rem 5000mrem 0.05 sv = Limit
    - 10 rem 0.1 sv = Limit to save property
    - 25 rem 0.25 = Limit to save life
    - 450 rem LD50
    - A CXR is 10mrem, CT abd is 1000mrem
  - Doses
    - < 200 rads sub clinical
    - 600+ lethal
  - Symptoms
    - The faster the prodrome onset, the higher the dose and poorer the prognosis
    - >200 rads (2Gy) onset 2d
    - >600 rads onset hours
    - >2000 rads onset minutes
  - ARS
    - Prodromal N/V/D\* if\* severe
    - Latent hrs-weeks
    - Manifestation (Bone marrow, GI, CV, CNS)
    -

### Communicable Diseases

- SARS -- incubation 3-10 days (avg 4-5 days); no cases of transmission from asymptomatic cases
- CDC Bioterrorism Agent Categories
  - Category A -- High-priority agents that are easily disseminated or transmitted from person to person. High mortality rates; potential for major public health impact.
    - Anthrax -- Not contagious between people.
      - Cutaneous - Incubation (1-12 days). Papule → Vesicle → Necrotic ulcer with black center/edematous. Usually painless. Case fatality: 5-20% without Abx, <1% with Abx.
      - Inhalational - Incubation (1-7 days). Prodrome (cough, myalgia, fatigue, fever). Possible improvement vs. rapid deterioration with high fever, dyspnea, cyanosis, shock. Pleural effusion with mediastinal widening; meningitis.
      - GI (rare) - Incubation (1-7 days). Pharyngeal lesions, fever, regional LAD. Abdominal pain, N/V/bloody diarrhea. Fatality 25-60%.
      - Anthrax Treatment: Cipro or doxycycline (for 60 days).
      - Post-exposure prophylaxis: Abx for 60 days
    - Botulism -- Not transmissible between people. Patient is afebrile, symmetric facial paralysis, blurred double vision, symmetrical descending weakness (leading to respiratory dysfunction), no sensory deficits. Treatment: Supportive care, Botulinum antitoxins, Botulinum immune globulin.
    - Plague -- Natural vector is the rodent flea. Bubonic or pneumonic forms.

- Bubonic Plague -- Incubation (2-6 days), Inflamed lymph nodes (Buboes; within 24 hours), Blood clotting problems (DIC, small vessel necrosis, purpuric skin lesions)
  - Pneumonic Plague -- Incubation (1-3 days); sudden onset HA, malaise, fever, myalgia, cough; pneumonia progresses rapidly; death from respiratory collapse/sepsis. Contagious via respiratory droplet.
- Smallpox -- Humans are only natural host. Human-to-human transmission via large respiratory droplets; contact with pustular material or scabs; rarely aerosol transmission. Prodrome (incubation 7-17 days), Exanthem (mucous membranes lesions 24 hours before rash; begin in face/hands/forearms and spread to lower extremities then trunk over ~7 days). Lesions on palms/soles.
 

	Variola	Varicella
Incubation	7-17 days	14-21 days
Prodrome	2-4 days	minimal/none
Distribution	Centrifugal	Centripetal
Progression	Synchronous	Asynchronous
Scab formation	10-14 days after rash	4-7 days after rash
Scab separation	1 4-28 days after rash	<14 days after rash
- Tularemia --
  - Ulceroglandular - Most common. Painful maculopapular lesion with subsequent ulceration and slow healing. Painful inflamed regional lymph nodes.
  - Glandular - Regional lymphadenopathy with no ulcer
  - Oculoglandular - Conjunctivitis with regional lymphadenopathy
  - Tularemia Clinical Features - Oropharyngeal (exudative stomatitis, pharyngitis, tonsillitis with cervical LAD), Intestinal (pain, V/D), Typhoidal (fever, hepatomegaly, splenomegaly), Pneumonic, Septic.
- Viral Hemorrhagic Fever -- High mortality (80-90% for Ebola). Abrupt onset of fever, myalgia, HA, N/V, abdominal pain, rash, bleeding manifestations (petechiae, ecchymoses, hemorrhage), CNS (somnolence, delirium, coma).
- Category B -- Second highest priority agents. Moderately easy to disseminate; generally low rates of transmissibility from person to person. Moderate morbidity and low mortality rates.
  - Ricin
    - Ingestion Exposure - Profuse V/D, influenza-like symptoms, hallucinations, seizures, hematuria, hypovolemic shock, MOSF, death
    - Inhalational Exposure - Cough, respiratory distress, bronchoconstriction, pulmonary edema, cyanosis, diaphoresis, influenza-like symptoms, hypotension, MOSF, death
    - Allergic syndrome from exposure to castor bean dust
    - Symptoms occur within 4-12 hours of exposure
- Isolation - used to separate ill persons
- Quarantine - used to separate and restrict the movement of well persons

### Traumatic Brain Injury

- All EMS care is aimed at limiting secondary injury (often from hypoxia)
- Brain killers in TBI:
  - Hypoxia - single sat <90% doubles mortality
  - Hypotension - single SBP <90 in adults and children  $\geq 10$  doubles mortality
  - Hyperventilation - even mild hyperventilation doubles mortality; one study  $\rightarrow$  6-fold inc death. ETCO<sub>2</sub> target should be 35-45 (40). Therapeutic hyperventilation not recommended.
- Concussion
  - Athletes with suspected concussion should be removed from play immediately, not to return in same day. They should rest physically and cognitively until symptoms resolve both at rest and with exertion.

### Assault: Domestic/Sexual/Child

- Domestic/Partner Violence
  - High-risk groups: Separated or divorced females (age 20-24), male with male partner (23% of relationships), pregnant females, disabled females
- Child Abuse - Evidence recovery is rare after 24 hours, but most protocols extend to 72 hours
  - Maltreatment
    - 62% neglect 16% Physical 9.3% sex 7.1% emotional
  - Risk Infants, preverbal, chronic illness
  - Bruising – If you don't crawl you don't bruise
    - Accidental Knees forehead

- Non accidental upper arms thighs, butt, hands, ears, cheeks
  - Can not date bruise by color
  - 50-70% fracture in kids < 1 year are abuse
- Elderly Abuse
  - Risk factors of the abused - Dementia, shared living with abuser, social isolation
  - Risk factors of the abuser - Mental illness, alcohol/drug abuse, dependency, exhaustion, stress, overwhelmed

### Environmental Emergencies

- Hypothermia - Active rewarming in field is generally not recommended. Prevention of further heat loss is very important. Gentle handling; transport in supine position.
- High Altitude Illness
  - Acute Mountain Sickness (AMS) - HA, N/V, anorexia. Tx: Hydration, hold ascent, NSAIDs, O2.
    - With in hours
    - AMS > 8-10K feet HA + 1 of the above sx, Diamox to Rx or prophylax causes met acid resulting in increased vent
  - High Altitude Cerebral Edema (HACE) - Ataxia, AMS, seizure, death. Tx: Descent, Dexamethasone, O2.
    - 2-4 days
  - High Altitude Pulmonary Edema (HAPE) - Cough, severe hypoxia, death. Tx: Descent, O2, PDE-5 (tadalafil).

AMS	HAPE	HACE
HA +1 GI, sleep, fatigue, dizzy	SOB	HA visual SX
Rapid onset Hours	2-4 days	
Acetazolamide	Nifedipine, Tadalafil	DXM

- 
- Drowning/Submersion - >1 hour of submersion unlikely to be resuscitated
- Lightning Injuries
  - Keraunoparalysis - temporary paralysis
  - Delayed rhabdomyolysis and compartment syndromes
- Electrical Injuries
  - AC likely to cause VF. DC likely to cause asystole.

### Respiratory Emergencies

- N/A

### Cardiovascular: ACS/STEMI

- Prehospital fibrinolysis -- Goal of EMS to needle of <30 min. Evidence demonstrates decreased mortality rates.
  - Protocol: Checklist, ASA, Clopidogrel, Tenecteplase (wt based, NTE 50 mg), LMWH or unfractionated heparin

### Stroke/Seizure

- Los Angeles Prehospital Stroke Scale (LAPSS) -- Cincinnati PLUS:
  - Age >45
  - No history of seizures
  - Symptoms <24 hours
  - Baseline function not bedridden or wheelchair
  - Glucose 60-400 mcg/dl
- Stroke care -- avoid hyperoxia

### Diabetic Emergencies

- Hypoglycemia defined as <70 mg/dl
- Oral glucose most common replacement
- IV D50 (D25 for children) or D10 study shows no difference in median recovery time (8 min); IM glucagon takes longer
- Hyperglycemia defined as >200 mg/dl
- DKA mortality is 9-14%; NKHS mortality is 10-50%
- 34-69% of hypoglycemic patients refuse transport
- Up to 9% of all EMS non-transports are diabetic calls

### Renal Emergencies

- Hyperkalemia --> peaked T-waves, lengthening PRI, widening QRS

### OB and Gynecologic Emergencies

- Pregnancy changes:
  - Blood volume increased by >50%
  - HR increased by 10-15%
  - RR increased by 10-15%
  - Cardiac output increased
  - BP decreased or normal

### APGAR Scoring System

<b>Sign</b>	<b>0</b>	<b>1</b>	<b>2</b>
HR	Absent	<100	>100
RR	Absent	Slow, irreg	Good, crying
Muscle tone	Flaccid	Some flexion	Active motion
Reflex Irritability	No response	Grimace	Vigorous crying
Color	Blue, pale	Body pink, ext blue	Pink

### Altered Mental Status

- Recommends not allowing refusal after long acting insulin or oral hypoglycemics

### Procedures and Airway

- Tracheostomy bleeding --> First hyperinflate the cuff
- Pediatric Considerations:
  - Larynx more superior and anterior
  - ET tube size = 4 + [age / 4]
  - ET tube depth = [age / 2] + 12 (cm)

### Orthopedics

- Reduction without anesthetics:
  - Austere environment
  - Pulseless or neurologically devastated extremity

### Trauma

- [Review CDC Trauma Triage Criteria]
- Compartment pressures (as cited)
  - <10 mmHg normal
  - 10-20 mmHg may be tolerated without significant damage
  - 30-50 mmHg can cause tissue toxicity over a few hours

### Behavioral Emergencies

- N/A

### Procedure "Orphans"

- Tube thoracostomy: >1000 ml immediately or >300 ml/hr --> surgery

### Vascular Access

- Lidocaine for IO: 20-40 mg (1-2 ml) for adult; 0.5 mg/kg pediatric
- FAST-1: sternum; age 12+
- Bone Injection Gun: age 12+

### Pain Management

- N/A

### Flight Physiology

- Gas Laws:

- Boyle - effect of altitude on gas volume (balloon; pneumothorax). Volume inversely proportional to pressure.
- Dalton - effect of altitude on O<sub>2</sub> availability (partial pressures). Total barometric pressure = sum of partial pressures. Partial pressure = Total pressure x %gas. As you ascend, % oxygen is same, but partial pressure of oxygen decreases.
- Henry - gas equalization due to pressure changes (open beer can; the bends)
- Charles - effect of temperature on gas volume (oxygen cylinder during cold morning)
- Graham - diffusion of gases from higher to lower concentrations (normal respiration)
- Physiologic Zones
  - Physiologic Zone - SL to 10,000 feet (can adapt to this zone)
  - Physiological Deficient Zone - 10,000 to 50,000 feet (hypoxia)
- Aircraft
  - Helicopters: <15,000 feet
  - Fixed wing turboprops: 6,000 - 18,000 feet
  - Jets: higher with pressurization

## Pediatrics

- Yearly volume of pediatric calls in an EMS system = 4-10% total volume
  - Bimodal age distribution: 0-3 (mostly medical), 13-18 (mostly trauma)
  - 12% of peds calls are ALS
  - Pediatric Assessment Triangle:
    - Appearance -- tone, interactiveness, consolability, look/gaze, speech/cry
    - Work of breathing -- sounds, position, retractions, flaring (infants grunt; kids retract/flare)
    - Circulation to skin -- pallor, mottling, cyanosis
  - Pediatric Trauma Score -- scores <9 predict high mortality
  - Age that child is able to consent/refuse varies by state (14-19 years)
  - Febrile Seizures -- will occur in 5% of children <7 years old
    - If lasts > 5 min give meds
  - Apparent Life Threatening Event
    - An episode frightening to observer characterized by some combination of apnea, color change, marked change in muscle tone, choking, or gagging.
    - Peak incidence 10-12 weeks old
    - 50% have a defined cause discovered on evaluation
  - IO Drill if > 1 yr 10 kg Jamsheedi if <1 yr 10kg
- Epi and adenosine are the same, atropine is 2x epi, anti convulsants are the same, amio = adult dose
- Respiratory distress
    - Stimulate /position
    - Check breathing, if none give 2 breaths
    - If no breathing, reposition 2 breaths
    - Choking
      - If < 1 year 5 back sslaps w/ head down the 5 chest compressions
      - If > 1 yr 5 abd thrusts
  - Hypotension
    - Newborn < 60
    - 1-12m < 70
    - 1-10 yeaes 70 + (2x age)

Epinephrine	0.01mg/kg
Atropine	0.02mg kg
Bicarb	1 meq/kg
Adenosine	0.01mg/kg
Amiodarone	5mg/kg
Glucose Newborn D10	1-2ml/kg
D25	2-4ml/kg
Valium	0.1mg/kg
Midazolam	0.1mg/kg
Lorazepam	0.05- 0.1mg/kg

## Geriatrics

- EMS transport rate for the >65 age group is >4x that of younger population

- Falls are the leading and preventable cause of trauma in the elderly
  - 30% fall annually and 50% repeatedly
  - 25% suffer serious injury

#### Bariatrics

- N/A

#### End of Life Issues

- **Living Will** - Expresses wishes of patient in the event of permanent coma or terminal illness
- **Power of Attorney** - Designates surrogate for the patient. Best if they are available during EMS treatment.
- **Physician Orders for Life-Sustaining Treatment (POLST)** - Communicates patient's preference in form of medical orders in transition between outpatient and inpatient settings; addresses resuscitation, transport, aggressiveness of care

#### Termination of Resuscitation

- Criteria for Adult ALS TOR
  - No pulse in 20-25 min (unwitnessed) or 30 min (witnessed)
  - Asystole
  - Persistent ETCO<sub>2</sub> <10
 Does not apply to persistent VF or hypothermia
- Criteria for Adult BLS TOR
  - 3 rounds of CPR
  - 3 AED analyses without a shock
  - No ROSC
- Criteria for Pediatric TOR -- Ped TOR not widely accepted
  - No pulse after 20-25 min of ALS
  - Most pediatric arrests are transported to the hospital
- Criteria for Blunt Trauma
  - Apneic or pulseless with clearly associated trauma
  - Exceptions:
    - VF
    - Simple airway blockage
    - Pregnant with potentially survivable fetus
    - Becomes pulseless 2-3 min from receiving facility
    - Narrow QRS at >80 bpm
    - Concern for hypothermia or drug overdose
    - CO or CN exposure/toxicity
- Criteria for Adult Penetrating Trauma TOR
  - No signs of life on scene
  - Asystole en route
- Criteria for Pediatric Trauma TOR
  - No literature to guide us; best to transport

#### Social Issues

- N/A

#### Mass Casualty

- Incident Command Priorities: 1. Life safety, 2. Incident stabilization, 3. Property conservation
- ICS Sections - Responsible for a major functional area of the incident. Lead by a Chief. 4 primary sections:
  - Operations - Tactical decisions, situational awareness
  - Planning - Incident action plan
  - Logistics - Service branch (communications, food & water, medical support), Support branch (fuel, maintenance, access to fixed facilities)
  - Finance/Administration - Staffed when significant procurement capabilities are needed; maintains records
- ICS Branches - Used when number of divisions or groups exceed the recommended span of control (3-7). Led by a Director.
- ICS Division - Used to divide an incident geographically. Led by a Supervisor.
- Units - Functional responsibility for a specific activity (e.g. situation unit, supply unit)
- Single Resources - An individual or single piece of equipment with its personnel complement
- Task Force - A combination of mixed resources. Led by a Task Force Leader.

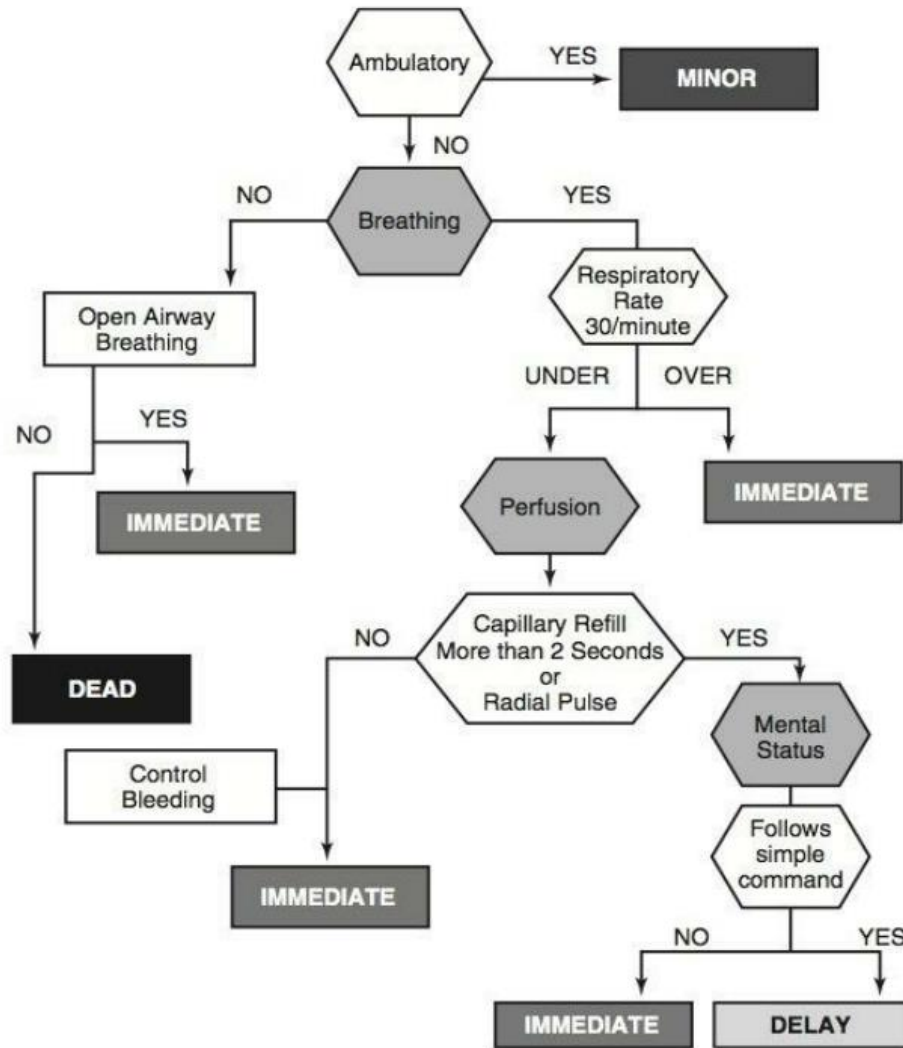
- Strike Team - Set number of similar resources. Led by a Strike Team Leader.
- Staff Positions (interact directly with the Incident Commander; are not included in the ICS span of control constraints)
  - Safety Officer
  - Public Information Officer (PIO)
  - Liaison Officer
- Triage Principles:
  - Reverse Triage - In military, minor injuries treated first so they can maintain security or meet military objectives
  - [Review Triage systems]
  - START Triage
    - Ambulatory?
    - Breathing?
    - Perfusion?
    - Mental Status?
  - JUMP START
    - Able to walk?
    - Breathing? (5 rescue breaths if not)
    - Respiratory Rate?
    - Palpable Pulse?
    - AVPU?
  - Mass Triage
    - Move
    - Assess
    - Sort (wave hand)
    - Send
  - SALT Triage
    - Walk --> 3rd
    - Wave/Purposeful movement --> 2nd
    - Still/Obvious life threat --> 1st
      - Assess for LSI's: Major hemorrhage, open airway, chest decompression, auto injector antidotes

START	Jump Start	SALT Sort Assess Life saving Rx Transport
Walk Spont Breathing? Respiratory rate <30 Perfusion Mental status – Obeys Commands	Walk Spont Breathing? Respiratory rate 15-45 Perfusion Mental status APVU	Walk wave Still Interventions Breathing Y/N Resp / Pulse/ Obeys Commands Likely to survive
Adults Head tilt no other treatment Only expectant is not breathing Not breathing after head tilt-> dead Only not breathing makes you EXPECTANT	Kid version of START Head position Pulse check 5 breaths if not breathing, If still not breathing-> Dead Only not breathing makes you DEAD	Sort- walk, wave, still Life saving interventions -Control bleeding -Tilt head 2 breaths for kids Chest decomp Antidote auto injector

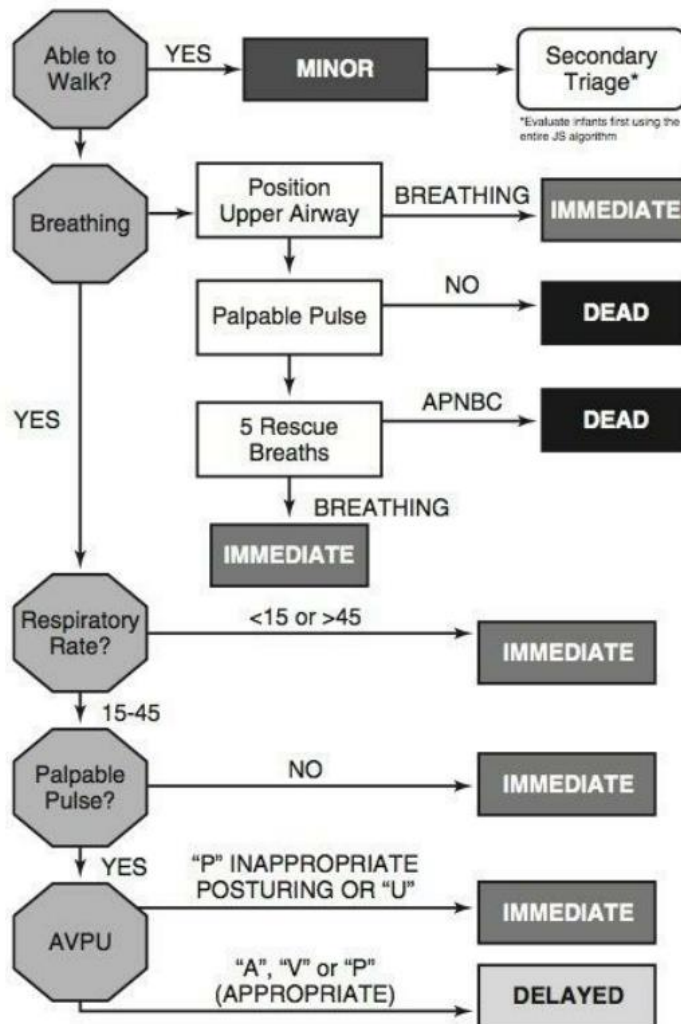
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- Phases of Emergency Management
  - Mitigation
  - Preparedness
  - Response
  - Recovery



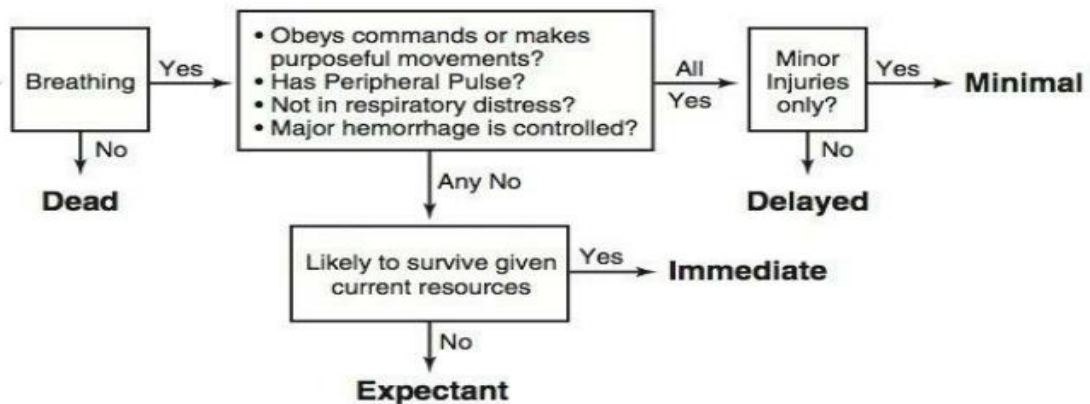
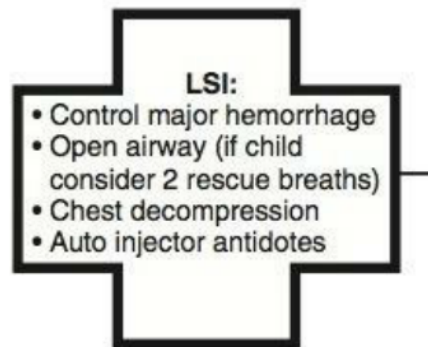
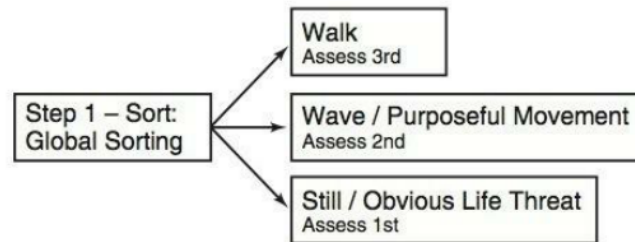
## START Triage



## JUMP START Triage



## SALT Triage



### Mass Gathering Medicine

- Bounded/Focused Events -- Tend to have higher patient presentation rates (PPR). Examples: stadium sporting events.
- Unbounded/Extended Events -- Tend to have lower PPR. Patients may seek care outside event medical plan. Examples: marathons, parades.
- Factors that increase PPR:
  - Bounded/Focused events
  - Events over 6 hours
  - Freely mobile crowds
  - Availability of alcohol and drugs
- Crowd size is less important than event characteristics
- Disaster - "a situation in which the severity of damage or the number of patients exceeds the ability of scene responders and local management authority to provide immediate management"
- Communications:
  - Handheld P25 compliant interoperable radios allow for multiple agencies to share common frequencies
  - Truncated systems prevent walk over

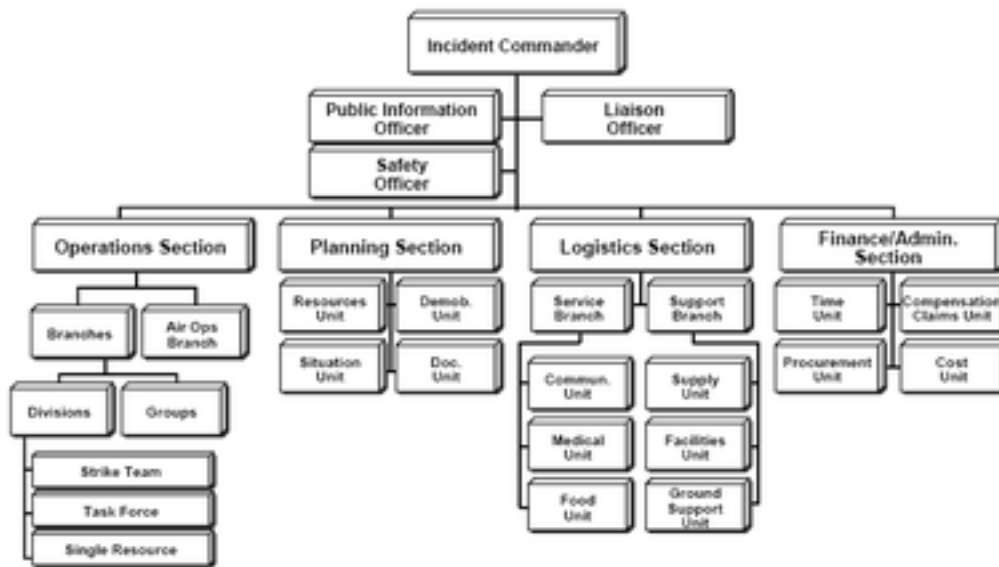
### Explosive Incidents/WMD

- Categories of Community Hazards: Property, Life, Critical infrastructure
- Fusion Centers - Receive, Analyze, Disseminate, Gather. Owned and operated by state and local entities (with support from Federal partners)

### Catastrophic Events

- NIMS
  - First developed in response to wild land fires in western US (1970)
  - Outlines common terminology, concepts, and management approaches regarding response operations
  - Simple design, sharing characteristics with battle proven military command structures
  - Designed to coordinate multiagency multiple jurisdictional responses to large-scale emergencies (allows interoperability for various participants by using common language and definitions)
  - Is a fixed framework, but not a fixed structure
- National Response Framework
  - Consists of 5 parts: Core document, 3 sets of annexes, and partner guides
  - Core Document:
    - Who - roles and responsibilities
    - What - response actions
    - How - response organization
    - Planning - a critical element of effective response
    - Additional resources - the national response framework resources center
  - Annexes
    - Emergency Support Functions - Provide structure and means of grouping functions frequently used to provide federal support to states and federal-to-federal support
      - 1. Transportation
      - 2. Communications
      - 3. Public Works and Engineering
      - 4. Firefighting
      - 5. Emergency Management
      - 6. Mass Care, Emergency Assistance, Housing, and Human Services
      - 7. Logistics Management and Resource Support
      - 8. Public Health and Medical Services
      - 9. Search and Rescue
      - 10. Oil and Hazardous Materials Response
      - 11. Agriculture and National Resources
      - 12. Energy
      - 13. Public Safety and Security
      - 14. Long-Term Community Recovery and Mitigation
      - 15. External Affairs
    - Support Annexes - Describe functional and administrative processes that are required for each event
    - Incident Annexes - Discuss policies and the situation (planning assumptions), concept of operations, and responsibilities related to each of the events described
- Incident Command System (ICS)

- Unity of Command - Each member of the team regardless of the assigned position reports to and is responsible to only one person
- Span of Control - No leader is directly responsible for more than 3-7 personnel or functions



Task Force – Mixed group of responders (Fire, Police, EMS)

Strike Team – All of the same type of responders. i.e., 4 fire trucks

Command	
Section	Chief
Branch	Director
Division	Supervisor
Group/Unit	Leader

#### Note Staff Positions – PIO Liaison Safety

- Disaster Relief and Emergency Assistance Act (Stafford Act)
  - Establishes process for requesting and obtaining a Presidential disaster declaration
  - Defines the type and scope of assistance available from the Federal government
  - Sets the conditions for obtaining that assistance
- FEMA/EPR assistance falls in 3 categories:
  - Individual Assistance
  - Public Assistance
  - Hazard Mitigation Assistance
- Posse Comitatus Act
  - Federal military can't act as police/surveillance
  - Exceptions: Martial law (civil disorder), civil defense operations authorized by statute, Acting in military role of defense of country; does not apply to national guard troops under governor's command
- Restoration Act
  - President can use federal forces to restore law and order to a state
  - May occur in: Major public emergency, civil disobedience
  - Must notify Congress and repeat every 14 days
- Emergency Management Assistance Contracts (EMACs)
  - Made state with another state
  - Temporary recognition of licenses
  - Activated by state governor
- National Disaster Medical System (NDMS)

- Partnership with DOD, FEMA, DHS, and Public Health Service Commissioned Corps Readiness Force. Comprised of 3 components:
  - National Disaster Medical Assistance Teams (DMATs) - volunteers; provide onsite medical care
  - Global Patient Medical Requirements Center (GPMRC) - coordinates transportation out of the area for victims, and works in conjunction with the US Transportation Command for airlift capability
  - Definitive care of these patients is provided by ~1500 volunteer hospitals across the US
- DMATs
  - Volunteer system for onsite medical care
  - "Emergency departments in a tent" providing patient care and evacuation services
- USaR
  - Consist of ~85 personnel
  - Self-sustaining for 14+ days
  - Include advanced medical, communication, search, and rescue capabilities
- Weapons of Mass Destruction Support Teams (WMD CSTs)
  - Full time National Guard personnel, trained and equipped by the federal government
  - Often considered state resources until activated by the federal government
  - Capable of initial recognition and decontamination of a variety of WMD agents
- Public Health Service
  - Tier 1 - Public health rapid deployment force teams of 105 members for deployment within 12 hours. 3 such teams exist.
  - Tier 2 - Applied public health teams; Mental health teams.
  - Tier 3 - All active-duty commissioned PHS officers not already deployed
  - Tier 4 - Inactive reserve corps
- Medical Reserve Corps
  - Volunteers from all aspects of the community
  - MRC supplies medical workers to assist in facilities where local medical community is overwhelmed, displaced, or unable to meet demand
  - MRC can provide shelters, medical care to evacuees, and veterinary services
- State and Federal Assets:
  - Strategic National Stockpile
  - Regional ChemPacks
  - Metropolitan Medical Response System (MMRS) / Urban Area Security Initiative (UASI) - funded caches of medical equipment and medications

### Special Response Considerations

- Core Concepts of Resource Management:
  - Consistency - standardized methods to identify, acquire, allocate and track resources
  - Standardization - resource classification to improve effectiveness of mutual aid agreements
  - Coordination - facilitation/integration of resources
  - Use - incorporating all available resources (local, government, non-government)
  - Information Management - integration of communications and IT elements
  - Credentialing - criteria for training, licensure, and certification
- Principles
  - Planning
  - Use of agreements
  - Categorization of resources
  - Resource identification / ordering
  - Effective management of resources
- Resource Management
  - Identify requirements - pre-existing agreements is key
  - Order and acquire
  - Mobilize
  - Track and report
  - Recover and demobilize
  - Reimburse
  - Inventory

### Tactical EMS

- Team member safety is a super-priority
- Patient care is extremely focused on stopping immediate life threats and extraction to safety
- Care in hostile environment:

- Sensory Deprivation Physical Assessment (SDPA)
  - Sensory Overload Physical Assessment (SOPA)
- Zones of Operation
  - Inner Perimeter (inside is "Hot Zone") - controlled by the tactical team
  - Outer Perimeter (outside is "Cold Zone") - the larger area of law enforcement operations
  - Hot Zone - LSIs and extraction
  - Warm Zone - risk/benefit of interventions considered; evacuation still key
  - Cold Zone - more definitive management
- "Call-A-CAB 'N Go"
  - Call for help, communicate
  - A: Abolish threats
  - CAB: Circulation, Airway, Breathing
  - 'N: Neurologic status check
  - Go: Extricate patient to ambulance, then appropriate hospital
- Tactical Combat Casualty Care (TCCC)
  - Primary Goals:
    - Treat the casualty
    - Prevent additional casualties
    - Complete the mission
  - 3 Phases of Care:
    - Care under fire
    - Tactical field care
    - Tactical evacuation care

#### Wilderness EMS

- BLS Levels
  - Wilderness First Aid (WFA) - 8 hours
  - Wilderness First Responder (WFR) - 70 hours
  - Outdoor Emergency Care Technician (OEC-T) - Ski Patrol; 100 hours
  - Wilderness EMT - 150 hours
- ALS Levels
  - Wilderness AEMT/Paramedic
  - Wilderness Mid-Level Providers (PA, NP, etc)
  - Wilderness Physician

#### OPALS Study

- Improved response time improved survival
- ALS did not
- Better survival if < 75, Bystander CPR, early defib
- Respiratory illness ALS improves outcome Albuterol, NTG

#### Hypothermia for post arrest

- Better survival but more sepsis, bleeding. Pneumonia

#### Military

- Casualty collection points triage immediate care
- Ambulance exchange points i.e., Amb-> helicopter

#### Aeromedical

- The atmosphere
  - 18,000 ft 1/2 ATM
  - Sea level 1ATM
  - 33ft below 2ATM
- Gas laws
  - Boyles Pressure = 1/vol

- Dalton Sum of pressures i.e. O<sub>2</sub> is always 21%
  - Henrys gas in liquid soda bottle
- PPE
  - LEVEL A Encapsulated Splash AND Vapor
  - Level B Splash SCBA
  - Level C APR PAPRs (cartridges) O<sub>2</sub> level must be OK Must have the right cartridge
  - Level D duty uniform including fire turn out

## TEMS

- Hot Zone open airway, tourniquet No CPR No intubation
- Warm Zone Needle decomp, IV, immobilize

## Explosions

- Thermal- short duration
- Blast wave 1,000S of MPH
  - Positive
  - Negative

## Animals

- Horses Bad when RR> HR nl HR ~ 40 ?
- Dog ketamine 5-22mg/kg Epi 10-20ug/kg

## QA

- Donabedian
  - Structure- Process- Outcome
- JCAHO
  - Clinical indicators i.e., data, measurable, not quality indicators
    - 2 types
      - Sentinel – investigate every case
      - Rate – Does the event occur at a rate higher than expected
- Demming
- Bell Curve
  - +/-1 STD 65%
  - 2 STD 95.5 %
  - 3 STD 99.73 %
  - six sigma looks at the 0.27% outside of 3STD

## Neurology

- Back pain and SCI
  - MVA, Falls, Sports, Violence
- TBI
  - Fire arms\*, MVA, Falls \*in males self inflicted

## Utstein

- Bystander CPR
- Witnessed
- # Shocks



- Initial rhythm
- Any ROSC
- CPC