



What If ?.....

**EMERGENCY PREPAREDNESS AND
DISASTER RESPONSE FOR RESPIRATORY
AND CRITICAL CARE PROFESSIONALS**



DISCLOSURES

- Frank G. Rando is a co – owner of TEACH 2 PREPARE ,LLC ,a training and consultancy entity . Mr.Rando is also an independent government contractor.
- No financial disclosures or conflicts of interest to report at this time.
- Ms.Dee Ruelas , consultant and business associate assisted with the design and delivery of the original version of this presentation
- All opinions and subject matter are those of the author and based on current scientific,medical and emergency preparedness and response concepts and and do not present official policies of any one organization. Please follow your organization's policies, protocols and procedures .

Disasters and Healthcare: Objectives

- Provide you, the respiratory care and critical care provider, with an overview of healthcare emergency preparedness and response.
- Discuss ways that disasters affect healthcare delivery systems, public health , providers and affected populations.
- Ways that disasters challenge the healthcare delivery systems ,public health and health professionals with emphasis on respiratory care and critical care operations.
- Your roles and responsibilities in emergency preparedness, mitigation, response and community resiliency and recovery.



A Unique Marriage: Health Care & Emergency Management

- Public has strong expectations of the roles of health care delivery systems should play in disasters.
- Commonalities of preparedness in the healthcare setting include fire safety, back up power and the ability to surge and handle victims of a mass casualty event ,so part of the framework already exists to be built upon and expanded.
- Healthcare facilities are expected to provide both emergency care and continuance of the day-to-day healthcare responsibilities regardless of the volume and demand (under an *ideal paradigm ,which in a disaster /mass casualty event would be altered and even austere. Standards of care may be severely impacted and modified and triage and scarce resource allocation protocols may be implemented utilizing triage based decision making*
- Public perception and expectations that healthcare institutions are bastions of safety in a threatening and dangerous environment and considered facilities for community refuge
- The terrorist attacks in the Fall of 2001 and the Northeast Blackout of 2003,the public flocked to hospitals ,even when they DID NOT require medical care..

A Unique Marriage : Health Care & Emergency Mgmt.(cont'd)

- **Comprehensive Emergency Management (CEM) –**
- With increased intelligence that of the vulnerabilities of healthcare infrastructure and the desire of terrorists to exploit this, institutions have focused **limited** resources on safety and security **rather** than comprehensive emergency management efforts and activities.
- Healthcare systems have discovered that changes in preparedness and planning for hazards and vulnerabilities have been necessary to address the total and evolving threat spectrum . This utilizes and an “ **All-Hazards” approach** which can be applied across all hazards and vulnerabilities that may befall a community and its healthcare institutions.
- Non-healthcare entities play key roles in both community –wide and healthcare preparedness, eg. emergency management and public health agencies and initiatives on mass vaccination ,pandemic planning ,increasing capabilities of HCFs to perform HAZMAT response with decontamination of contaminated casualties **and** providing life-saving therapeutic interventions simultaneously.

A Unique Marriage: Health Care & Emergency Mgmt. (cont'd)

- Roles of the hospital in emergency management and population health can be seen in revised mandates, regulations, and even accreditation standards eg., JCAHO change from placing emergency preparedness standards in the Environment of Care section to placing the standards in a separate and distinct section with specific goals and requirements .
- Release of the OSHA document ***Best Practices for Hospital –Based First Receivers*** which delineates personal protective countermeasures and equipment (PPE) for health care personnel.
- Healthcare - Providing community-based healthcare for individuals.
- Emergency Management- Goal is to assist the largest number of people (entire populations) with the limited resources that are available and within the various phases of crises ,emergencies ,disasters and catastrophic events .
- ***Healthcare system must think outside the proverbial box and whether planning /preparing or operating in a disaster response mode, address the affected population with scarce resources!***

Health Objectives of Emergency Preparedness

- Prevent morbidity and mortality and optimize clinical outcomes
- “ Do the most good “ Triage & resource allocation
- Provide care for casualties and manage fatalities
- Manage adverse climatic ,environmental and austere operational challenges
- Protect staff , public health, healthcare infrastructure , and medical assets
- Ensure restoration of normal health and wellbeing
- Reestablish health services

Emergency Preparedness Cycle



What is Emergency Preparedness ?

- **Emergency Preparedness** – A continuous and comprehensive cycle of planning ,organizing, training ,equipping ,exercising, evaluating and taking corrective action in an effort to ensure effective and safe mitigation ,response , resiliency and recovery for both natural and man-made events .eg. severe weather , terrorism , technological disasters, public health emergencies and other crises ,emergencies ,extreme and catastrophic events ,eg. active shooter /active killer events ,civil disorders ,etc.
- **Individual preparedness** - The basic element of all preparedness efforts
- **Family preparedness**
- **Institutional preparedness**
- **Local/community preparedness**
- **State /regional preparedness**
- **National & international/global preparedness**

What is Emergency Preparedness (con'td)

- First, **ALL** disasters begin as *local events*, and initially handled as a local response. Local and integrated emergency preparedness activities, such as training and exercises, need to be conducted regularly.
- Healthcare and public health systems are considered **critical infrastructure** by the Department of Homeland Security (DHS), and are involved in regular emergency preparedness activities.
- An “**all-hazards**” approach is used that considers **disaster commonalities/similarities**, which can be used in preparedness and applied to a wide variety of emergency and disaster situations.
- Conducting a **Hazard Vulnerability Assessment/Analysis (HVA)** of a community is essential to determine what types of threats exist, emergencies and disasters can occur, and the most likely to impact your community and workplace.
- Eg. Hurricanes are not likely to occur in Tucson, but, earthquakes, infectious disease outbreaks, terrorism, industrial accidents & severe weather are.

Identifying Community Hazards

- **Activity....Let's think about it, shall we?**
- **Identify three hazards (natural, technological ,or human-generated) within your local community.**
- **What hazards may be present and occur on a regular basis in your community?**
- **How might these hazards impact your role as a health care provider, and citizen?**
- **Give and briefly share an example of a disaster or other emergency that you experienced and how you dealt with it.**



Hazard Vulnerability Assessment (HVA)

- The use of “**C-A-R-V-E-R + Shock**” model
- Originated from military
- Adaptable to all civilian sectors and infrastructures
- Especially useful in terrorism threat assessments
- Criticality
- Access
- Recuperability
- Vulnerability
- Effect
- Recognizability
- Shock-any impacts or consequences ,e.g. physical, psychological, economic



Emergency Operations Plan/Continuity of Operations Plan

- A written and ***rehearsed*** “all –hazards ”plan ,based on an all-hazards vulnerability and threat assessment that gives clear direction as to actions, precautions, notifications and other essential information for a variety of emergency conditions, whether internal or external.
- ***The EOP addresses the acute,emergency phase of an incident or event .***
- ***COOP/BCP-It addresses the question “How can a business continue to operate when power or other critical infrastructure fails?” i.e. ,The HCF where you work.***
- ***Business continuity planning helps organizations determine how their business will survive a disaster.***
- 1).Identify points of failure within an organization based on specific hazards the organization is likely to encounter and
- 2). To develop a prioritized strategy (whats most important) to prevent failures,minimize the impact of failures (mitigation) when prevention is not possible,and return to normal following those failures (resiliency and recovery)
- **AN EOP/COOP ARE ESSENTIAL TOOLS AT THE ROLE –SPECIFIC /DEPARTMENTAL LEVEL AND ORGANIZATIONAL LEVEL**

The EM Cycle / Disaster Continuum



National Incident Management System (NIMS)

- NIMS- *What is it?....* http://www.fema.gov/pdf/emergency/nims/NIMS_core.pdf
- *A comprehensive guide that can be used by communities and organizations (eg.,HCFs) to help plan for disasters and to manage incidents.*
- *It provides a common framework for governmental and nongovernmental entities during an incident or event.*
- 5 components:
- Preparedness
- Communications and Information Management
- Resource Management
- Command and Management, Ongoing Maintenance

National Response Framework (NRF)

- *What is it?...*
- *As per the U.S. Department of Homeland Security (DHS), the NRF details how the nation conducts all-hazards response for small and large incidents.*
- *NIMS and the NRF are companion documents –NIMS is a template for the management of ALL incidents; the NRF provides the structure and mechanisms for national-level incident response policy.*
- *Emergency Support Functions (ESFs)- Provide the structure for coordinating federal interagency support for a federal response to an incident .*
- *ESF #8- Medical Care and Public Health*

PANDEMIC & BIOLOGICAL THREATS : MANAGEMENT STRATEGY FROM HSPD- DIRECTIVE # 10

Homeland Security Presidential Directive # 10

- | | |
|-----------------------------|---|
| ▪ “ Pillars “ of strategy : | Defined for healthcare environment: |
| ▪ Threat Awareness | Situational Awareness |
| ▪ Protection and Prevention | Protection of healthcare infrastructure & staff |
| ▪ Surveillance | In- house infection prevention and control |
| ▪ Detection | Prevention of disruptions in service delivery |
| ▪ Response & Recovery | Organized ,timely surge medical response &
recovery to the previous steady state |

Incident Command System (ICS)

- *What is it?...and WHO's in Charge??...(SEE video:http://cts.virginia.edu/incident_mgnt_training.htm)*
- *A system designed to organize and coordinate response at the scene of an incident or event.*
- *Provides a configuration and a common language that assist different agencies ,institutions, and professionals work together.*
- *ICS is a flexible management system*
- *It has a top-down structure with a single person in charge ,the INCIDENT COMMANDER.*
- *It creates order out of chaos*
- *www.fema.gov/independent study.. ICS-100,200,700,800.*

HICS : Hospital/Healthcare Incident Command System

- HICS- A methodology for using ICS in a hospital/healthcare environment .
- (<http://training.fema.gov>) Independent Study courses IS-100.HC,IS-200.HC)
- (<http://www.emsa.ca.gov/HICS/default.asp>)
- A single Incident Commander (IC) is responsible for all aspects of the disaster response, whether operational or medical.
- Initiating HICS requires the declaration of an internal disaster or an external disaster to activate the Hospital/Healthcare Emergency Operation Center (HEOC) ,to implement the , based upon the nature and extent of the disaster, to organize the disaster response through designation of section chiefs (*General Staff*) and staff officers (*Command Staff*).
- Functional job action categories:Command and Staffing (“ The Leaders”),Finance and Administration (The Payors”),Logistics (“ The Getters”), Operations (“ The Doers”) and Planning and Intelligence (“ The Thinkers” and “ The Predictors”). Remember mnemonic “CFLOP”. Command staff includes:Liasion ,Medical/Technical/PIO and Safety Officer.

EMERGENCY PREPAREDNESS FOR HEALTHCARE PROFESSIONALS: TRAINING AND PROFESSIONAL DEVELOPMENT

- POST 9/11 – With the inception of the U. S. Department of Homeland Security (DHS), there has been a plethora of preparedness activities for First Responders, Healthcare .Public Health .
- *Training, education ,drills and exercises are the cornerstone of preparedness*
- National Domestic Preparedness Consortium
 - Academic institutions ,centers and facilities funded by the DHS to provide no-cost training to local, state , territorial and tribal responders.eg. Center for Domestic Preparedness ,Anniston ,Ala.
- Federal Emergency Management Agency –Emergency Management Institute and National Fire Academy, Emmitsburg,Maryland Independent Study Program (FREE)
 - Residential & on-line learning opportunities, integrated into health professions academic programs.
- Conferences, seminars /webinars and workshops
- Professional and trade journals
- Agency in-services , continuing education credits from educational companies

TRAINING AND PROFESSIONAL DEVELOPMENT

- PREPAREDNESS EXERCISES: BASICS (NOT A COMPLETE LIST)
- Table-Top (TTX):Involves key personnel discussing simulated scenarios in an informal setting.
- Drill: A coordinated ,supervised activity usually employed to test a single ,specific operation or function within a single entity.
- Functional (FE):A “non-boots on the ground” which examines/validates the coordination, command, control between various multi-agency coordination centers.
- Full-Scale (FSE):Is a multi-agency ,multi-jurisdictional ,multi-discipline exercise involving functional *and* “ boots on the ground” response.

What are we preparing for?...

What is a Disaster?

- An emergency of such severity and magnitude that routine procedures or resources cannot effectively manage its consequences.
- ***Simplified definition: When Needs EXCEED resources. A catastrophic event requires even more extensive planning and preparedness than a disaster.***



AMA- National Disaster Life Support Paradigm

- **D**etection
- **I**ncident Command
- **S**cene Assessment-Safety& Security
- **A**ssess Hazards
- **S**upport
- **T**riage/Treatment/Transport
- **E**vacuation
- **R**ecovery/Resiliency
- **REMEMBER : D-I-S-A-S-T-E-R**



The “New Normal”

- Emerging infectious diseases and viral mutations on the rise. Epidemics and pandemics are inevitable, eg. **SARS-Cov-2/COVID-19**, *emerged variants*.
- Wars, conflicts, civil unrest, political violence and asymmetric threats to our homeland increasing. Possible uses of chemical and biological warfare agents, explosive and incendiary devices, toxic industrial chemicals and materials used as Weapons of Convenience and Opportunity, use of riot control agents, radiological materials, cyberthreats.
- Climate change seems to be generating more severe weather events, globally and domestically.
- **CLIMATE CHANGE ALSO INFLUENCES DISEASE VECTORS / INFECTIOUS DISEASE EPIDEMIOLOGY AS WELL AS OTHER ILLNESS / INJURY**, eg, HEAT –RELATED ILLNESS, FLOOD-RELATED ILLNESSES AND INJURIES, WILDFIRES, ETC.
- Ecosystem disruption, environmental degradation, (eg., deforestation, pollution, etc.), may initiate, exacerbate or act synergistically to create disaster-extreme/catastrophic events, eg. such as pandemics, large toxic algal blooms, air pollution emergencies and mass toxicological exposures
- Critical infrastructure and societal support systems deteriorating.
- Technological disasters and catastrophic failures, eg., Industrial fires, explosions and toxic/HAZMAT releases, power failures, nuclear reactor meltdowns.
- Complex humanitarian emergencies.
- Increased and sustained psychosocial stressors and deleterious mind-body interactions and behavioral health issues for affected populations and healthcare providers/caregivers.

Preparedness: You NEVER know...and..."YO-YO"... ***(You're On Your Own)***

- ***Disasters and emergencies are like a box of chocolates..You never know what you're going to get..***



Types of Disasters

▪ *Natural Disasters*

- Earthquakes, hurricanes, tornadoes, wildfires, drought, excessive heat, floods, naturally-occurring re-emerging and emerging infectious diseases, eg. Influenza, Ebola viral disease
- ***Na-Tech Event- Natural disaster causes secondary technological disaster ,eg. Japan earthquake generated tsunami which caused Fukushima Daiichi reactor meltdown***

▪ *Technological Disasters*

- Fires, explosions, nuclear reactor accidents, chemical and oil releases, power failures, structural failures, laboratory accidents

▪ *Human-generated Disasters*

- Terrorism, war, riots/civil disturbances/complex humanitarian disasters



Disaster Commonalities

- Mass casualties/Mass fatalities
- Extensive resource needs
- System overload
- ***Inadequate planning***
- ***Inadequate training***
- ***Poor execution of ICS (Incident Command System)***
- ***Limited communications capabilities***
- ***Psychosocial needs – Larger “footprint” than physical effects***



How Do Disasters Affect Healthcare ?

- ***SPACE- Is there enough space for patients, HCWs, supplies and equipment? Can we create space? Improvise? Convert? Alternate sites, gym, auditoriums, cafeteria, parking lot?***
- ***STUFF- Do we have enough supplies and equipment, eg dressings, bandages, solutions, injectables, linen, examination tables, oxygen, ventilators, emergency food, generator, N-95-masks, gloves, sutures, etc.? Can we re-supply? From where? Do we have a list of vendors that can guarantee supplies in a disaster ? What about Strategic National Stockpile (SNS) assets?***
- ***STAFF- Call list ,phone tree for additional personnel? How will additional staff be contacted? What if communications and transportation systems are affected? Will our families be OK ,if we come to work to help? Who will feed my pet? Can we interface with volunteers such as the local Medical Reserve Corps (MRC), Community Emergency Response Team (CERT), Federal NDMS Disaster Medical Assistance Team (DMATs)?***

Disaster Epidemiology

- Disasters generate an epidemiologic profile.
- Each disaster is a “disease process” and a “disease generator”.
- Disasters may result in multiple public health challenges ,eg infectious diseases outbreaks, loss of critical infrastructure , psychosocial effects ,etc.
- Complex multifactorial injury/illness matrix may be observed.
- Disasters create austere operational settings.
- Projected epidemiological profiles should be used in pre-disaster planning.



Mechanisms of Harm & Health Effects

- **Thermal** Incendiary injury
- **Etiological** Infectious disease
- **Asphyxiating** Oxygen deficiency
- **Mechanical** Structural collapse
- **Chemical** Toxic & corrosive
- **Psychological** PTSD
- **Radiological** Radiation illness
- ***“TEAM CPR”-acronym***



CASUALTY ASSESSMENT

- **Airway**
- **Breathing**
- **Circulation**
- **Disability**
- **Exposures**

Toxidrome – A constellation of S&S indicating a toxic syndrome

Eg. Nerve Agent toxicity

Biodrome – A constellation of S&S indicating a biological / infectious disease syndrome

Eg ,Severe febrile illness

Living Terrors: Re-emerging and Emerging Infectious Diseases

- Severe febrile respiratory illnesses and infectious diseases that pose direct or indirect respiratory compromise are on the rise and require intense and expansive resources and care. Direct infection of pulmonary tissue and/or systemic responses and complications to infection ,eg. cytokine storm /hyperimmune response ,sepsis can lead to pathology such as alveolar-capillary leak and full-blown ARDS with subsequent respiratory failure or septic shock which manifests itself with increased vascular permeability, vasodilation caused by actions of endotoxins and other biochemical mechanisms .This results in circulatory collapse ,hypotension ,poor tissue perfusion and oxygen delivery .
- ARDS and its sequale ,such as Acute Respiratory Failure, are associated with many infections and their pathophysiologic mechanisms ,e.g, **SARS- Cov-2 /COVID -19** related illness, *highly pathogenic avian influenza (HPAI)* , *smallpox (Variola major)* ,*monkeypox*, *Viral Hemorrhagic Fever* such as *Ebola* ,*Marburg* and *Lassa* fevers, *Hantavirus*,bacterial agents such as *Bacillus anthracis* which causes *anthrax*,*Y. pestis* which causes *bubonic plague* and its variant *pneumonic plague*, *F. tularensis* which causes *tularemia* and several other *biohazardous threat agents*.
- *It is essential that RTs and critical care staff prevent HAIs in mass casualty respiratory and critical care environments and practice scrupulous infection control !*

PANDEMIC: SARS CoV-2/COVID-19 RELATED ILLNESS

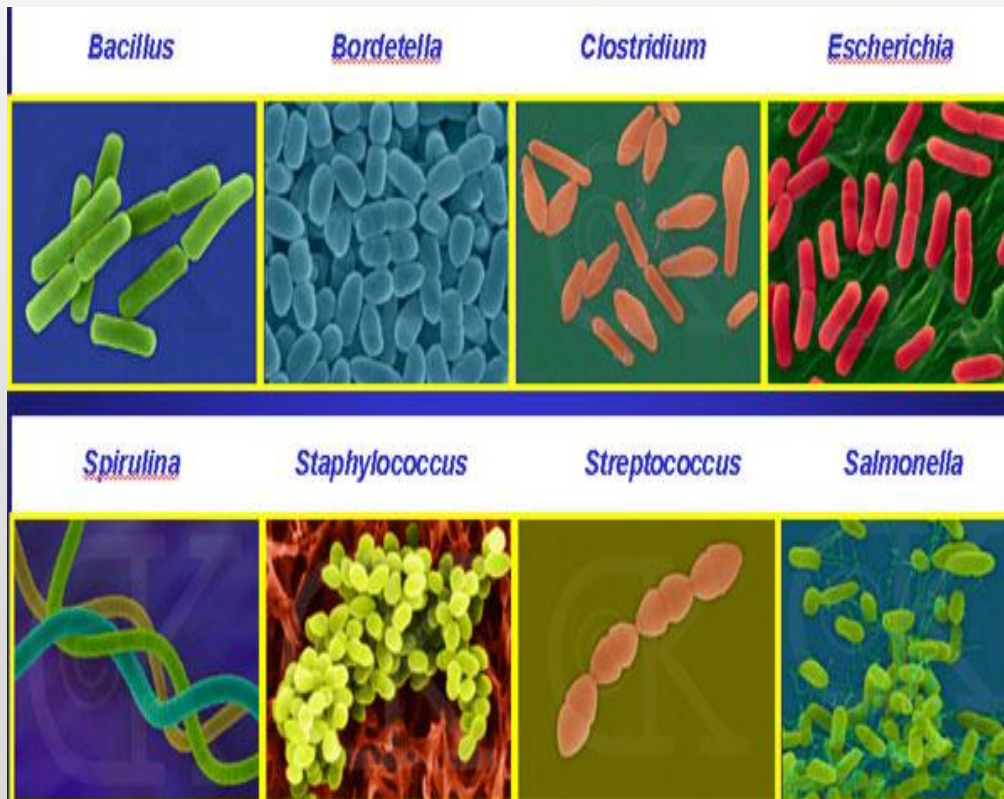
- Zoonotic disease involving trans-species jump ,bat-snake- pangolin-human connection?
- Origin?
 - Natural? Bat vector ?
 - Anthropogenic?
 - “Wet” market?
 - Lab accident ?
 - Infected research staff resulting in community spread ?
 - Biowarfare/Bioterrorism ?
- Coronavirus- novel coronavirus (SARS-CoV-2) and variants
- Mammalian, single –stranded RNA virus
- Four main structural proteins : spike(S), membrane (M),nucleocapsid (N) and envelope (E),which are encoded inside the 3’ end of the viral genome.
- Recognizes angio-tensin converting enzyme II (ACE2) receptors which are ubiquitous throughout various human systems such as lungs, cardiovascular, G.I. ,reproductive tissues,etc. . Binding occurs between virus and ACE2 receptors – leads to infection, intracellular replication and various disease manifestations which may require extensive critical care resources ,including mechanical ventilation

PANDEMIC PITFALLS : CHALLENGES IN PREPAREDNESS

- Novel viral pathogen with rapid spread potential and no known diagnostics or medical countermeasures. Exposed populations highly susceptible to infection and critical illness.
- Strategic National Stockpile (SNS) depleted of critical supplies and equipment during prior H1N1 outbreak and not inventoried and replaced.
- PPE and mechanical ventilators in very short supply nationwide.
- Insufficient critical care beds and key healthcare staff
- Hospitals using “just in time” purchasing strategy not designed for resupply during disasters and catastrophic events.
- EMS and healthcare delivery systems stressed and overwhelmed by patient surges
- Triage and scarce resource allocation protocols instituted .
- Politicization of public health/pandemic emergency, errors in risk assessment and risk communications .Creation of fear, anxiety ,panic, uncertainty
- Acute need for rapid mobilization of PPE, ventilator and vaccine production and distribution.
- Inadequate /inaccurate/misleading risk and threat assessments and risk communications by health authorities and political leaders. Inconsistent public health measures .

BIOHAZARDOUS THREAT AGENTS

MICROBIAL THREATS



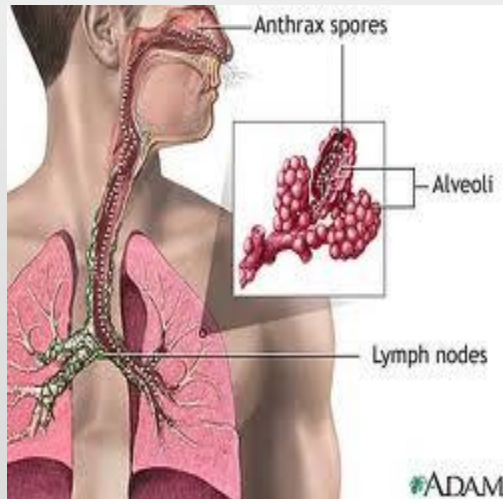
VIRAL THREATS



Bioterrorism: Bacillus anthracis- High threat “select agent”

Large, spore-forming Gram-positive rod –shaped bacterium.

Common in farm and wild animals



Research Lab, Toxic Warfare –Chemo-terrorism or Meth Lab?

Acute & Chronic Respiratory & Systemic Effects



WMD-CBRN FOR RESPIRATORY- CRITICAL CARE

THE THREAT ENVIRONMENT

Recent uses of nerve agent, chlorine and explosives on civilian populations in Syria and terrorist plans for use of CBRNE agents against Western countries and other nations. Prolific IED use. Nerve agents utilized for targeted political assassinations in major Malaysian airport and in suburban areas in England. Radiological poisoning of former Russian FSB agent , dissident and journalist in major urban area utilizing potent radionuclide, Polonium -210. Theft and diversion of nuclear material.

Widespread availability of sophisticated biotechnology to modify microorganisms or create novel pathogens, lapses in bio-safety and biosecurity. Use of emerging pathogens for bioterror.

Low -tech attacks possible using common substances and materials, food and chemical sector vulnerabilities, increasing international tensions , crime, political violence and terrorism. Toxic Industrial Chemical and Materials may be easily used as Weapons of Opportunity & Convenience (WO/C),



The Tragedy of Bhopal

Dec. 3rd 1984

the worst ever
industrial disaster
happens in Bhopal

Just after midnight a cloud of toxic gas leaked from a Union Carbide pesticide factory in Bhopal, India, and spread over the city.

At least 8,000 people died within the first few days of the leak and, to date, a total of at least 25,000 have died as a result of the disaster.

The Sambhavana clinic, situated in the worst affected area of Bhopal, is the only centre offering free, rational treatment to those affected by the gas and water poisoning

[Click here to learn more](#)



REMEMBER

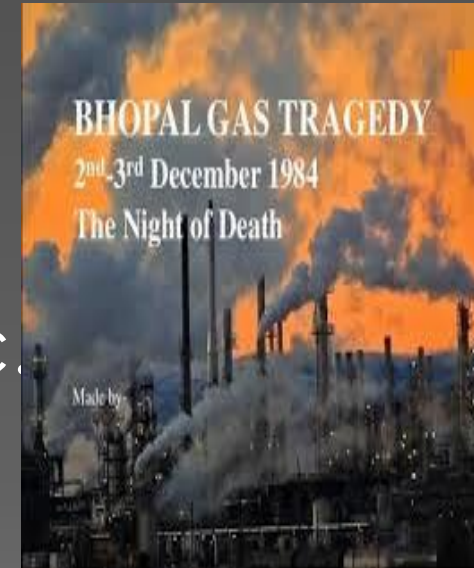
CASE STUDIES: PULMONARY AGENTS

2 -3 DECEMBER 1984: CATASTROPHIC INDUSTRIAL CHEMICAL RELEASE, BHOPAL

- Union Carbide carbaryl insecticide (Sevin) plant
- Sentinel event for chemical- sector safety and security reviews and policy-making/ emergency planning for HAZMAT events.(Emergency Planning & “Right to Know”)
- Release occurred late night ,many residents asleep, warning siren silenced by plant operators to “ avoid panic”. Many crucial safety systems failed.
- Emergency planning and preparedness for major chemical incident non-existent.
- Over 40 metric tons of product released into atmosphere resulting from a runaway exothermic reaction caused by water incursion into a plant reaction vessel . One consultant report indicated sabotage by disgruntled employee .
- Methyl isocyanate and phosgene gas were released ,both potent pulmonary toxicants that can induce pulmonary edema.
- ***Toxic terrorism attacks utilizing commercial and industrial gases ,such as anhydrous ammonia and chlorine ,more likely than military -grade CWAs***

Pulmonary Agents: Case Study

- ◉ Bhopal ,India Methyl Isocyanate Release (cont'd)
- ◉ Resulted in over 3,000 immediate deaths
- ◉ ~500,000 injuries and toxicant- induced illnesses
- ◉ Mass casualties from respiratory distress, acute respiratory failure, toxicant-induced ocular injury, etc.
- ◉ Mass psychological impact, PTSD
- ◉ After 35 years post-event : chronic health effects , including many congenital defects, cerebral palsy, chronic respiratory dysfunction and many disabilities
- ◉ Data may be applied to model intentional toxic industrial chemical releases and impacts



Pulmonary Agents: Case Study

- 5 January 2005, 0240, EST – Graniteville, South Carolina chlorine tanker release
- Released approximately 60 tons of chlorine
- 851 treated for chlorine exposure
- 72 people hospitalized
- 15 admitted to area ICUs
- 5,400 residents evacuated, 7,000 told to shelter in place
- 9 deaths
- Delayed identification of chlorine for almost one hour
- Many in community left with chronic health problems, including PTSD, to present day
- Some authorities suspected sabotage/terrorism
- ***Plausible scenario for a chemo-terrorism event***

Reference: Railroad Accident Report RAR-05-04-NTSB
(www.nts.gov)



PERSONAL PROTECTION EQUIPMENT

- ◉ LEVEL A - Fully encapsulated ,vapor –proof ensemble with SCBA
- ◉ LEVEL B- Same respiratory protection, less outer body /skin protection
- ◉ LEVEL C- Full- facepiece ,air purifying ,canister –equipped respirator or Powered Air Purifying Respirator (PAPR)
- ◉ LEVEL D- Uniform or simple safety equipment such as safety goggles ,gloves. No respiratory protection.

Mass Casualty Events -Considerations

- Have the potential to rapidly overwhelm or exceed local capacity of and threaten responder/healthcare/public health capabilities
- Scale/Magnitude
- Duration
- Intensity
- Loss of services
- Infrastructure destruction
- Supply shortages
- Triage
- Ethical concerns, psychosocial issues

Medical Surge: Examples

- September 11, 2001
- St. Vincent's Medical Center-
- ~800 victims Tx
- February 20, 2003
- ***Rhode Island nightclub fire-"The Station"***-~100 immediate fatalities,
- 200 injured, Kent County Hosp.-
- 40 victims post-1hr, 25 rapid ETT
- 16 HCFs in region rec'd 196 burn victims
- Ran out of critical supplies & vents

■ September 11, 2001-aftermath:

- Mass fatality management mainly
- Acute injuries, burns and toxic inhalations
- Post-disaster respiratory disease-toxicant –induced respiratory dysfunction effects such as a eg,,mesothelioma, pneumoconiosis , chronic reactive airways ,pulmonary fibrosis, bronchiolitis obliterans



Radiological Exposures



Exposure vs. Contamination

Exposure: irradiation of the body → absorbed dose (Gray, rad)

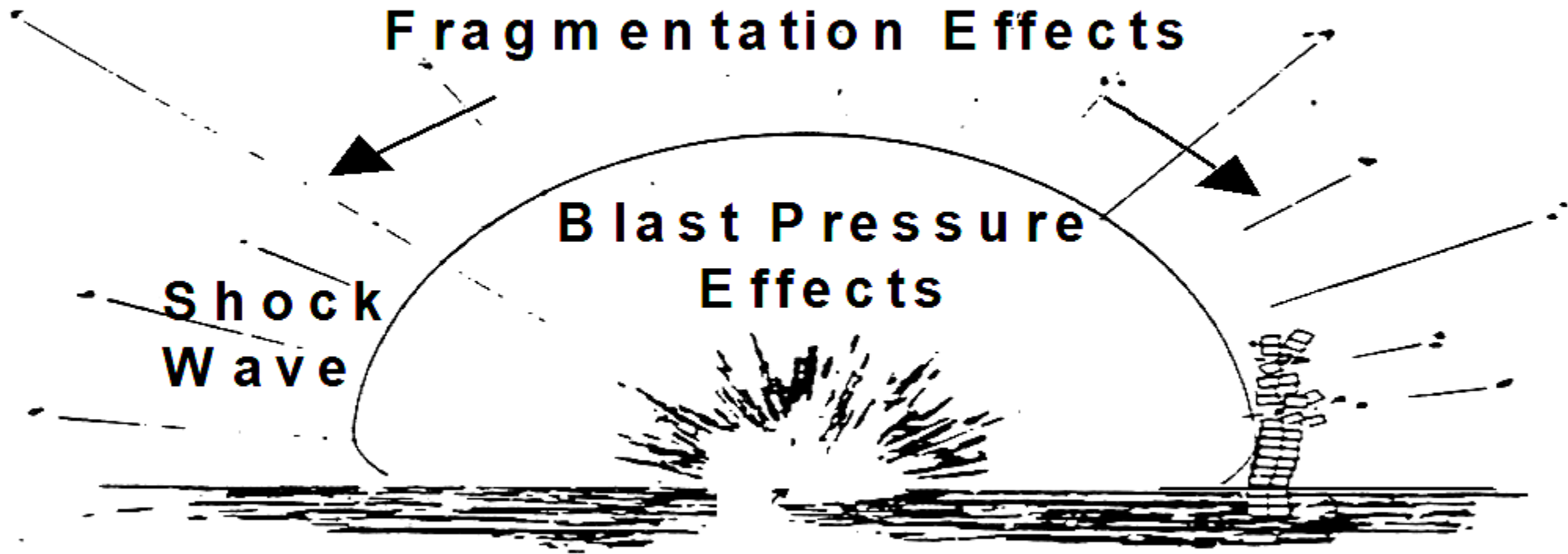


Contamination: radioactive material on patient (external) or within patient (internal)



Blast Effects

- **POSITIVE BLAST PRESSURE**
- **NEGATIVE BLAST PRESSURE**



Blast Trauma : Physics vs. Physiology



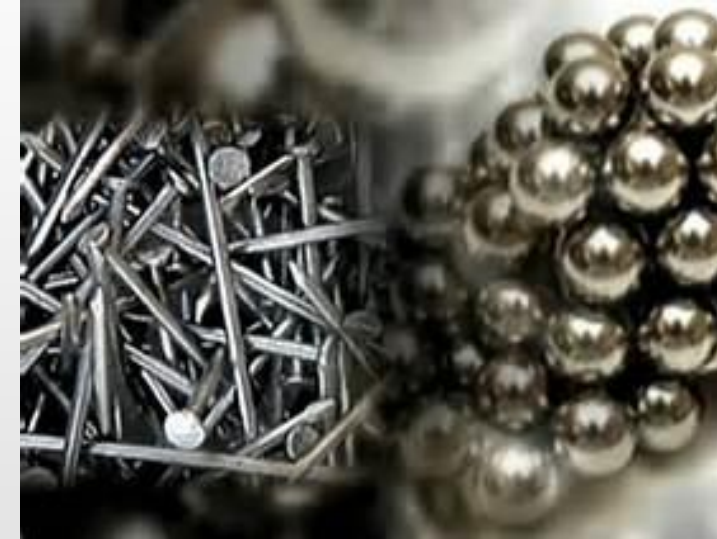
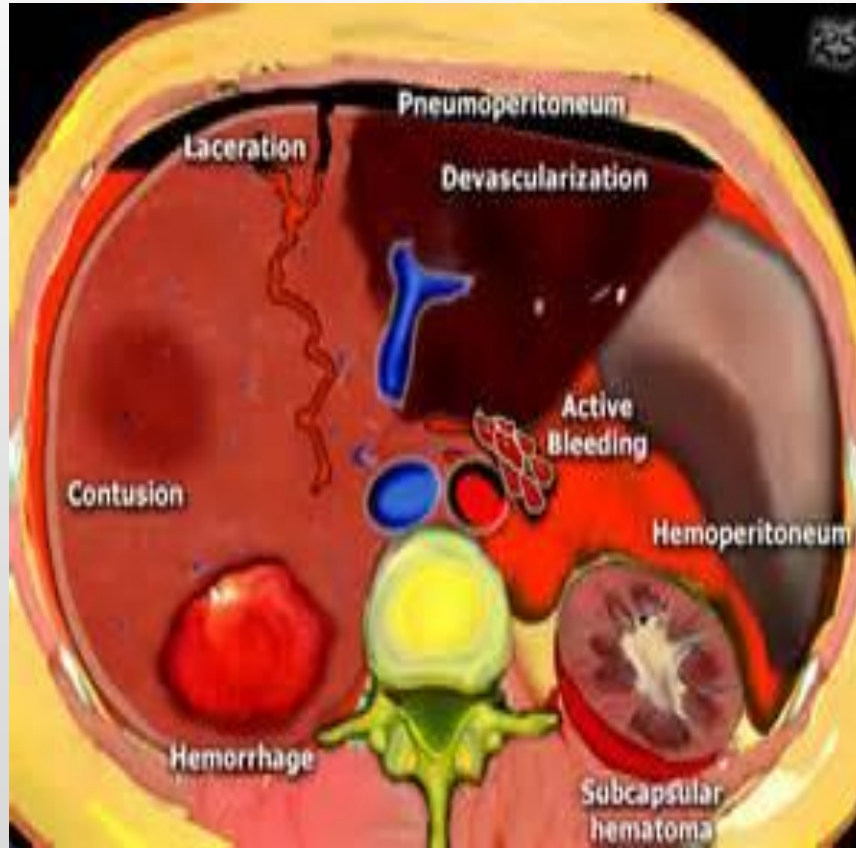
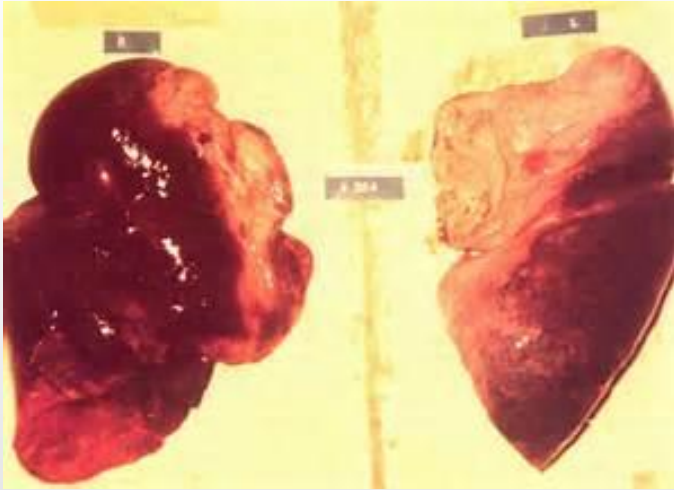
Mechanisms of Injury – Explosive Blast

Mechanism of injury

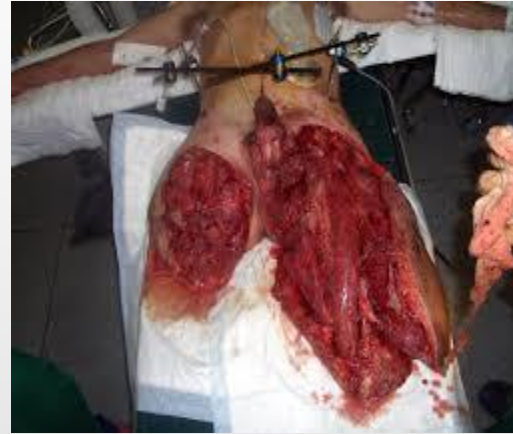
- ↘ Direct impact or movement of organs
- ↘ Compressive, stretching or shearing forces
- ↘ Solid Organs > Blood Loss
- ↘ Hollow Organs > Blood Loss and Peritoneal Contamination
- ↘ **Retroperitoneal** > Often asymptomatic initially



Special Considerations :Respiratory and Critical Care



Types of Bombing Injuries



Blast Injury

Predominant cause of TBI in OIF/OEF

A significant number of soldiers returning from the conflicts in Iraq and Afghanistan have this injury and will suffer long-term consequences.



Bancroft
One world. For everyone.



It's a Disaster!.. “ RESPIRATORY..STAT!! “

- Madrid, Spain – 11 March 2004 – Case Model for Surgical Services
- 10 simultaneous explosions on commuter trains ,177 instant fatalities,>2,000 injuries
- Rapid surge of surgical patients. > 270 victims at closest facility between 0800-1030 hours.
- 966 pts to 15 public community MTFs
- ***GOAL: Establish decision-maker responsible for RTS and Respiratory Care capable of self-sustainment for up to 72-96 hours. Stand up HICS and hospital EOC.***
- ***Triage and immediate life-saving interventions, eg. Airway, Hemorrhage Control***
- ***Staff, Space & Stuff***
- ***Federal resources(DMATs,etc)? > or = 72 hrs.***



Trauma & the “Triad of Death”



Trauma Triad of Death



A Century of Hemostasis



The Grim Reaper Cometh': Sepsis, DIC, SIRS ,ARDS & MODS

- Sepsis- Overwhelming systemic infection –leads to cytokine storm and capillary leak-vasodilation - septic shock-profound hypovolemia- poor tissue perfusion Rx: Systemic antibiotics, fluid resuscitation,cytokine removal?
- Systemic Inflammatory Response Syndrome (SIRS)
- DIC- Disseminated Intravascular Coagulation (coagulopathy)
- ARDS- Acute Respiratory Distress Syndrome (Hypoxemic Respiratory Failure)- Inadequate ventilation and tissue oxygenation used to be called :shock lung, DaNang lung,etc. Rx: Mechanical ventilation c PEEP, permissive hypercapnia
- MODS- Multiple Organ Dysfunction Syndrome –physiological derangements caused by hypoxemic, hypovolemic and biochemical injury mechanisms

RESPIRATORY CARE IN DISASTER MEDICAL OPERATIONS

- Conservation of medical oxygen and other medical gases .Titrate oxygen based on pulse oximetry and clinical S&S.
- Mass casualty mechanical ventilation-
- Use of lung protective strategies and modalities are critical ,avoid iatrogenic lung injury superimposed upon disaster related respiratory pathology.
- Use non invasive ventilation modalities first, if clinically safe and feasible.
- Minimize generation of bioaerosols in highly infectious disease contexts and wear suitable PPE
- Perform regular testing and maintenance of inventoried/stockpiled ventilators and other respiratory care equipment and supplies .Check shelf lives of dated supplies.
- Mobilize train and drill utilizing surge equipment. Plan and perform departmental related scenario based exercises utilizing in house emergency management expertise and guidance .
- Cross-train and practice in airway & other life saving skills ,such as pleural decompression , nerve agent and cyanide antidotal therapy administration, cricothyrotomy and hemorrhage control

MASS CASUALTY MECHANICAL VENTILATION

- Mass casualty respiratory failure requires the ability to provide mechanical ventilatory support to those who would benefit (survivability)
- Requires triage protocols ,bioethical considerations , evidence – based resource allocation
- Requires a tiered response using a variety of devices (not everyone will require sophisticated critical care mechanical ventilatory support) eg non- invasive ventilation , HFNC , nebulized medications ,basic airway / management/ recovery position

SNS Ventilator Cache

- Strategic National Stockpile (SNS) is a disaster public health emergency strategic cache which may be requested by state health departments via the Governors office for either 12 hour pushpacks or specific vendorized medical supplies , equipment and pharmaceuticals plus a SNS team to coordinate and assist with logistics ,distribution , accountability ,etc
- The cache includes various transport style ventilators approved by the HHS Assistant Secretary for Preparedness and Emergency Response (ASPER) and the HHS Biomedical Advanced Research and Development Agency (BARDA). Responsible for R & D and evaluation of biomedical countermeasures .
- There is a program in place to train RTs to utilize these ventilators

SNS Ventilators

GE CARESCAPE R 860 VENTILATOR



SNS VENTILATOR – LTV 1200

- VYAIRE- LTV 1200
- May be utilized for neonatal- pediatric patients & adults



PNEUMATIC – PRESSURE LIMITED RESUSCITATORS

- One use disposable device
- Gas powered ,consider your medical gas consumption in resource constrained setting
- Pressure cycled ,pressure limited
- Not for use in ARDS or pathology associated with low lung/ thoracic compliance Has PEEP valve available .
- May be considered using a triage / resource allocation algorithm (tiered response) ,eg head trauma ,transport to MRI
- Designed for short term use such
- MRI compliant
- Not designed as a critical care ventilator or sophisticated transport style ventilator
- NOT in the SNS

Pneumatic Pressure Cycled, Pressure Limited Resucitator

EASY AS 1,2,3!



New Easy Set up Labeling

- New 1,2,3 labeling allows for ease of use when setting up the GO2VENT™ Automatic Resuscitator on a patient
- New color coded labeling to relate settings to pressure manometer ranges



New Manometer

- New VORTAN® Manometer is certified MRI Conditional
- GO2VENT™ Automatic Resuscitator is now completely certified MRI Conditional
- Perfect for MRI/CT, transport, and disaster preparedness



New Entrainment Controls

- New quick change entrainment allows for changing from 50% to 100% FIO2 during operation
- New white and green colors used to identify supply gas connection for both the U.S. and European standards

Simple Solutions for Difficult Situations!

POLIO EPIDEMIC : 1st Case of Mass Casualty Ventilation

- POLIOMYELITIS (POLIO) IS CONSIDERED THE FIRST CASE OF MASS RESPIRATORY FAILURE SUPPORTED BY MECHANICAL VENTILATION ; THE IRON LUNG .
- The iron lung was developed by Philip Drinker ,biomedical engineer and industrial hygienist appointed to the Harvard School of Public Health and Louis Agassiz Shaw invented the iron lung ,which used “ External Negative Pressure to provide respiratory support to patients with respiratory paralysis during the polio epidemic (pre- vaccine)
- The device became known as the “ Drinker respirator” .
- John Haven “ Jack “ Emerson created an updated version of the Drinker apparatus which resulted in a legal battle and subsequent patent issues for Dr.Drinker.
- Emerson ‘s forward thinking approach led him to design the piston driven PPV Emerson ventilator and to be among the first to recognize HFV as a useful modality .

POLIO WARD – IRON LUNG



SARS-CoV-2 - COVID -19 PANDEMIC

- **THE 2nd major case of Mass Respiratory Failure and Mass Critical Care requiring intensive and extensive resources and scarce resources allocation .**
- **Resulted in US enacting wartime powers to convert non medical industrial base to manufacture more ventilators as well as vaccine (Operation Warp Speed)**
- **Illness took the form of severe respiratory failure caused by cytokine storm (hyperinflammatory response , refractory ARDS , coagulopathy / DIC and multi – organ failure**
- **Supply and distribution chains were disrupted and health care facilities were overwhelmed**
- **Respiratory therapists were on the forefront of critical care response .**

COVID-19 RESPONSE – RESPIRATORY CARE



Roles & Responsibilities of Health Professionals

- Health professionals possess assessment and medical skills that are needed to assess, triage and treat injured and/or ill victims.
- Provide invaluable input in institutional and community planning activities.
- Each health profession has special and administrative/clerical skills that are critical in emergency response.
- Have an understanding of how healthcare systems work, what is required for patient care and safety, and how to safely and effectively interface with diverse populations and are skilled at caring for individuals who are injured, ill, or worried.
- When responding to emergencies and disaster events ,they do so within their ***scope of practice***.

Roles and Responsibilities of Health Professionals- (cont'd)

- Basic medical skills, eg, vital signs, history –taking ,first aid treatment, assisting nurses and practitioners, physicians,physician assistants, etc.
- Each profession has special clinical and administrative skills that are invaluable in emergency response,eg, airway management & mechanical ventilation, record – keeping...**documentation**
- ***Decision-making: In a disaster situation (mass casualty event),would you stop to give CPR to a 4-year old,(no pulse, no respirations) when you know that a 30-year-old laying next to the child has an arterial bleed and may be going into shock?...***
- ***What would happen if your EMR systems became dysfunctional,and your EMRs were lost due to a disaster or other emergency?***
- ***Do you have back up /alternate ways to access essential medical information and record/document data? How?***
- Health professionals possess an understanding of how healthcare systems work.
- HCWs can use therapeutic communications and crisis intervention skills in disaster and emergency situations.

CRITICAL CONDITION : RESPIRATORY & CRITICAL CARE

IMPACTS OF DISASTERS

- Disasters and public health emergencies affect/impact respiratory and critical care services

HOW??

- Acute care medical surges –high volume demand
- Need to maintain on-going care despite additional surge,possibly in austere or non – conventional care environment
- Pathophysiology /Illness/Injury Matrix
- Breathing and gas exchange are fundamental to all life processes
- Circulation and perfusion are fundamental to all life processes

“If You Cant Breathe, Nothing Else Matters ! “

RESPIRATORY-SPECIFIC CONCERNS IN DISASTERS

MECHANISMS- Human respiratory system is a major target organ system and conduit for systemic exposures .

- Lung specific pathology e.g., severe respiratory illness –influenza , including acute exacerbations of chronic respiratory diseases
- Systemic pathology associated with inducing acute or chronic compromised respiratory function ,eg cyanide toxicity inhibiting mitochondrial function or CO poisoning
- Trauma directed at chest or other bodily system involvement which can result in direct or indirect respiratory compromise ,eg explosive pulmonary blast injury or severe hemorrhage ,eg. hemorrhagic shock (impaired tissue oxygen delivery due to blood loss)

<u>CLINICAL MANAGEMENT</u>	<u>PERSONNEL</u>	<u>EQUIPMENT& SUPPLIES</u>
AIRWAY / PATENCY/MAINTENANCE	ENOUGH STAFF?	VENTILATORS/RESUCITATORS
VENTILATION	“ ADEQUATE “ TRAINING	MEDICAL GASES
OXYGENATION/GAS EXCHANGE	PERSONAL PROTECTION	AIRWAY SUPPLIES
HEMODYNAMICS	FAMILY CONCERNS	RESPIRATORY DRUGS

S.A.L.T. Triage System

S.A.L.T. Triage System Model

Sort , Assess, Life-Saving Interventions,
Treatment and/or Transport

-Proposed national standard

Consists of 4 activities: Global sorting of patients using voice commands
-Individual assessments for lifesaving interventions: *Hemorrhage control*, *Airway mgmt.*

Pleural decompression for tension pneumo.,
and providing *Antidotes for chemical exposures*
Further treatment and/or transport



Triage for Critical Care Assets: S.O.F.A.

- **Sequential**
- **Organ**
- **Failure**
- **Assessment**
- Triage scoring system that assesses the performance of several organ systems and (neurologic, blood., liver, kidney, and blood pressure/hemodynamics) and assigns a score based on the data obtained in each category .
- The higher the SOFA score, the higher the likely mortality.

SOFA TRIAGE TOOL

The Rapid Emergency Triage and Treatment System (RETTTS). RETTTS triage priority is given based on worst vital sign, i.e. if one vital sign is within red limits the patient receives red triage. Sepsis if red triage, strong sepsis suspicion if orange triage.

A	Blocked Airway Oxylor			
B	Respiratory Rate (RR) ≥ 30 or ≤ 10 ☐ Oxygen saturation (SpO_2) $< 90\%$ with oxygen (O_2) ☐	RR ≥ 25 ☐ SpO_2 < 90 without O_2 ☐	SpO_2 ≥ 95 without O_2 ☐	RR ≤ 25 ☐ SpO_2 ≥ 95 without O_2 ☐
C	Heart Rate (HR) < 50 if sinus rhythm or else ≥ 130 ☐ Systolic Blood Pressure (SBP) < 90 mmHg ☐	HR > 120 or < 40 ☐	HR > 120 or < 50 ☐	HR > 50 ≤ 120 ☐
D	Unconscious/ Glasgow Coma Scale (GCS) < 9 ☐ Orange ☐	Somnolence ☐	Acute disorientation ☐	Alert ☐
E		Temperature (Temp) $> 41^\circ\text{C}$ or $< 35^\circ\text{C}$ ☐	Temp $> 38.5^\circ\text{C}$ ☐	Temp $37.5 - 38.5^\circ\text{C}$ ☐
120 no x1	Perforated ☐	Signs of infection and strong pain ☐ Fever $> 38.5^\circ\text{C}$ + shivering's at or before arrival ☐ Fever $> 38.5^\circ\text{C}$ and prothrombin ☐ Anticoagulative medication ☐	Severe local infection ☐	No symptomatic yellow, orange or red priority ☐

The Systemic Inflammatory Response Syndrome (SIRS). Sepsis if x1 signs (Sepsis) definition:

Sign:	HR $> 90/\text{min}$ or HR < 60 ☐	Temperature $> 38.5^\circ\text{C}$ or $< 36.5^\circ\text{C}$ ☐	HR $> 90/\text{min}$ ☐	White blood cell count $> 12.0 \times 10^9/\text{l}$ or $< 4.0 \times 10^9/\text{l}$ ☐
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The quick-SOFA (qSOFA) score. Suspect sepsis if x1 signs (Sepsis) definition:

Sign:	HR $> 11/\text{min}$ ☐	Systolic Blood Pressure (SBP) < 100 mmHg ☐	Glasgow Coma Scale (GCS) ≤ 15 ☐	
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Note: All risk stratification systems presented require confirmed or suspected infection as a basis for triggering the alert

S.T.A.R.T. Triage System

- Respirations – < 30
- Perfusion – Capillary Refill < 2 secs.
- Mental status – Follows simple commands

“Thirty , two ,Can Do”!

VICTIMS CAN BE PLACED IN MINOR / DELAYED CATEGORY
MUST BE MONITORED FOR DECOMPENSATION

The Grim Reaper Cometh': Sepsis, DIC, SIRS ,ARDS & MODS

- Sepsis- Overwhelming systemic infection –leads to cytokine storm and capillary leak-vasodilation - septic shock-profound hypovolemia- poor tissue perfusion Rx: Systemic antibiotics, fluid resuscitation,cytokine removal?
- Systemic Inflammatory Response Syndrome (SIRS)
- DIC- Disseminated Intravascular Coagulation (coagulopathy)
- ARDS- Acute Respiratory Distress Syndrome (Hypoxemic Respiratory Failure)- Inadequate ventilation and tissue oxygenation used to be called :shock lung, DaNang lung,etc. Rx: Mechanical ventilation c PEEP, permissive hypercapnia
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PSYCHOLOGICAL, EMOTIONAL AND SPIRITUAL IMPACT OF DISASTERS ON HEALTHCARE WORKERS

- BE PREPARED FOR A DISASTER, AT HOME AND AT WORK. THINK ABOUT HOW YOU WILL RESPOND PERSONALLY TO A GIVEN SITUATION IN YOUR COMMUNITY OR REGION.
- PREPARE YOUR FAMILY- THEY NEED TO KNOW WHAT TO DO AS WELL. IT WILL MAKE IT EASIER ON ALL OF YOU
- HAVE A PLAN FOR ALL OF YOU. PLANNING IS KEY.PRACTICE YOUR PLAN.
- TALK WITH THEM AS OFTEN AS YOU CAN. IT WILL HELP THEM UNDERSTAND AND WILL PROVIDE COMFORT FOR EACH OF YOU. NO, YOU DO NOT HAVE TO GIVE THE DETAILS!
- NEVER UNDERESTIMATE THE IMPACT OF WORKING THROUGH A DISASTER
- LIFE AND DEATH HAPPEN EVERY DAY IN OUR WORLD, THIS IS NO DIFFERENT, JUST MORE INTENSE
- DO YOUR BEST TO TAKE CARE OF YOURSELF WITHIN THE PARAMETERS OF A CRISIS SCHEDULE. YOU DO HAVE TO EAT, HYDRATE, EXERCISE, SLEEP AND TAKE YOUR MEDS. IMPORTANT TO TALK WITH FAMILY/FRIENDS WHEN YOU CAN TO KEEP UP A STRONG BASE OF SUPPORT AND LET THEM KNOW HOW YOU ARE DOING. THEY WORRY ABOUT YOU. YOU ARE STILL A MOTHER,FATHER,SPOUSE,DAUGHTER,SON,GRANDCHILD,BFF.
- REMEMBER, THIS IS NOT GOING TO LAST FOREVER !!

- **ALLOW YOURSELF TO CRY AND GRIEVE. IF YOU WEREN'T SUPPOSED TO, GOD WOULD NOT HAVE GIVEN YOU LACRIMAL GLANDS AND DUCTS ! AS WE HAVE LEARNED THROUGH THE SARS COV2 PANDEMIC, THERE IS MUCH SADNESS AS WELL AS ANGER THAT THAT WE GO THROUGH. GO THROUGH YOUR PROCESS IT WILL HELP YOU TO BE HEALTHIER IN THE LONG RUN, PHYSICALLY ,EMOTIONALLY AND PSYCHOLOGICALLY. IF YOU ARE EXPERIENCING A LOT OF DIFFICULTY, PLEASE SEEK HELP FROM A PROFESSIONAL COUNSELOR. SOMEONE WHO IS TRAINED IN DEALING WITH POST TRAUMATIC STRESS, A PSYCHOLOGIST OR A PSYCHIATRIST. THIS IS ALL ABOUT BEING HEALTHY AND FIGURING OUT HOW TO DEAL WITH THINGS WE HAVE NOT PREVIOUSLY NOT DEALT WITH. THERE IS NO SHAME! YOU NEED TO SUPPORT YOUR FRIENDS IN THIS IF THEY ARE STRUGGLING.**

- **YOU ARE AMAZING! YOU ARE IMPORTANT! YOU ARE A WELL TRAINED,SKILLED PROFESSIONAL! YOU ARE A ROCKIN' RRT/RT!!! WOOHOO! THE BEST! YOU KNOW IF THEY CAN'T BREATHE, NOTHING ELSE MATTERS....RIGHT??? OF COURSE RIGHT! BUT MY DEAR ONES, EVEN YOU CANNOT SAVE THEM ALL NO MATTER HOW VALIANTLY YOU TRY AND HOW MUCH YOU PRAY. THIS IS A PAINFUL LESSON THAT CARING FOR COVID19 PATIENTS HAS TAUGHT US. WE SEE THIS IN MANY TYPES OF DISASTERS, BUT THIS PANDEMIC HAS OPENED OUR EYES TO THINGS WE NEVER DREAMED WE WOULD SEE. IT HAS RIPPED OUR HEARTS OUT, IT HAS CAUSED US TO QUESTION MUCH AND, FOR SOME, IT HAS CAUSED THEM TO COMPLETELY GIVE UP ALL HOPE.**

Summary

- Disasters and emergencies will continue to occur ,and may worsen ,eg. terrorism, natural disasters, technological disasters, pandemics , emerging infectious diseases and complex humanitarian emergencies.
- Disasters and high consequence events generate complex injury/illness matrix.
- ALL HCWs and health professions students MUST be trained in emergency preparedness and response.
- Leadership must be owned and team organization must be established and apply National Incident Management System and ICS at all levels.
- In community emergencies and disaster situations ,you and your facility may be on your own for greater than 96 hours, possibly up to or > 2 weeks.
- Life safety of providers comes FIRST.. THEN victims .. This includes wearing the appropriate PPE and practicing body substance isolation and universal precautions.
- May have to implement alternate standards of care in large scale event, leading to selective resource allocation in austere operational settings ,medicolegal ramifications and ethical dilemmas.
- All aspects and operations of healthcare can be affected.

????.... Q&A....????

ANY QUESTIONS ?????

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THANK YOU !!



