INTRODUCTION TO DISASTER PREPAREDNESS AND RESPONSE

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OCTOBER 18, 2024


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2020-2021

UPDATE
INTRODUCTION TO DISASTER PREPAREDNESS AND RESPONSE

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OCTOBER 18, 2024

I HAVE NO FINANCIAL DISCLOSURES OR CONFLICTS OF INTEREST

DISASTER RESPONDER- FIRST 48 HOURS

- 2001 NYC terrorism
- 2010 Haiti Earthquake
- 2013 Philippines typhoon Haiyan
- 2014 Philippines typhon Glenda
- 2016 Ecuador Earthquake
- 2017 Puerto Rico Hurricane Maria

OUTLINE

Basic Concepts in Disaster Medicine

Preparedness: Disaster Management Cycle and Hazard Vulnerability Analysis

Health care system response to a disaster

Disaster: A serious disruption of the functioning of a community involving widespread human, material, economic or environmental losses which exceeds the ability of the affected community or society to cope using its own resources.

TYPES OF DISASTERS

Natural disasters

Man Made Conflicts

Complex Humanitarian Crisis

DISASTER MANAGEMENT CYCLE

Mitigation

- Conduct risk assessments/ Hazard Vulnerability analysis
- Inspect healthcare facilities for structural weaknesses
- Support public awareness of disaster preparedness
- Assist with writing environmental policies with disaster risk reduction in mind
- Land-use regulations for those living in zones at high risk for disaster

Recovery:

- Assist with reconstruction
  - Healthcare system
  - Power
  - Communication
  - Water lines
  - Community
- Provide mental health services for those affected by disaster
- Manage shelters for temporary housing

Preparation

- Establish early warning systems
- Develop emergency response operation plans
- Education
- Conduct drills
- Public awareness

Response

- Conduct health needs assessments
- Assess damage of healthcare facilities
- Oversee health care
- Monitor environmental health
  - Decontamination
  - Monitor for water contamination
- Monitor food safety/ contamination
- Issue health advisories/ communicate with public
- Promote good hygiene practices
- Repair Sanitation systems
- Food and water distribution
- Security

CYCLE IS SILLY

Critique of the disaster “cycle”

Cycle – has to recur?

Cycle – has to have an order?

Cycle- incomplete if one is not performed?

Cycle – must be sequential vs contemporaneous

Cycle – implies time vs social phases

HAZARD VULNERABILITY ANALYSIS

- Identifies the highest vulnerabilities to a hospital and community so that effective disaster plan can be developed

- Lists possible events that could occur
- Identify the probability or risk of these occurring
- Assess the current level of preparedness
- Identify the areas with the highest risk and lowest level of preparedness
- Align resources to fill priority gaps

Event	Probability	Risk	Level of Preparation
Natural			
Biological			
Man-made			

DISASTER RESPONSE: ADLS "DISASTER PARADIGM"

Detection

Incident Management

Safety and Security

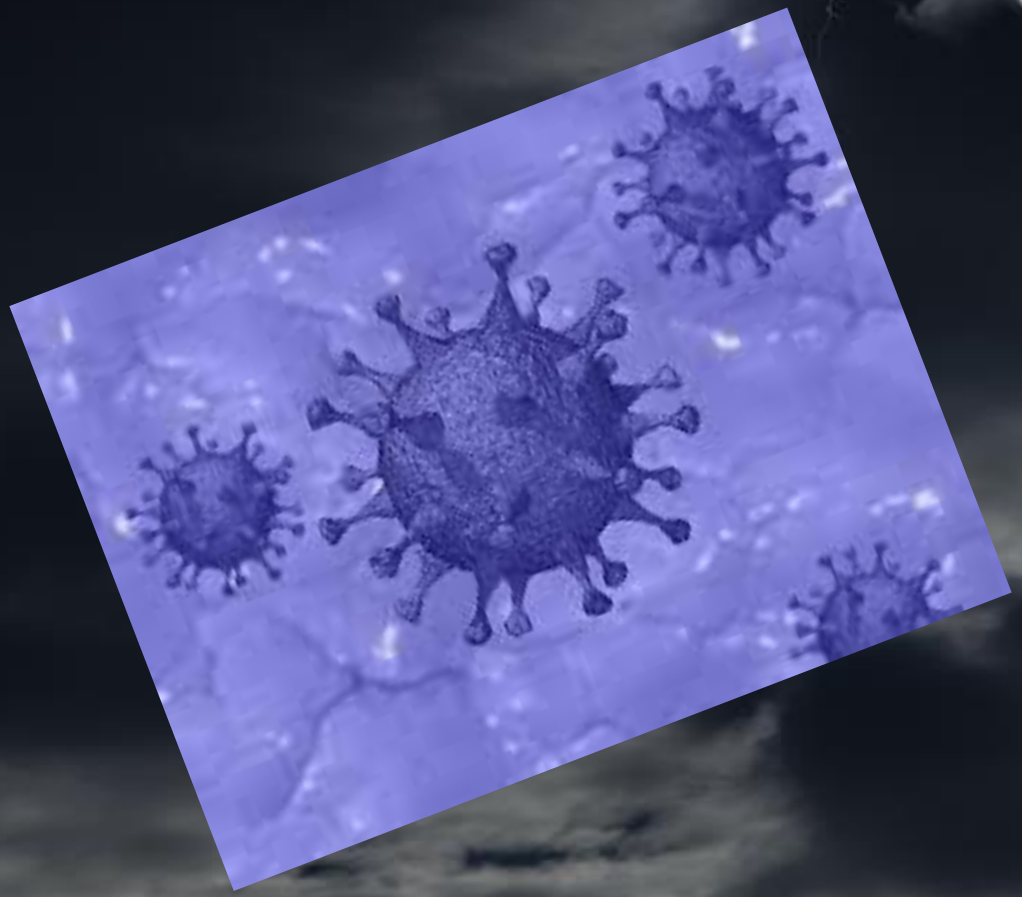
Assess Hazards

Support/ **S**urge

Triage

Evacuation

Recovery




HURRICANE
SEASON

DETECTION

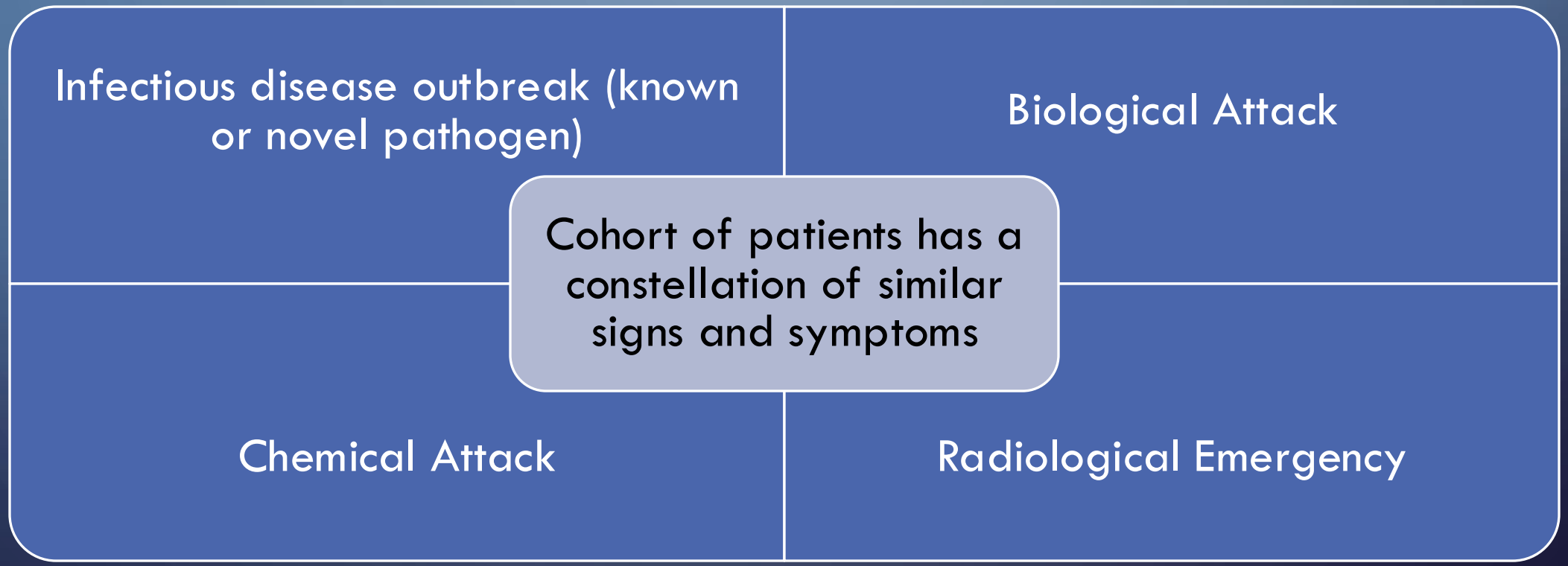

Infectious disease outbreak (known or novel pathogen)
Biological Attack
Cohort of patients has a constellation of similar signs and symptoms
Chemical Attack
Radiological Emergency

Table 2. Onset, Health Impacts, and Treatments for Some Agents of Concern

Disease (agent)	Incubation period*	Symptoms	Spread (person to person)	Lethality if untreated	Persistence of Organism	Vaccine Status (as of March 2005)	Medical Treatment
HIGH THREAT AGENTS (CATEGORY A)							
Anthrax *(Bacillus anthracis)* (inhalational)	typically 1–6 days, but up to 42	Fever, cough, profound sweats malaise, fatigue, myalgiaus	No (only skin form spreads)	High (if inhaled) viable in soil > 40 yrs	Very stable spores	Licensed	Antibiotics
Plague *(Yersinia pestis)*	1–7 days (usually 2–3 days)	Fever, cough, shortness of breath, sore lymph nodes	Moderate	High unless treated within 12–24 hours (pneumonic)	For up to 1 year in soil; 270 days in live tissue	Not current	Antibiotics
Tularemia *(Francisella tularensis)*	1–21 days (avg 3–6)	Fever, cough, pneumonia, headache	No	Moderate	For months in moist soil or other media	Not current	Antibiotics
Marburg (Viral hemorrhagic fever)	4–21 days	Sudden onset, fever, headache, followed by vomiting and diarrhea, rash, generalized bleeding in severe cases	Via fluids	>25% lethal	Relatively unstable	None	Supportive treatment onl
Ebola (Viral hemorrhagic fever)	4–21 days	Sudden onset, fever, headache, followed by vomiting and diarrhea, rash, generalized bleeding in severe cases	Via fluids	50–80% lethal	Relatively unstable	Investigational	Supportive treatment onl
Smallpox (Variola major virus)	7–17 days (avg 12)	Fever, aches, after 2–4 days rash appears	Moderate	High to moderate ≥30% lethal	Very stable	Licensed	Supportive
Botulism *(Clostridium botulinum* toxin)	12 hours–5 days	Muscle paralyzing illness	No	High without respiratory support	Stable for weeks in nonmoving food/water	Licensed (availability uncertain)	Antitoxin if administered quickly
LOWER THREAT AGENTS (SELECTED CATEGORY B AGENTS)							
Cholera *(Vibrio cholerae)*	4 hours–5 days (usually 2–3 days)	Sudden onset of voluminous watery diarrhea, vomiting, cramps, dehydration	Rare, although spreads rapidly via untreated water	Low with treatment, high without	Unstable in aerosols & fresh water, stable in salt water	Investigational	Antibiotics
Glanders *(Burkholderia mallei)*	1–14 days via aerosol	Pneumonia with or without blood poisoning ulcers in nose, mouth, throat and lungs	No	Death in 7–10 days in blood poisoning form	Very stable	None	Antibiotics
Q fever *(Coxiella burnetii)*	7–41 days	Flu-like illness that can lead to pneumonia and hepatitis	No	Very low	For months on wood and sand	Not licensed in U.S.	Antibiotics
Encephalitis (Alphaviruses)	2–6 days	Fever, aches, pain behind the eye, nausea, vomiting	Low	Low	Relatively unstable	None	Supportive treatment
Ricin *(Ricinus communis)*	18–24 hours	Can shut down organ function	No	High (injected)	Stable supportive treatment	Investigational	No antidote;

BIOLOGICAL ATTACK: HUMAN PATHOGENS, BIOTOXINS, AND AGRICULTURAL THREATS NEWS &TERRORISM. COMMUNICATING IN A CRISIS. A fact sheet from the National Academies and the U.S. Department of Homeland Security. 2004 National Academy of Sciences. In optional ReALMS as prep_biological_fact_sheet

Table 1. Effects and treatment of some chemical weapons developed for military use

	Nerve Agents		Blister Agents (injure skin, eyes, and airways)		Blood Agents (cause blood changes and heart problems)		Choking Agents	
Examples	Sarin	VX	Mustard	Lewisite	Hydrogen Cyanide	Cyanogen Chloride	Chlorine	Phosgene
Odor	Odorless		Garlic or Mustard	Geraniums	Burnt almonds		Bleach	Mown hay
Persistency*	Non-persistent (min. to hrs.)	Persistent (>12 hrs.)	Persistent		Non-persistent		Non-persistent; vapors may hang in low areas	
Rate of Action	Rapid for vapors; liquid effects may be delayed		Delayed	Rapid	Rapid		Rapid at high concentrations; delayed at lower concentrations	
Signs and Symptoms	Headache, runny nose, salivation, pinpointing of pupils, difficulty in breathing, tight chest, seizures, convulsions, nausea, and vomiting		Red, burning skin, blisters, sore throat, dry cough; pulmonary edema, eye damage, nausea, vomiting, diarrhea. Symptoms may be delayed 2 to 24 hrs		Cherry red skin/lips, rapid breathing, dizziness, nausea, vomiting, convulsions, dilated pupils, excessive salivation, gastrointestinal hemorrhage, pulmonary edema, respiratory arrest		Eye and airway irritation, dizziness, tightness in chest, pulmonary edema, painful cough, nausea, headache	
First Aid	Remove from area, treat symptomatically, Atropine and pralidoxime chloride (2-PAM chloride), diazepam for seizure control		Decontaminate with copious amount of water, remove clothing, support airway, treat symptomatically		Remove from area, assist ventilations, treat symptomatically, administer cyanide kit		Remove from area, remove contaminated clothing, assist ventilations, rest	
Decontamination	Remove from area, remove clothing, flush with soap and water, aerate							

*How long a chemical remains at toxic levels

Taken directly from CHEMICAL ATTACK WARFARE AGENTS, INDUSTRIAL CHEMICALS, AND TOXINS NEWS & TERRORISM: COMMUNICATING IN A CRISIS. A fact sheet from the National Academies and the U.S. Department of Homeland Security. 2004 National Academy of Sciences. In optional ReALMS as prep_chemical_fact_sheet

RADIATION EMERGENCIES

https://www.cdc.gov/radiation-emergencies/about/index.html

- **Symptoms:**
  - Can be immediate or delayed
  - **Early onset** nausea, vomiting, followed by bone marrow suppression, GI destruction, cardiovascular effects, central nervous systems effects-> **acute illness**
  - In latent stage, person can look healthy

THE "DISASTER PARADIGM"

Detection

Incident Management

Safety and Security

Assess Hazards

Surge

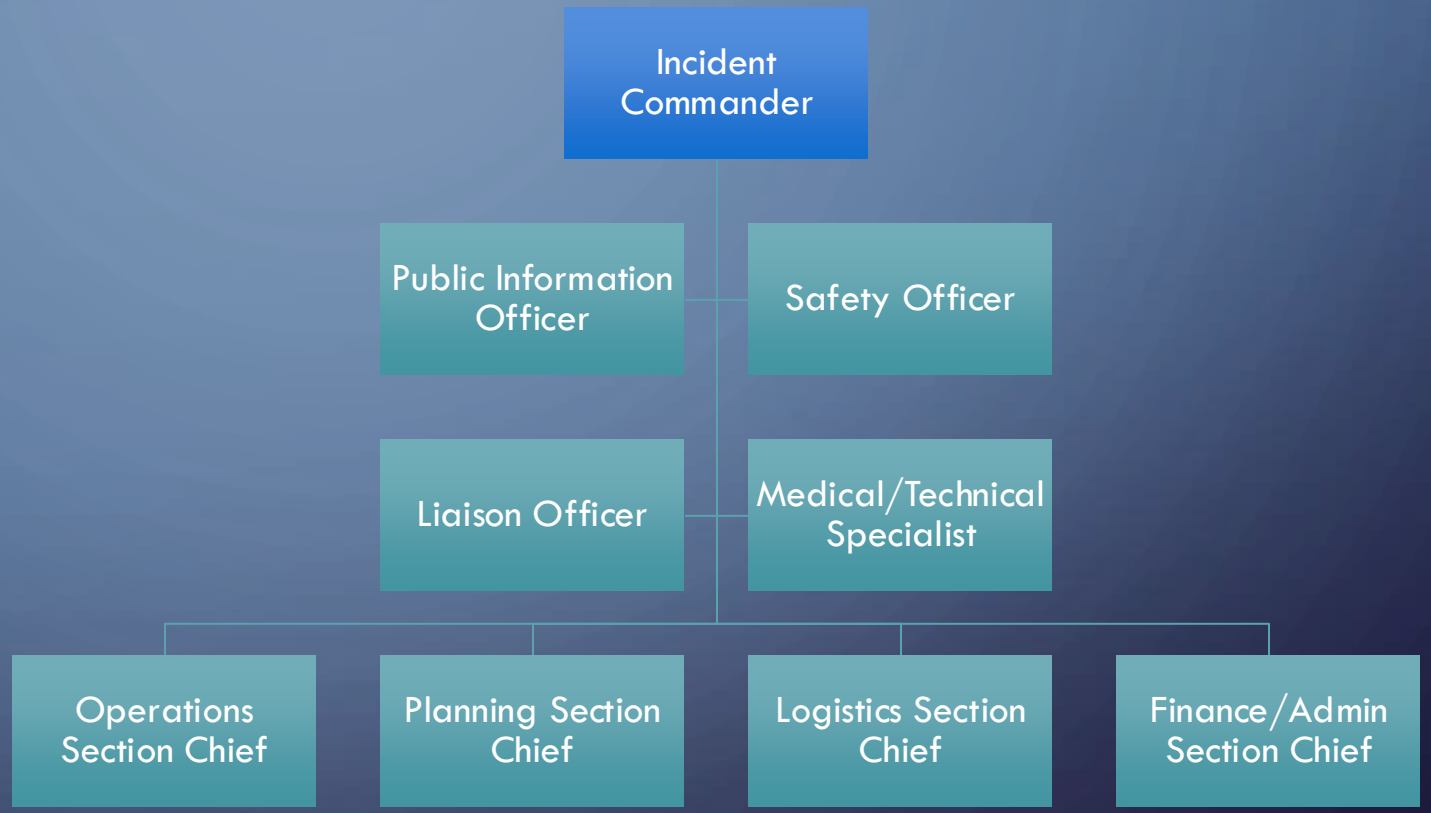
Triage

Evacuation

Recovery

HOSPITAL INCIDENT COMMAND SYSTEM

- An incident command system structure specifically designed for hospitals.
- Can be used for **emergent** incidents or **non-emergent** events
- Can be small or expand for larger incidents



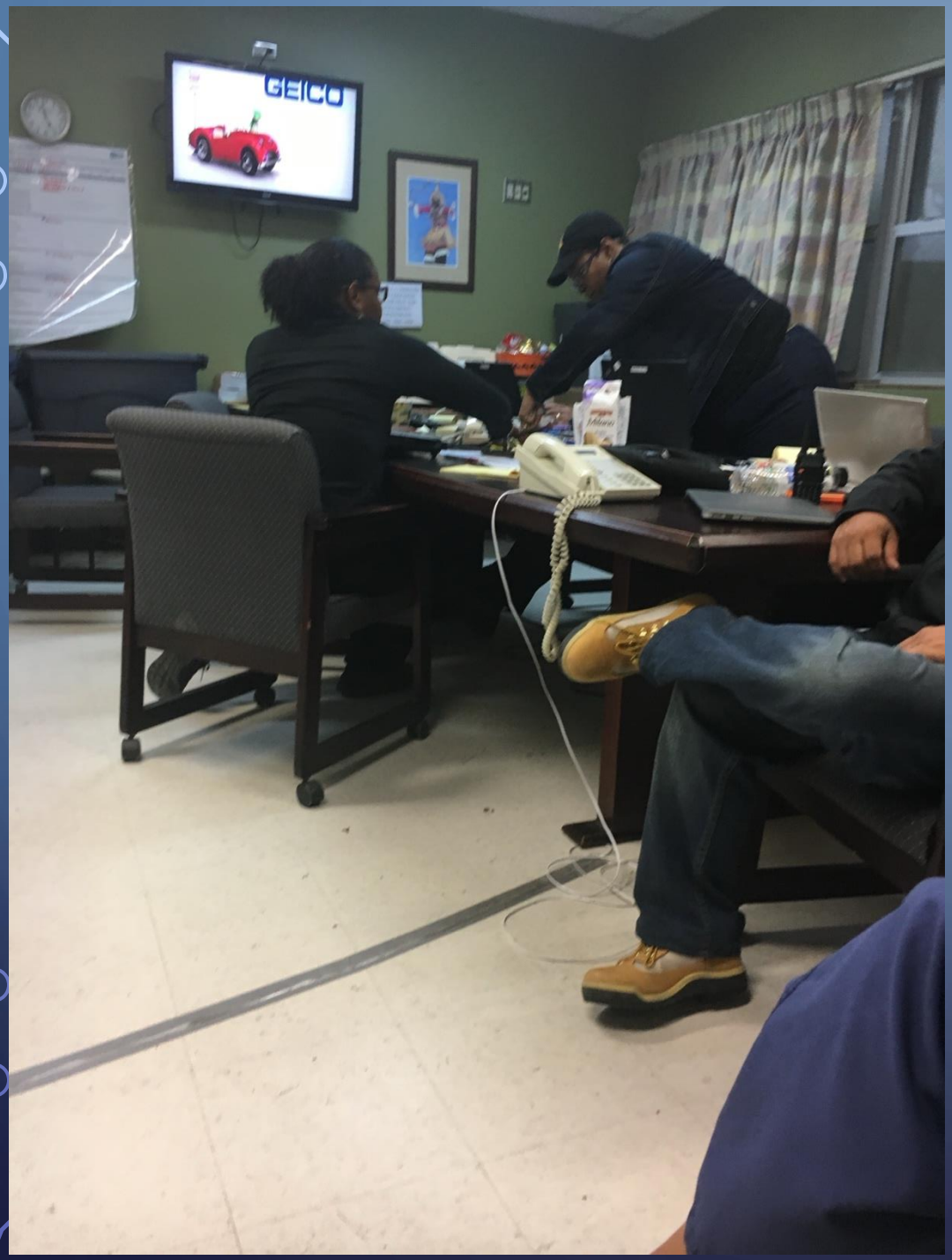

GEICO

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Image credit: https://www.tmj4.com/news/republican-national-convention/froedtert-employees-explain-why-there-is-a-tent-outside-froedtert-hospital

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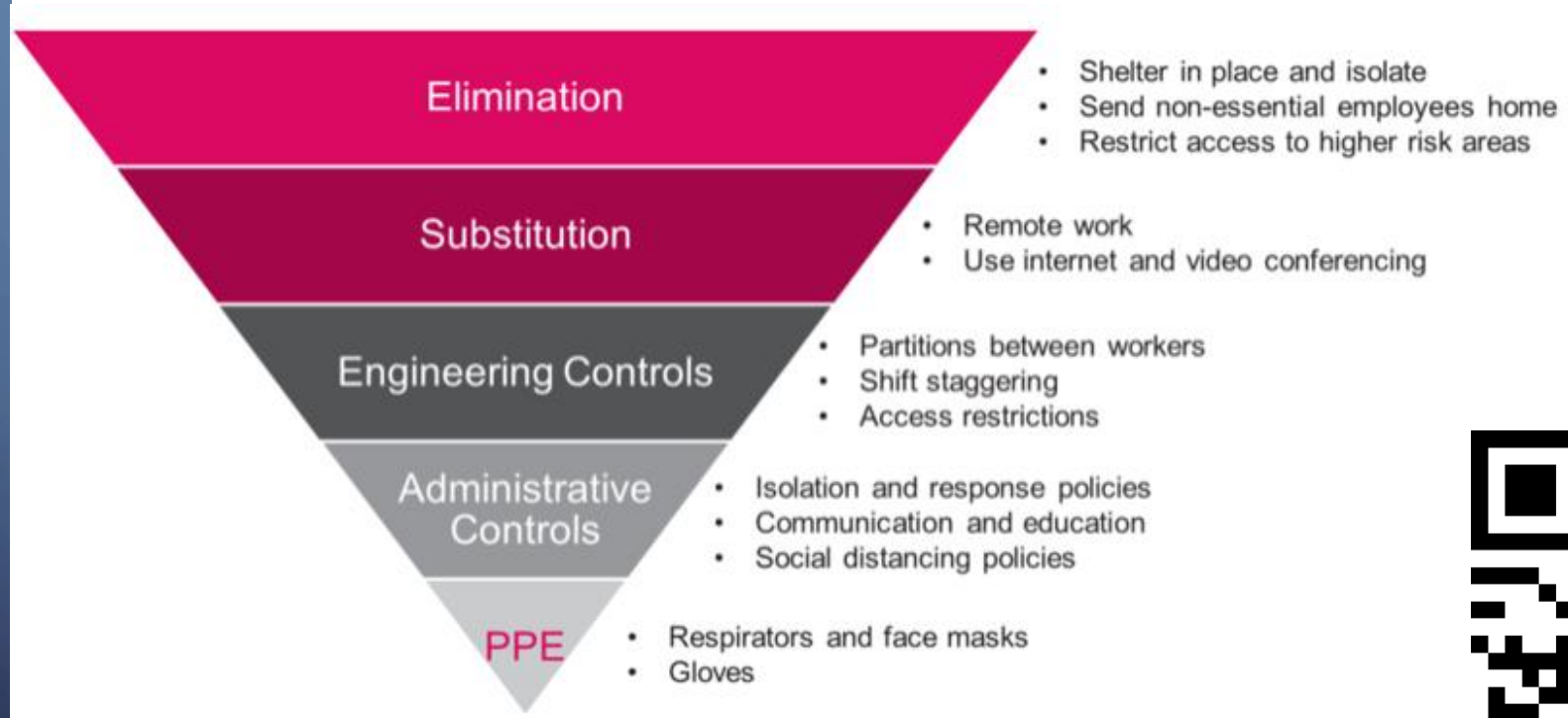
INFECTION PREVENTION & CONTROL IN THE HEALTHCARE FACILITY

- Transmission Prevention:
  - Minimize exposures
  - Implement engineering controls
  - Monitor exposed healthcare personnel
  - Train and educate healthcare personnel (just in time training!)
  - Ensure adherence to infection control guidelines
  - Implement environmental infection control
  - Manage visitor access and movement

FUNDAMENTAL ELEMENTS OF TRANSMISSION PREVENTION



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DISASTER SURGE

Surge: sudden influx of causalities

Surge capacity: the "healthcare systems' ability to rapidly expand beyond normal services to meet the increased demand for qualified personnel, medical care and public health in the event of bioterrorism or other large-scale public health emergencies or disasters"

PHASES OF SURGE CAPACITY

Conventional Phase

- Normal patient care with usual resources and personnel

Contingency Phase

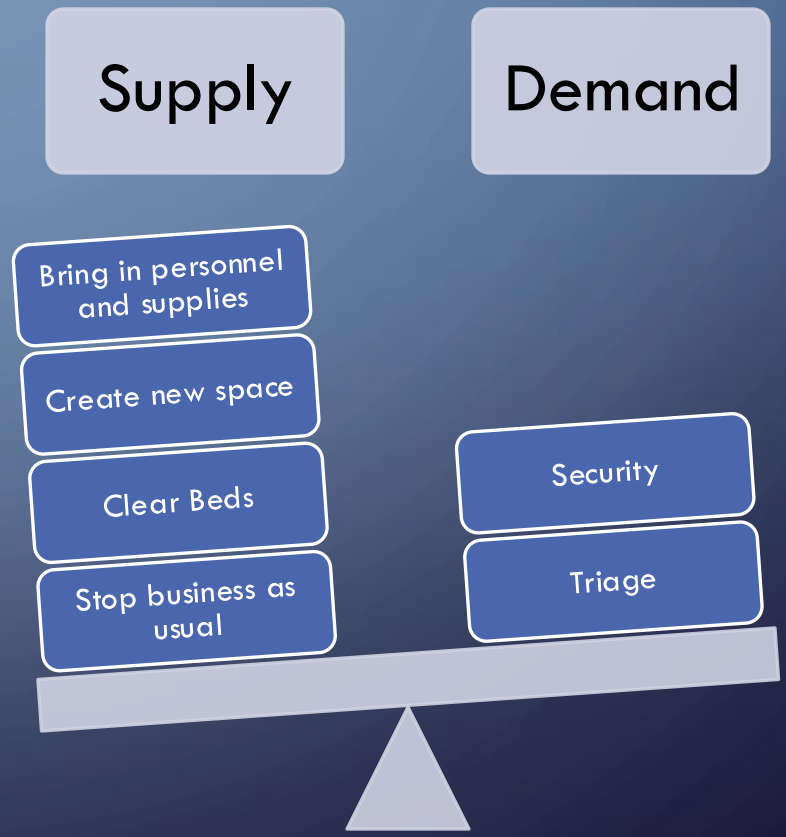
- Minor adaptions must be made but not enough to result in significant change to patient care

Crisis Phase

- Disaster Surge large enough to cause drastic changes to healthcare system which results in altered standard of care

SURGE CAPACITY RESPONSE PRINCIPLES

- Increase resources
- Reduce demand
- Redistribute resources



Surge Capacity of Hospitals in Emergencies and Disasters With a Preparedness Approach: A Systematic Review

- Space
- Staff
- Supplies
- System

SPACE

Reverse triage:

Evacuate inpatient units of any patient whose care can be postponed

Classification system “a” through “d” from no risk of discharge to critically ill inpatients

Increase the amount of physical treatment space:

Discharge patients from the ED (or admit quickly)

Pre-Op and Procedural areas can become ICU’s with monitored beds

Parking lot

Hallways

Conference rooms

Auditoriums

Dining rooms

Lounges

Surge Sites:

Field Hospitals/ tents

Alternative Care space: schools, gyms, hotels

SURGE SITES/ ALTERNATIVE CARE SPACE

- Pros:
  - Minimizes exposure risk to other areas of the facility in ID outbreaks
  - Augments the number of patients that the facility can treat effectively
- Cons:
  - Require additional staffing, equipment, and preparation
  - May take resources away from the main facility
  - May involve regulatory and legal considerations

COVID-19 Testing Site

Surge Site

EXTERNAL OR VIRTUAL SCREENING

- On-Site
  - Can be useful if there is a surge of “worried well” who would like to be screened and there may not be risk of exposure
- Phone/Virtual
  - Especially useful during outbreaks of diseases that are highly contagious
- Both require visible messaging, signage, and staffing to carry out effectively

EXAMPLES USES OF SURGE SITES IN COVID-19

- Vaccination clinics
- Testing for COVID-19 in a walk-through setting:
  - Patients
  - Employees
  - First responders
- Triage and segregation of patients based on clinical acuity and suspicion of COVID-19
- Fast-track to evaluate potential COVID-19 patients
- Serve as an Emergency Department overflow facility
- Manage low-acuity patients in a tent environment

SUPPLIES TO CONSIDER FOR SURGE SITES

- Power (solar, generator…)
- Climate control and ventilation
- Tables and chairs
- Curtains or other physical separations
- Trash cans, biohazard receptacles, sharps containers
- Handwashing stations and hand sanitizer
- Infection-control supplies
- Carts and tables
- Computer access/technology
- PPE (both staff and patients)
- O2 Tank
- Pharmaceuticals
- Consumable supplies
- Diagnostic capabilities (radiology, laboratory...)
- Vaccination supplies (consider cold chain, needles, alcohol swabs...)
- Phones/radio
- TV/radio for waiting areas
- Staff

SUPPLIES

Transfer equipment and supplies from units less needed to key units

Have a backup storage of supplies in easy accessible location

Request supplies from local/state resources

Requesting federal assistance with strategic national stockpile

SYSTEM

Have full knowledge/ data ahead of time about hospital capacity

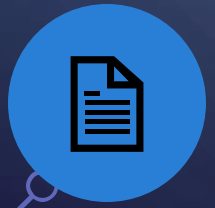
Activate HICS and set up emergency operations center early

Development of methods for decision making in terms of the allocation of scarce resources

Evacuate the ED: any patient in need of admission goes immediately to inpatient units

Cancel elective surgeries and outpatient appointments (creates space, allows redistribution of supplies, frees up providers to increase staff)

Shorter triage and quicker registration methods.



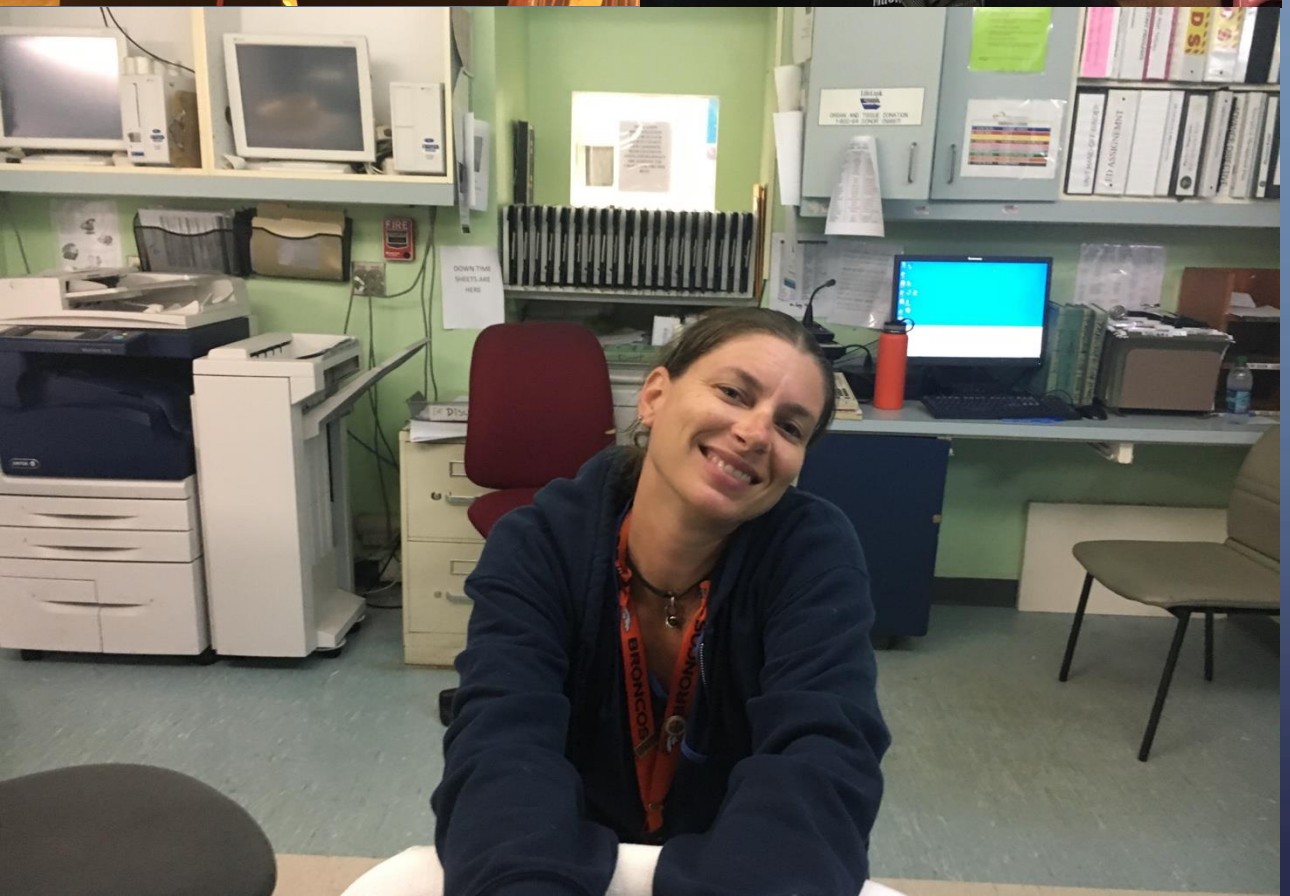
Incorporate transmission prevention methods into triage including screening and isolation

Communication with staff- daily phone calls, virtual meetings, just in time training

SYSTEMS CONSIDERATIONS WHEN SETTING UP AN ALTERNATIVE CARE SITE OR SURGE SITE

- Patient flow (unidirectional)
- Handwashing stations
- Additional precautionary measures:
  - Keep patients at least 1 meter apart
  - Install appropriate ventilation systems
- Staffing plan
  - Environmental and laundry services
  - Nearby bathrooms
  - Staff respite area
  - Clean supply area
  - Medication storage and preparation area
  - Dirty utility area

Best practice: Conduct a brief drill with staff acting as patients before opening the surge site, to identify potential gaps in planning.



STAFF

- Staff Redistribution
  - Shift workers from outpatient units to ED, inpatient units and ICU to absorb influx of sick patients
- Have contingency staff on a back up list
  - Other hospitals
  - Medical and nursing students
  - Volunteers
  - Retired employees
- Mobilize community groups
- In crisis phase staff may practice above usual scope of practice

THE "DISASTER PARADIGM"

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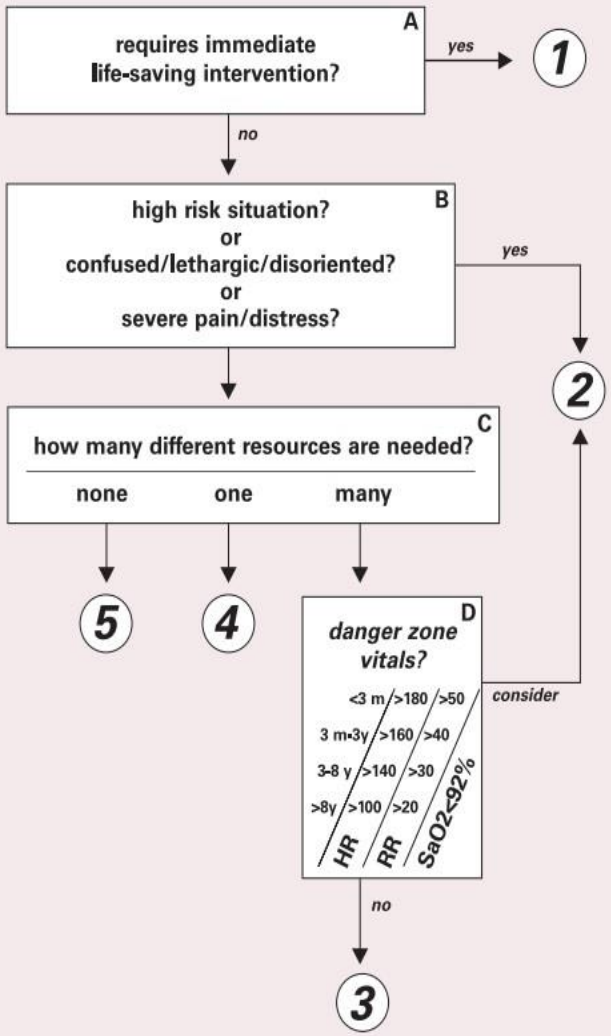
ESI Triage Algorithm



A. Immediate life-saving intervention required: airway, emergency medications, or other hemodynamic interventions (IV, supplemental O2, monitor, ECG or labs DO NOT count); and/or any of the following clinical conditions: intubated, apneic, pulseless, severe respiratory distress, SPO_2<90, acute mental status changes, or unresponsive.

Unresponsiveness is defined as a patient that is either:
(1) nonverbal and not following commands (acutely); or
(2) requires noxious stimulus (P or U on AVPU) scale.

B. High risk situation is a patient you would put in your last open bed.

Severe pain/distress is determined by clinical observation and/or patient rating of greater than or equal to 7 on 0-10 pain scale.

C. Resources: Count the number of different types of resources, not the individual tests or x-rays (examples: CBC, electrolytes and coags equals one resource; CBC plus chest x-ray equals two resources).

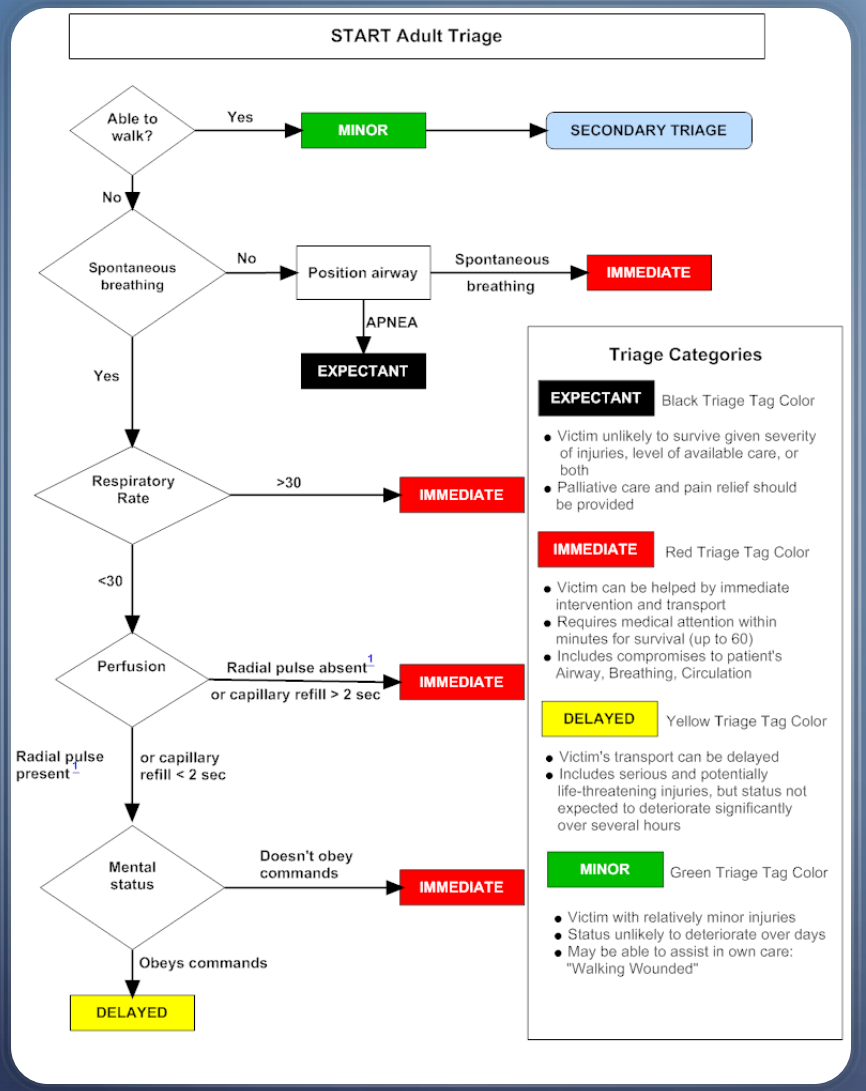
Resources	*Not Resources*
• Labs (blood, urine) • ECG, X-rays • CT-MRI-ultrasound-angiography	• History & physical (including pelvic) • Point-of-care testing
• IV fluids (hydration)	• Saline or heplock
• IV or IM or nebulized medications	• PO medications • Tetanus immunization • Prescription refills
• Specialty consultation	• Phone call to PCP
• Simple procedure =1 (lac repair, foley cath) • Complex procedure =2 (conscious sedation)	• Simple wound care (dressings, recheck) • Crutches, splints, slings

D. Danger Zone Vital Signs
Consider uptriage to ESI 2 if any vital sign criterion is exceeded.

Pediatric Fever Considerations
1 to 28 days of age: assign at least ESI 2 if temp >38.0 C (100.4F)

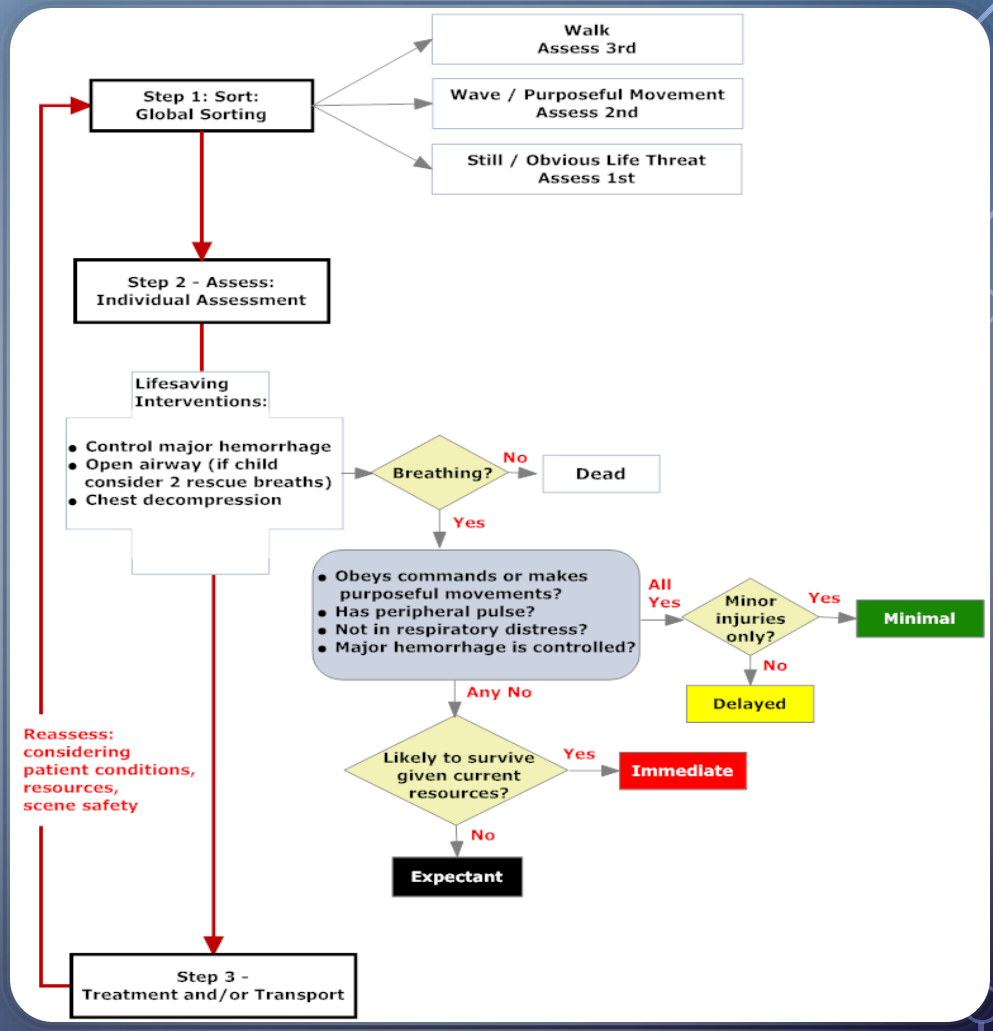
1-3 months of age: consider assigning ESI 2 if temp >38.0 C (100.4F)

3 months to 3 yrs of age: consider assigning ESI 3 if: temp >39.0 C (102.2 F), or incomplete immunizations, or no obvious source of fever



START TRIAGE:

SIMPLE TRIAGE AND RAPID TREATMENT



SALT Triage

Sort

Assess

Life Saving Interventions

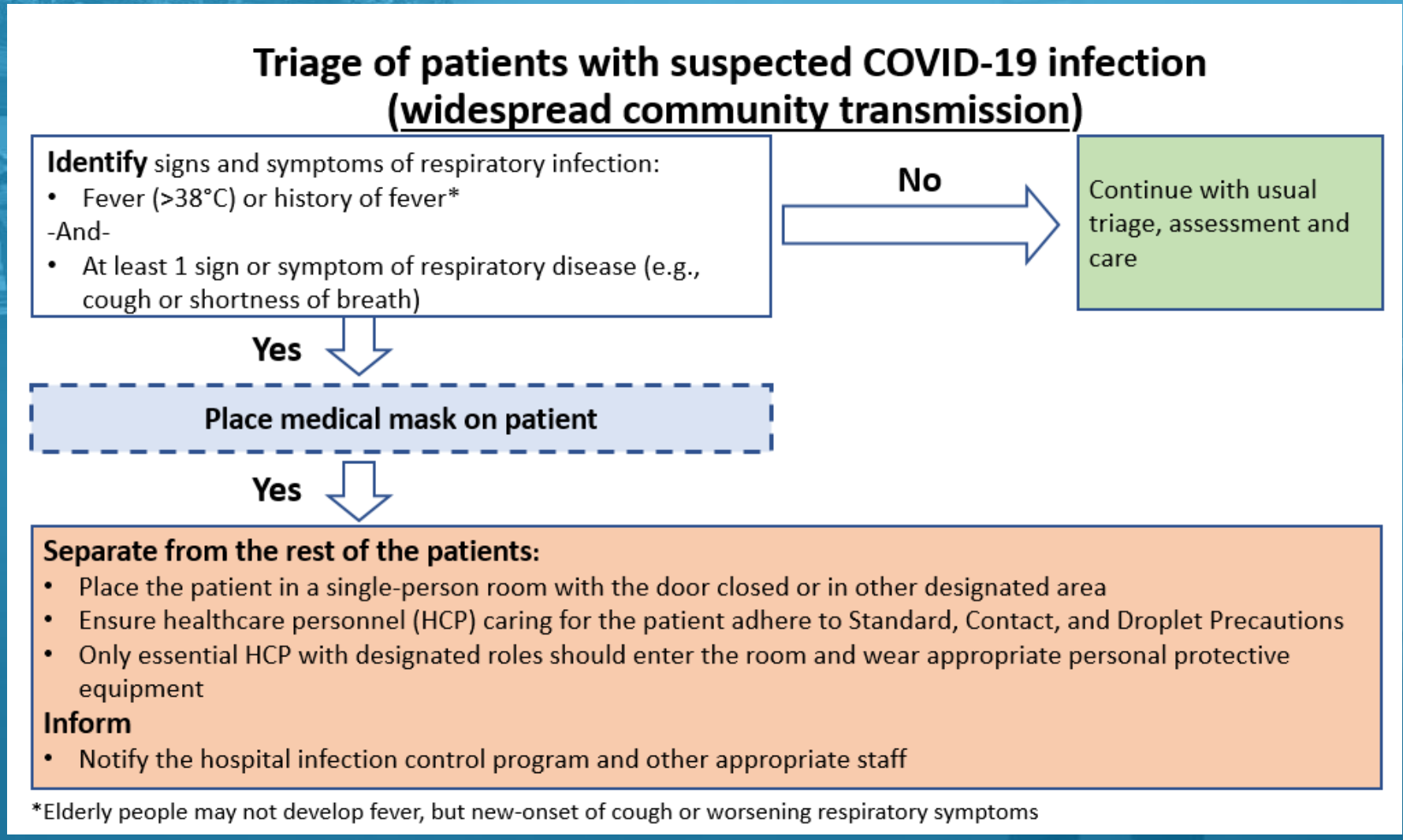
Treatment and transport

TRIAGE: HOW IS IT DIFFERENT IN A LARGE OUTBREAK?

- **Long-term event means that you do not know the number of patients you will see**
- **Must incorporate transmission prevention during triage**
- **Must adjust triage categories for disease symptoms and priority**
- **Staff need to understand the triage algorithm and be able to explain it to patients**


3M
Aura 1870+
NIOSH
DANGE
HIGH VOLTA
KEEP OU

TRIAGE ALGORITHM



ISOLATION ROOM

- At minimum: room removed from immediate patient care areas with closeable door and no recirculation of air to facility
- Best to have a bathroom included
- Controllable entrance/exit points to the donning and doffing area to the isolation room
  - If possible, the doffing area should be kept separate from the donning area
  - A place to dispose of PPE when doffing
- A place to store the PPE
- A sign-in sheet or logbook to track staff going in and out of the isolation room
- Hand hygiene supplies
- There should be a routine cleaning schedule and precautions for the room

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TYPES OF EVENTS:

Advanced Warning Events

- Teams have time before an event to make evacuation decisions
- Examples: hurricane, wildfires, terrorist threats

No Advanced Warning Events

- Examples: earthquake, tornado, possibly CBRNE/ terrorist events

PRE- DISASTER ASSESSMENT

- Part of disaster preparation and planning
- Hazard Vulnerability Assessment (HVA)
- Emergency Operations Plans
- Assessment of critical infrastructure
- Estimating the time required to evacuate patients from the hospital

PRE-EVENT EVACUATION

When to evacuate patients prior to an event?

- Assess nature of the event
- Hospital vulnerabilities
- Anticipated effects on both the hospital and the community

POST- EVENT EVACUATION

When to transfer?

- Disaster mandates evacuation secondary to loss of infrastructure
- Significant damage to community reducing ability to safely care for patients
- Security concerns
- Environmental factors
- Physician believes level of care will be higher at accepting facility

POST- EVENT EVACUATION

Sequence of patient evacuation

- The most medically fragile usually evacuated first (most resource intensive)
- Except: if there is immediate risk evacuate medically stable patients first
  - Ex. Earthquake with fear of building collapse
    - Start on first floor evacuating ambulatory patients
    - Move up the hospital
    - ICU patients last

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QUESTIONS????

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